Draft Environmental Assessment
ANAHOLA SOLAR PROJECT

ANAHOLA, KAUA'I

PREPARED FOR:

Kaua'i Island Utility Cooperative
USDA Rural Utilities Service
Department of Hawaiian Homelands

PREPARED BY:

PLANNING SOLUTIONS

MAY 2013

PROJECT SUMMARY

Project:	**Anahola Solar Project**
Applicant:	Kauaʻi Island Utility Cooperative 4463 Pāheʻe Street Līhuʻe, Hawaiʻi 96766-2000 Contact: Brad W. Rockwell (808) 246-8289
Approving Agency:	USDA Rural Utilities Service 1400 Independence Ave. SW Mail Stop 1571 Washington, DC 20250 Department of Hawaiian Home Lands State of Hawaiʻi 91-5420 Kapolei Parkway Kapolei, HI 96707
Location:	Anahola, Kauaʻi, Hawaiʻi
Proposed Project:	Installation of a ~12 MW photovoltaic facility including a dedicated substation with interconnections to the island-wide electrical grid and other ancillary facilities and construction of a Transmission and Distribution service center and base yard..
Tax Map Key:	(4) 4-7-004:002
Parcel Area:	422.15 acres
Project Area:	60 acres
Judicial District:	Kawaihau
State Land Use District:	Agriculture
County Zoning:	Agriculture
Required Permits & Approvals:	• NEPA Environmental Assessment • Chapter 343 Environmental Assessment • National Pollutant Discharge Elimination System – Notice of Intent [Construction] (NPDES-NOI[C]) • Noise permit • Construction on a State Highway Permit • Certificate of Public Convenience and Necessity • Grading Permit • Building Permit (Service Center only) • Well Construction and Pump Installation Permit
Anticipated Determination:	Finding of No Significant Impact
Parties Consulted:	See Chapter 9
Consultant:	Planning Solutions, Inc. 210 Ward Avenue, Suite 330 Honolulu, HI 96814 Contact: Perry White (808) 550-4483

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

List of Acronyms

Acronym	*Phrase*
AHHA	Anahola Hawaiian Homes Association
AIS	Archaeological Inventory Survey
AC	Alternating Current
BER	Borrower's Environmental Report
BESS	Battery Energy Storage System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIA	Cultural Impact Assessment
CWP	Construction Work Plan
DHHL	Department of Hawaiian Home Lands
EA	Environmental Assessment
EIS	Environmental Impact Statement
EISPN	Environmental Impact Statement Preparation Notice
EPC	Engineering, Procurement, and Construction
HAR	Hawai'i Administrative Rules
HBA	Homeowner's Benefit Agreement
HCDC	Homestead Community Development Corporation
HCP	Habitat Conservation Plan
HRS	Hawai'i Revised Statutes
IPP	Independent Power Provider
KIUC	Kaua'i Island Utility Cooperative
KRS One	Kaua'i Renewable Solutions One
kV	Kilovolt
MW	Megawatt
MWh	Megawatt Hour
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
PPA	Power Purchase Agreement
PV	Photovoltaic
RDEP	Rural Development Electrical Programs
RFP	Request For Proposals
RUS	Rural Utility Service
TMK	Tax Map Key
USDA	United States Department of Agriculture

1. PROJECT OVERVIEW

1.1 BACKGROUND

The Kauaʻi Island Utility Cooperative (KIUC) is a not-for-profit, tax-exempt cooperative association governed by an elected nine-member Board of Directors. KIUC is entirely ratepayer-owned and is responsible for the production, purchase, transmission, distribution, and sale of electricity on the Island of Kauaʻi, Hawaiʻi. The cooperative is regulated by the Hawaiʻi Public Utilities Commission, and is required by law to provide and ensure the availability of reliable electrical service. KIUC owns and operates a variety of electric utility installations on the island of Kauaʻi. Figure 1.1 shows the locations of the major KIUC facilities throughout the island. These include fossil fuel-fired generating stations at Port Allen and Līhuʻe, two hydroelectric stations, and twelve electrical substations and switchyards. In addition, it owns and operates over 700 miles of electrical transmission (57/69 kV) and distribution (12.47 kV) lines, several thousand miles of lower voltage lines that deliver the electrical power to individual homes and businesses, and over 3,000 streetlights. In addition to the above, KIUC maintains and operates support facilities including service centers, baseyards, offices, and warehouses.

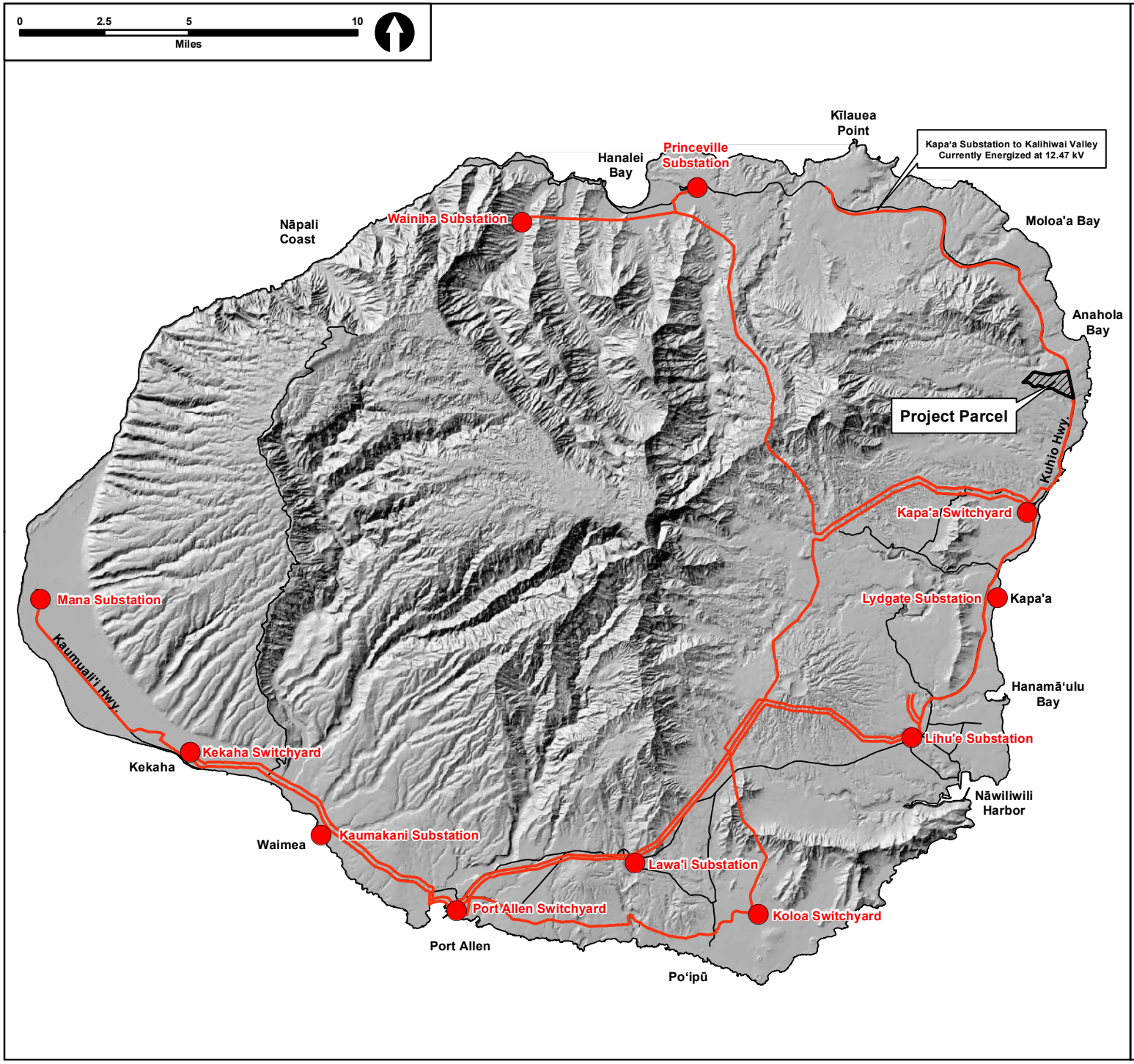
Through its subsidiary, KIUC Renewable Solutions One LLC (KRS One), KIUC is planning to construct, operate, maintain, and decommission as appropriate a 12 megawatt (MW) photovoltaic facility, including a dedicated substation with interconnections to the island-wide electrical grid. The Anahola Solar Project (the proposed Project) is situated approximately one-half mile inland from the shoreline on Kauaʻi's northeastern side, as shown on Figure 1.2. It is expected to produce 23,525 megawatt-hours (MWh) of electricity per year; this is 5.2 percent of KIUC's total electrical generation in 2010. The proposed facilities that collectively make up the proposed Project include:

(1) Fifty-three acres of photovoltaic (PV) panels, inverters, and transformers providing up to 12 megawatts of electrical energy to KIUC's electrical grid.

(2) An adjacent two-acre substation, which will be used for control equipment for the solar farm and to raise the boost the power from the 12 kilovolts (kV) delivered by the PV system to the 57/69 kV voltage of KIUC's electrical transmission system. An integral Battery Energy Storage System (BESS) will be constructed within the proposed substation that will provide an electrical buffer between the PV system and KIUC's grid. Short cables linking the substation to the KIUC transmission grid will also be installed.

(3) A five-acre service center with access drive, public and employee parking, pole storage, and 5 truck bays. This project component also involves necessary improvements to Kūhiō Highway, including widening a section of the highway and the addition of an acceleration/deceleration lane to allow customers and service vehicles safe ingress and egress to and from the highway.

The proposed facilities would occupy approximately 60 acres on the *makai* portion of a large, 422-acre parcel (TMK (4) 4-7-004:002) in Anahola, Kauaʻi, Hawaiʻi (see Figure 1.2 and Figure 1.3). The parcel, which is owned by the Department of Hawaiian Home Lands (DHHL), was formerly used for sugarcane cultivation, but as shown in Figure 1.4, it is currently fallow. DHHL must grant a General Lease for the proposed project; the issuance of the lease constitutes an agency action, thereby making the proposed Project subject to State of Hawaii Administrative Rules, Chapter 343. KIUC intends to seek financing from the U.S. Department of Agriculture (USDA) Rural Utilities Service (RUS) to construct, maintain, and operate the proposed Project, which thereby makes it a federal action subject to review under the National Environmental Policy Act of 1969, the National Historic Preservation Act of 1966 (NHPA), the Endangered Species Act (ESA), and all applicable federal environmental law and regulation.



Legend:

- KIUC 69 kV Transmission Lines
- KIUC Switchyards & Substations

Prepared For:

Kaua`i Island Utility Cooperative

Prepared By:

PLANNING SOLUTIONS

Source:

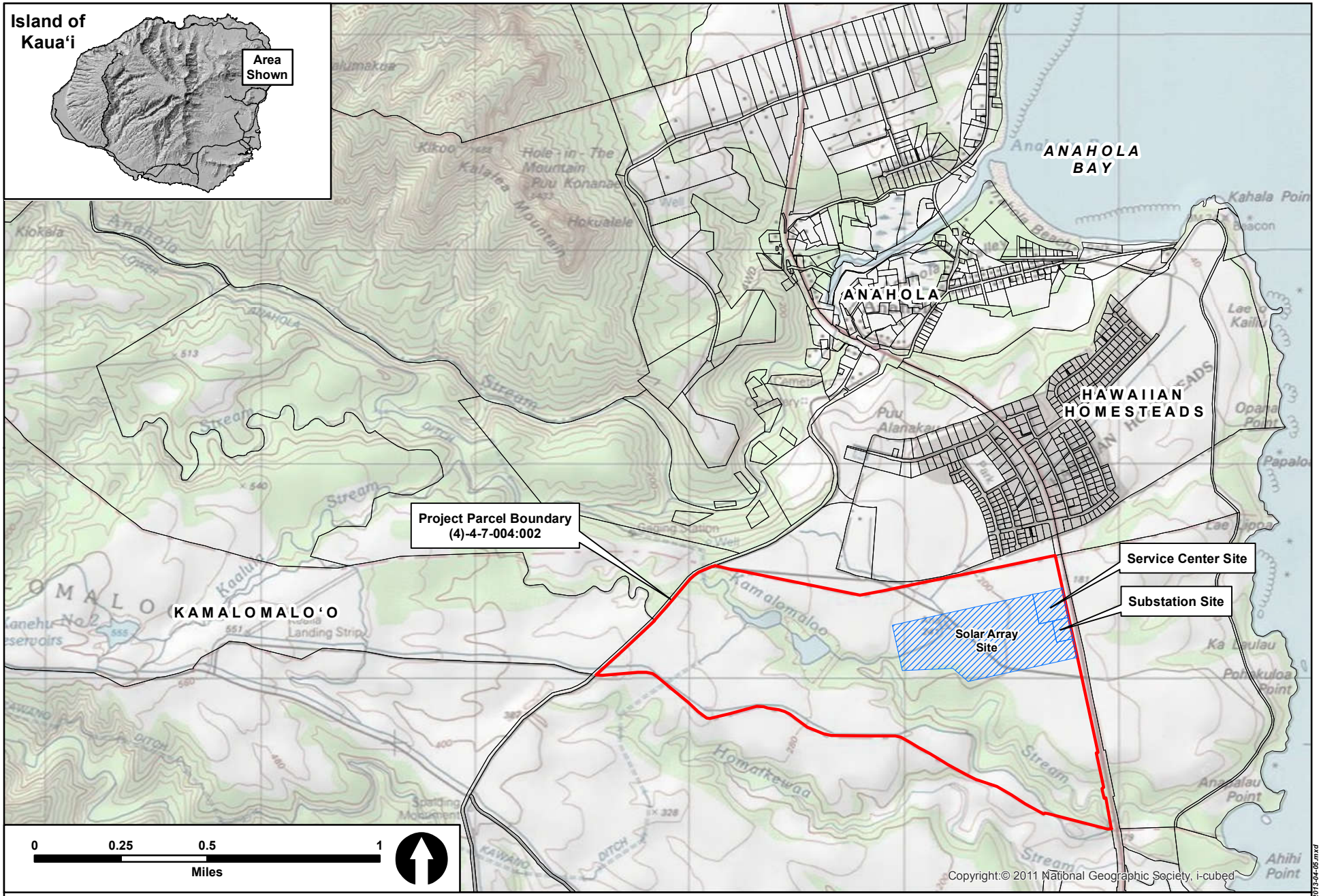
--Kaua`i Island Utility Cooperative
--State of Hawai`i GIS

Figure 1.1:

Major KIUC Facilities

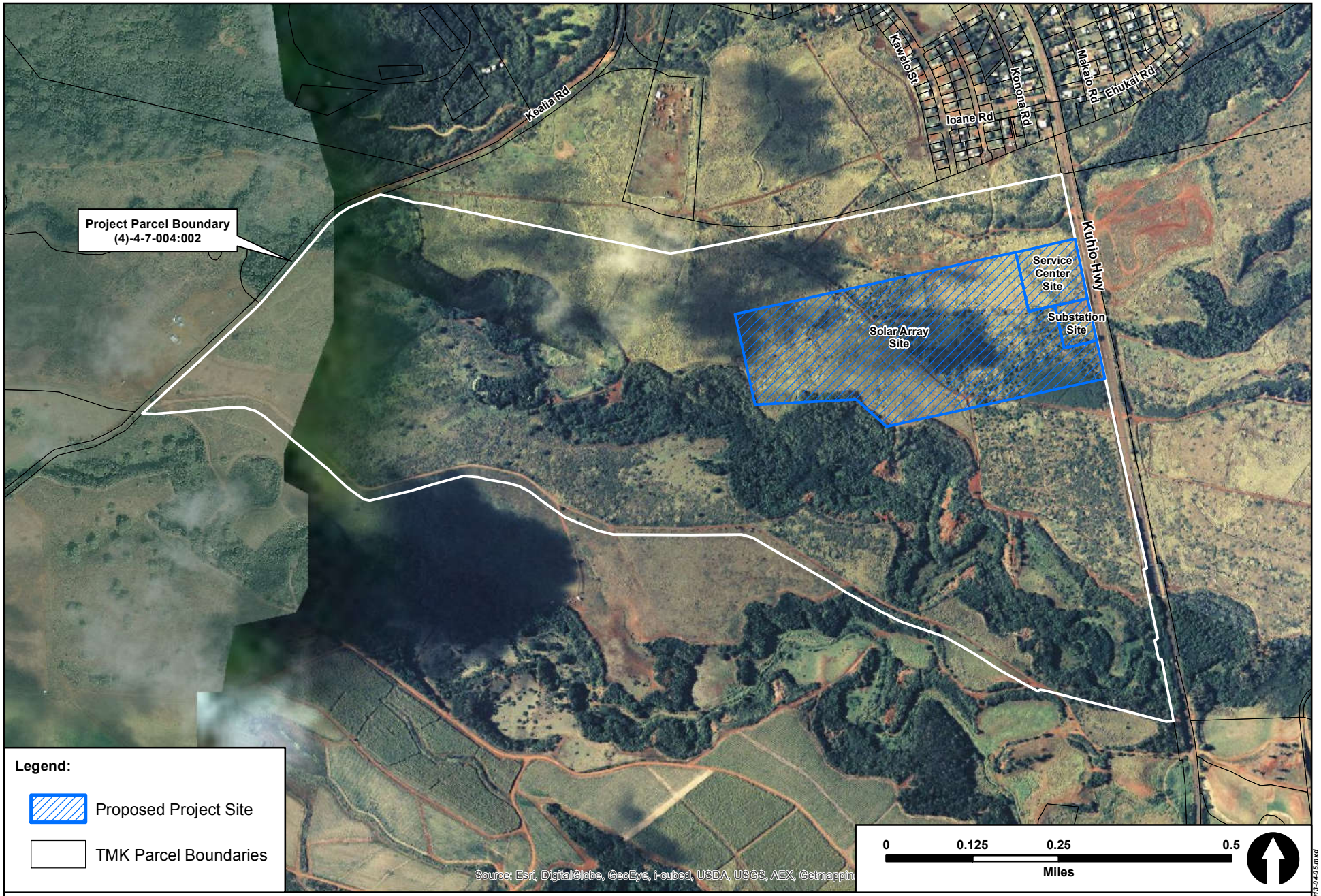
Anahola Solar Project

Figure 1-1 Major KIUC Facilities 2013-04-18.mxd



Prepared For:	Prepared By:	Source:	Project:	Figure 1.2:
Kaua'i Island Utility Cooperative	PLANNING SOLUTIONS	-State of Hawaii GIS -County of Kauai GIS -ESRI	Anahola Solar Project	**Location Map**

Figure 1-2 Location Map 2013-04-05.mxd



Prepared For:
Kaua'i Island Utility Cooperative

Prepared By:
PLANNING SOLUTIONS

Source:
State of Hawaii GIS
County of Kauai GIS
ESRI

Project:
KIUC Anahola Solar Project

Figure 1.3:
Vicinity Map

Figure 1-3 Vicinity Map 2013-0405.mxd

View south along Kūhiō Highway from the project site entrance.

View north along Kūhiō Highway from the project site entrance.

View west towards location of proposed solar array from interior of project site.

View north across location of proposed solar array from interior of project site.

Prepared For:	Prepared By:	Source:	Project:	Figure 1.4:
KIUC	PLANNING SOLUTIONS	PSI December 29, 2011	KIUC Anahola Solar Project	**Photographs of Existing Conditions on Project Site**

Figure 1-4 Photographs of Existing Conditions 2013-04-05.cdr

This Environmental Assessment (EA) was prepared in accordance with the requirements of both State and Federal environmental impact assessment regulations. The applicable State of Hawai'i requirements are contained in Chapter 343, Hawai'i Revised Statutes and Hawai'i Administrative Rules, Title 11, Chapter 200. The applicable Federal environmental impact requirements are specified in the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. §4321 et seq., the regulations promulgated by the Council on Environmental Quality (CEQ) for implementing NEPA, 40 Code of Federal Regulations (CFR) Parts 1500–1508 and the guidelines contained in , and RUS's Environmental Policies and Procedures, 40 CFR Part 1794. This EA also addresses other laws, regulations, executive orders, and guidelines promulgated to protect and enhance environmental quality including, but not limited to, the Endangered Species Act, the Farmland Protection Policy Act, the Clean Water Act, and executive orders governing floodplain management, protection of wetlands, and environmental justice.

1.2 PROJECT PARTICIPANTS

1.2.1 KRS ONE

KIUC Renewable Solutions One, LLC (KRS One) is a for-profit subsidiary that was created and is wholly owned by KIUC; it was formed in September 2011 by approval by the KIUC board of directors. KRS One's sole purpose is to allow KIUC to access federal and state tax incentives that are available to private third-party photovoltaic developers. KIUC does not qualify for federal or state incentives because of its tax-exempt status as a not-for-profit cooperative. KIUC expects that up to 50 percent of the cost of the solar photovoltaic system will be paid for by the incentives. KRS One will have title only to the PV portion of the undertaking; KIUC itself will own and operate the proposed substation and service center. For the purposes of this document, KIUC and KRS One will be referred to collectively as "KIUC". KIUC intends to combine the tax incentives with funding through the Rural Utilities Service (RUS) to achieve a cost of capital below levels possible for any investor-owned project and below what would otherwise be available to the Cooperative.

1.2.2 RURAL UTILITIES SERVICE (RUS) INVOLVEMENT

KIUC proposes to finance the proposed project by reallocating loan funds from an existing loan commitment with RUS. The RUS Electric Program makes loans and loan guarantees to finance the construction of electric distribution, transmission and generation facilities, including system improvements and replacements required to furnish and import electric service in rural areas, and for demand-side management, energy conservation programs, and on- and off-grid renewable energy systems. The RUS Electric Program makes loans to corporations, states, territories and subdivisions, and agencies such as municipalities, people's utility districts, and cooperative, nonprofit, limited-dividend, or mutual associations that provide retail electric service to rural areas or supply the power needs of distribution borrowers in rural areas.

In order for the projects which it wishes to undertake to qualify for these funds, KIUC must comply with the terms of its loan and with applicable federal regulations. In accordance with 7 CFR Part 1710, borrowers of RUS must prepare a Construction Work Plan (CWP), a Borrower's Environmental Report (BER), and other supporting documents as part of the loan application process. The CWP is a document that details the proposed projects that are required to meet anticipated energy demand growth and improve service reliability and quality for the upcoming 2-4 year period. The BER directs the borrowers to 7 CFR Part 1794 to determine the appropriate level of review of a proposed project.

KIUC's current 2009-2012 Construction Work Plan (CWP) does not include the proposed project. At the time the 2009-2012 CWP was prepared, KIUC did not anticipate that photovoltaic technology would evolve as quickly as it has, and the renewable energy incentives that now exist were not

available. KIUC has submitted an Amendment to its 2009-2012 CWP, which requests the reallocation of funds that will allow for the construction of the proposed Project. The environmental review, in accordance with 7 CFR Part 1794, must be completed prior to the approval of this Amendment. The construction of the proposed project is classified as a proposal normally requiring an EA in accordance with § 1794.23(c).

1.2.3 HAWAIIAN HOMES INVOLVEMENT

In its investigation of suitable sites for renewable energy projects that it believed could benefit its members, KIUC worked with the State of Hawai'i Department of Hawaiian Home Lands (DHHL) and with representatives of the various Homesteader Associations on the island to determine if any of those areas might be suitable for the development of renewable energy projects. As a result of this effort, KIUC developed a close working relationship with the Homestead Community Development Corporation (HCDC), the tax exempt development arm of the homestead associations in the state, including the Anahola Hawaiian Homes Association (AHHA). Founded by the Council for Native Hawaiian Advancement in 2009, HCDC's mission is to develop community and economic facilities and projects important to homestead areas and the Native Hawaiian people.

After holding numerous meetings and consulting with their Board, HCDC reached an agreement with KIUC on the nature of its participation in a joint effort to develop a solar array in Anahola in the fall of 2011. The "Homestead Benefits Agreement", which was signed on April 17, 2012, is intended to serve as a model of collaborative efforts towards development and use of Hawaiian Home Lands for the direct benefit of Hawaiian Beneficiary organizations and the Native Hawaiian community at large. HCDC presented its proposal for use of the Anahola Solar Project site to the Board of the Hawaiian Homes Commission (the nine-member executive board that heads DHHL), which took up the request at its October 2011 meeting. During the meeting, the Hawaiian Homes Commission approved a License from the State of Hawai'i, Department of Hawaiian Home Lands to HCDC and KIUC for the Anahola Solar Facility, under §207 of the Hawaiian Homes Commission Act of 1920. The Commission's approval provided that the license will convert to a General Lease to HCDC upon completion of the required environmental documentation, which would then lease the area to KIUC.

Under the terms of the agreement between HCDC and KIUC, the two are to work collaboratively to develop the Anahola Solar Project, and HCDC is now conducting further community outreach consultation intended to identify a community benefits package to be implemented by KIUC. HCDC will provide input, counsel, and advice in a collaborative relationship with KIUC and KIUC's construction contractors to ensure that the Anahola Solar Facility is constructed and operated in a manner that preserves the cultural, aesthetic, environmental, and practical considerations unique to Hawaiian Home Lands. The agreement between the two organizations contains the following specific provisions:

- *Leadership Partnership.* To assist in this collaborative effort, HCDC and KIUC will form a project advisory committee comprised of members of the homestead community and KIUC leaders to coordinate and share information, studies, and plans, conduct community outreach, and serve as a forum to coordinate Native Hawaiian issues.
- *Predevelopment Costs Reimbursement*. KIUC will reimburse HCDC for the pre-development costs and efforts of HCDC including staffing and volunteer hours, community outreach sessions, beneficiary inquiries and consultation, project due diligence, research, protocol reviews and coordination with KIUC, in a total amount not to exceed $55,000.
- *Joint Development Fee*. KIUC will pay HCDC a $150,000 one-time Joint Development Fee when the Anahola Solar Project enters commercial operation.
- *Stakeholder Participation Payment*. KIUC will pay a Stakeholder Participation Payment in an amount equal to 1% of the value of power generated from the Anahola Solar Facility during the

prior calendar quarter. The "value of power" is set at $200 for each metered megawatt hour ("MWh") of energy generated by the Anahola Solar Facility.

- *Responsibility for Project Costs*. KIUC is responsible for all construction costs, the Environmental Assessment necessary for compliance with the requirements of Hawai'i Revised Statutes (HRS) Chapter 343 and the National Environmental Policy Act for the Anahola Solar Facility Site, and the reasonable legal cost of negotiating and documenting the License and General Lease from DHHL.
- *Project Signage*. KIUC will erect signage at the site denoting the collaborative development and use of Hawaiian Home Lands for the facility.
- *Construction Worker Qualification*. KIUC and HCDC use their best commercially reasonable efforts to conduct outreach and referrals of Anahola homestead residents to be considered for employment by contractors, and to encourage the use of Anahola business vendors for products and services, involved in the construction of the Anahola Solar Facility. They will make similar efforts with respect to employment to perform services including routine maintenance, inspections, troubleshooting, security, site housekeeping, or other services and internships, fellowships, and employment training.
- *School Curriculum Development*. KIUC will provide access to its staff and use its reasonable best efforts to assist HCDC in developing meaningful opportunities for junior and senior high school students to participate in a curriculum on utility operations and renewable energy technologies, including engineering, project design, operations, maintenance, and financing.
- *Information Sharing*. KIUC will assist and share non-proprietary information with HCDC as part of a collaborative effort to build HCDC's knowledge and capacity in aspects of developing, financing, and operating renewable energy generation projects.

1.2.4 REC SOLAR

In order to qualify for the available tax incentives, KIUC needed to commit a portion of the total project cost before the end of 2011. Accordingly, it issued a request for proposals (RFP) to prospective solar suppliers in the fall of 2011 using the standard RUS engineering, procurement and construction contract documents. On October 3, 2011, KIUC issued an RFP to over 20 bidders for an Engineering, Procurement and Construction (EPC) contract for a minimum 10 MW (AC) solar array. The RFP asked for bids that would:

- Maximize solar generation on the 50-acre Anahola site, noting that KIUC anticipated a minimum of 10 MW and a maximum of 14 MW depending on project layout and panel selection.
- Have an expected design life and performance warranty of 25 years.
- Provide an anticipated minimum output of 18,500 megawatt-hours (MWh) in the first year.

KIUC received nine bids by the October 17, 2011 submission deadline. KIUC evaluated all of the proposals that were submitted in response to the RFP using the evaluation factors listed in Table 1.1. After evaluating all of the proposals, KIUC contracted with REC Solar for the construction of the proposed solar array. REC Solar's participation in the project is limited to construction of the solar array; KIUC is responsible for operating the solar array once it is completed and for both construction and operation of the substation and service center.

Table 1.1 Factors Used to Evaluate Proposals

Bidder's ability to comply with all Scope of Work and Contract requirements.
Capacity and energy output profiles of the proposed project.
Availability and reliability of the power and energy output.
Environmental impacts of the proposed project.[1]
Contractor and equipment warranties have acceptable warranty periods, terms, and provisions.
The proposed project schedule meets all requirements, including the timing for completion of construction, testing, and completion of the project.
Total delivered cost of power.
Life of project cost evaluation.
Expected losses of power and energy output of the project over time.
Expected operations and maintenance costs and direct assignment facilities costs.
Rate impacts, if any.
Cost of compliance with all applicable state and federal laws, rules, and requirements.
The legal, engineering, and other costs required to implement the proposed project.
Overall project viability.
RUS compliance and approvals.
Ability to comply with all requirements/or timely obtaining Treasury grant/funding, applicable federal and state tax credits, and other incentives.
The overall responsiveness and timeliness of the Bidder's proposal.
The demonstrated responsibility of the Bidder - including the financial viability of Bidder and any parent or guarantor of services.
Price.
Inverter design (for example multiple smaller inverters instead of fewer larger inverters), programming.
Flexibility and ability to integrate with utility SCADA system.
Robustness of design and equipment (for example using stainless steel inverter enclosures instead of mild steel, galvanized racks instead of uncoated steel. etc.).
12kV electrical equipment and protection scheme.
Contractor experience in delivering successful projects of similar scope.
Source: KIUC (2011)

[1] With respect to environmental protection, bidders were required to confirm that that they would perform the work in compliance with all applicable Federal, State, and local Environmental Laws. For purposes of this Agreement, the term "Environmental Laws" was defined as meaning all Federal, state, and local laws including statutes, regulations, ordinances, codes, rules, and other governmental restriction and requirements relating to the environment or solid waste, hazardous substances, hazardous waste, toxic or hazardous material, pollutants or contaminants including, but not limited to the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §§ 9601, et seq., the Federal Water Pollution Control Act, as amended, 33 U.S.C. §§ 1251, et seq., and the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901, et seq.

1.3 REGULATORY PROVISIONS GOVERNING THE EA

This Environmental Assessment (EA) was prepared in accordance with the requirements of both State and Federal environmental impact assessment regulations. The applicable Federal environmental impact requirements are specified in the National Environmental Policy Act (NEPA) and its implementing regulations 40 Code of Federal Regulations (CFR) Parts (§§)1500–1508 and the guidelines contained in 42 U.S.C. §4321 et seq. and CFR Part 1794. The applicable State of Hawai'i requirements are contained in Chapter 343, Hawai'i Revised Statutes and Hawai'i Administrative Rues, Title 11, Chapter 200.

NEPA Compliance. In accordance with the National Environmental Policy Act (NEPA) and other applicable environmental statutes, regulations, and Executive Orders, RUS is required to integrate and consider the potential environmental effects that its actions (in this case providing federal financial assistance to KIUC) may have on the human environment prior to taking that action. It accomplishes this by evaluating the environmental consequences of applicant proposals to ensure that environmental values are given appropriate consideration in agency decision-making along with economic and technical factors within the agency's mission.

This document has been prepared in consultation with other government agencies, private organizations, and the public. If, after circulating the document for public and agency comment, RUS finds that the proposed project will not have a significant effect on the quality of the human environment, it will prepare a Finding of No Significant Impact (FONSI). Notification of the EA and FONSI will be published in the Federal Register and in newspapers with circulation in the proposal's area. If substantive comments are received on the EA, RUS may provide an additional period (15 days) for public review following the publication of its FONSI. If at any point in the preparation of an EA RUS determines that the proposal will have a significant effect on the quality of the human environment, it will initiate preparation of an Environmental Impact Statement.

Chapter 343 Compliance. As indicated above, the Hawaiian Homes Commission's approval of the license to HCDC provided that the license will convert to a General Lease to HCDC upon completion of the required environmental documentation. In this case, that documentation consists of an Environmental Assessment prepared in accordance with Chapter 343, HRS. For the purpose of compliance with that law and the implementing regulations (HAR 11-200), the issuance of the lease constitutes an "agency action" and the Department of Hawaiian Home Lands is the "approving Agency".

2. DESCRIPTION OF THE PROPOSED PROJECT

The locations within the overall parcel of the photovoltaic solar array, substation, and service center that collectively make up the proposed project are depicted in Figure 2.1. This chapter provides detailed information about the design of the proposed facilities, the construction materials, the procedures that would be used, the estimated costs, and the projected timeline.

2.1 SOLAR ARRAY

2.1.1 SOLAR ARRAY: DESCRIPTION

KIUC is proposing to construct a 53-acre photovoltaic solar array for electrical power generation. The array will consist of 59,000 ground-mounted photovoltaic modules installed on ~11,000 foundation piles. The construction would be phased as shown on Figure 2.2.

As shown in the elevation views and photographs in Figure 2.3, the modules (each of which is approximately 5.5 feet long by 3.25 feet wide) would be mounted in groups of four on galvanized steel cross-members supported by rows of steel piles. The lower end of each group of four modules would be a minimum of 2 feet above grade while the upper end would be approximately 9 feet above ground. Sufficient space (minimum of 6.5 feet) will be provided between the rows to allow ready access for maintenance work. Figure 2.4 provides the individual module specifications. The electrical cables that connect the individual photovoltaic modules to the larger electrical system will be located in buried PVC conduits designed for low-voltage underground DC and AC power runs.

The modules will be connected in twelve 1-MW (ac) groupings using inverters, transformers, pull boxes, interconnections, and other equipment situated with small compounds situated at the corner of the grouping that is closest to the substation. Connections will be via conductors in buried conduits.

2.1.2 SOLAR ARRAY: CONSTRUCTION ACTIVITIES

Construction activities will require the services of managers, heavy equipment operators, licensed journeyman electricians, and laborers working on-site. It will include the use of heavy, combustion-engine powered equipment including heavy and light utility vehicles, pick-up trucks, pile drivers, all-terrain forklifts, and excavators (see Table 2.1). Construction activities for the solar array and support facilities are described below.

Initial Site Preparation. REC Solar will begin by installing a 6-foot high chain-link security fence around the portion of the Service Center site that it will use as a construction baseyard and laydown area and around at least the lowermost portion of the area dedicated to the solar array and support facilities at the beginning of construction. REC Solar will build the construction access road leading from Kūhiō Highway at this time as well. It will erect security fencing around the remainder of the solar array area as soon as construction of site access roads makes it practical.

Figure 2.1. Overall Layout of Project Elements.

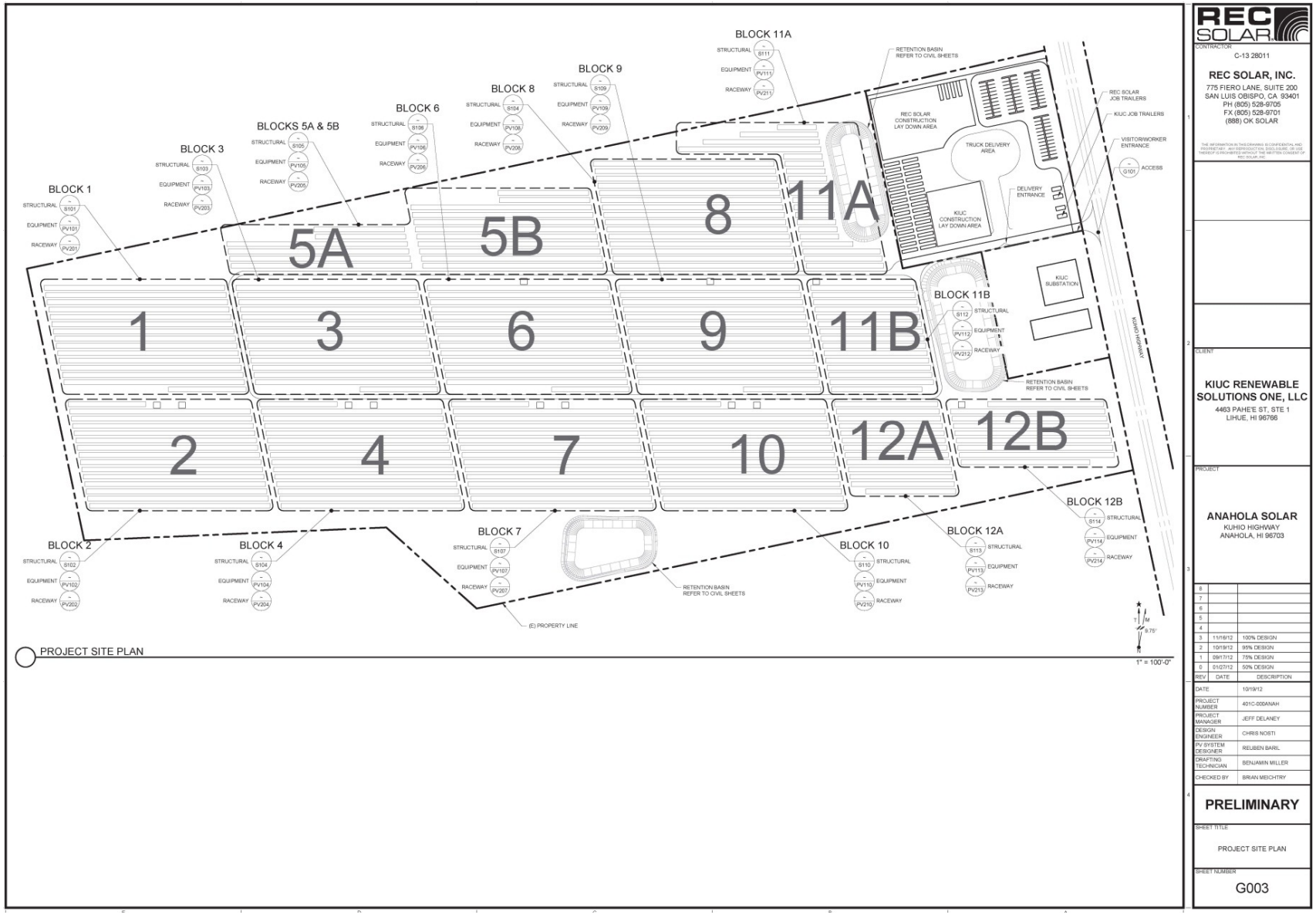


Figure 2.2. Phasing Plan for REC Solar Array

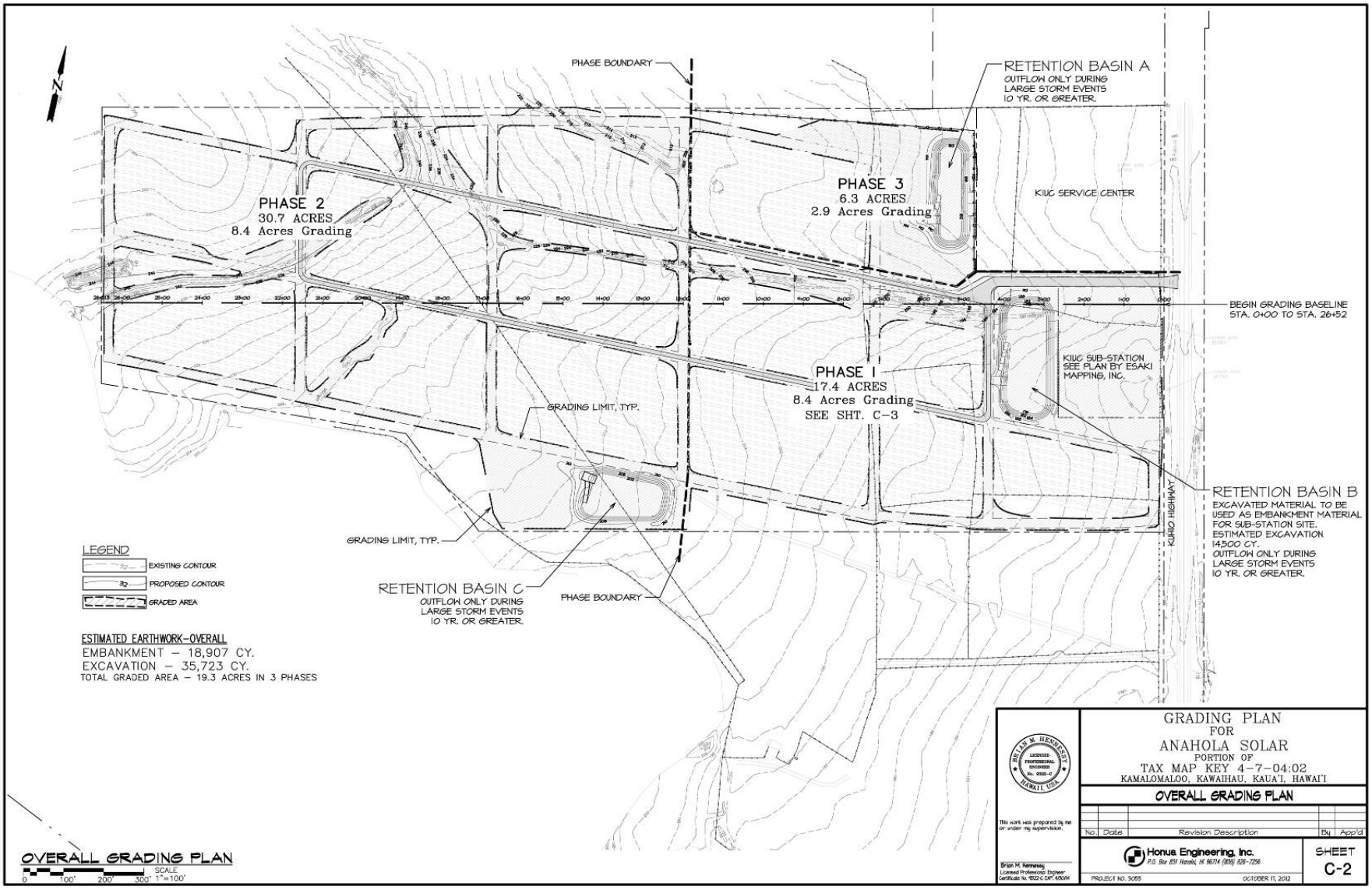
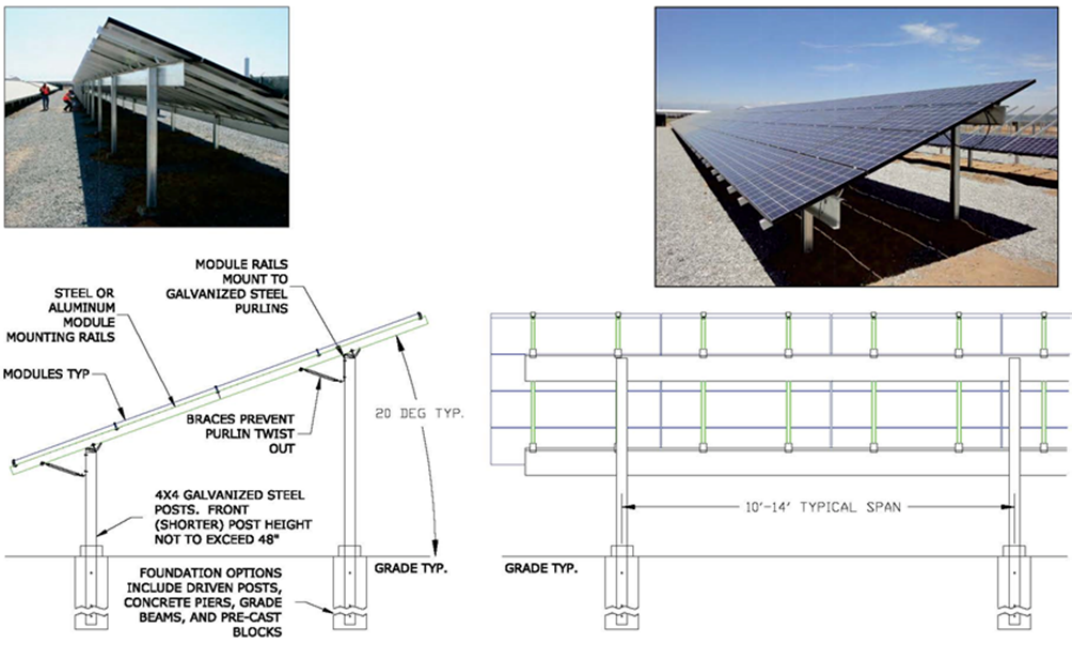


Figure 2.3 Typical Solar Array



Source: REC Solar

Figure 2.4. Individual Module Specifications

ELECTRICAL DATA @ STC	REC225PE	REC230PE	REC235PE	REC240PE	REC245PE	REC250PE
Nominal Power - P_{MPP} (Wp)	225	230	235	240	245	250
Watt Class Sorting - (W)	0/+5	0/+5	0/+5	0/+5	0/+5	0/+5
Nominal Power Voltage - V_{MPP} (V)	28.9	29.2	29.6	29.9	30.2	30.5
Nominal Power Current - I_{MPP} (A)	7.79	7.88	7.96	8.04	8.12	8.20
Open Circuit Voltage - V_{OC} (V)	36.2	36.5	36.7	37.0	37.2	37.5
Short Circuit Current - I_{SC} (A)	8.34	8.43	8.51	8.60	8.68	8.76
Module Efficiency (%)	13.6	13.9	14.2	14.5	14.8	15.1

Values at standard test conditions STC (airmass AM 1.5, irradiance 1000 W/m², cell temperature 25°C).
At low irradiance of 200 W/m² (AM 1.5 and cell temperature 25°C) at least 97% of the STC module efficiency will be achieved.

GENERAL DATA	
Cell Type	60 REC PE multi-crystalline cells 3 strings of 20 cells - 4 by-pass diodes
Glass	3.2 mm solar glass with anti-reflection surface treatment by Sunarc Technology
Back Sheet	Double layer highly resistant polyester
Frame	Anodized aluminium
Junction box	IP67
Cable	4mm² solar cable, 0.90m +1.20m
Connectors	Hosiden 4mm² (HSC 2009/2010) MC4 connectable

ELECTRICAL DATA @ NOCT	REC225PE	REC230PE	REC235PE	REC240PE	REC245PE	REC250PE
Nominal Power - P_{MPP} (Wp)	167	170	173	176	179	182
Nominal Power Voltage - V_{MPP} (V)	26.6	26.8	27.1	27.3	27.6	27.9
Nominal Power Current - I_{MPP} (A)	6.27	6.33	6.39	6.45	6.51	6.56
Open Circuit Voltage - V_{OC} (V)	33.4	33.6	33.8	34.1	34.3	34.5
Short Circuit Current - I_{SC} (A)	6.79	6.85	6.90	6.96	7.01	7.06

Nominal cell operating temperature NOCT (800 W/m², AM 1.5, windspeed 1 m/s, ambient temperature 20°C).

MAXIMUM RATINGS	
Operational Temperature	-40 ... +80°C
Maximum System Voltage	1000V
Maximum Snow Load	550 kg/m² (5400 Pa)
Maximum Wind Load	244 kg/m² (2400 Pa)
Maximum Series Fuse Rating	25A
Maximum Reverse Current	25A

Source: REC Solar

Table 2.1. List of On-Site Construction Equipment for Solar Arrays and Related Facilities

Description	*Quantity*
Vibratory Pile Driver	3
All-Terrain High Reach Fork Lift	3
Flat Bed Truck	3
All-Terrain People Mover with bed	4
Skid Steer	2
Field Generator	4
Crane	1
Water Truck	2
Dozer	1
Backhoe	2
Front End Loader	1
Excavator	2
Earth Compactor	1
Tractor with Mower Attachment	1
Dump Truck	1
Scraper (similar to CAT 657)	1
Grader (similar to John Deer 570)	1
Source REC Solar Transmittal #026 to KIUC dated November 8, 2012.	

Grubbing and Grading. The construction of the 53-acre solar array will begin with an incremental grubbing process. This process consists of dividing the site into 3 units, which will be sequentially grubbed and graded. Once an increment has been grubbed, it will be graded according to an approved grading plan using heavy diesel-powered equipment such as bulldozers, backhoes, graders, and scrapers brought to the project site via tractor trailer. This equipment will be transported to the site as needed and kept there for as long as they are needed; the equipment will be fueled by lube truck or temporary on-site fuel tank. The storage, maintenance, and fueling of these pieces of equipment will be in compliance with all applicable NPDES regulations and best management practices (BMPs).

As previously noted, construction of the solar array portion of the project will be carried out in three phases.

- *Phase 1*. The first phase will involve about 8.4 acres of grading on 17.4 acre portion of the site on the southeast corner of the project. The majority of the grading for this phase will be to create a pad for the KIUC sub-station site and the excavation of the first of three storm water retention basins (Retention Basin B) on the site. In addition, it will grade and install the following items within the phase limits: (*i*) the primary construction access road to Kūhiō Highway, (*ii*) the interior access drives for the array blocks, and (*iii*) the swales to direct runoff to the retention basin. This work will erase all traces of the abandoned irrigation ditches. Upon completion of the grading operations the disturbed areas will be hydro-seeded with mixture of rye grass for short term erosion protection and Bermuda grass for long term protection. All vegetation removed from the graded areas will be shredded on-site and used as mulch on the non-graded areas to provide weed control and minimize dust from the installation of the array blocks.

- *Phase 2*. Once the Phase 1 portion is stabilized, REC Solar will extend the access roads further inland and grade 8.4 acres of the 30.7 acre Phase 2 area in accordance with the pattern established in Phase 1. It will excavate Retention Basin C together with the swales and other grading needed to channel runoff into it. Site restoration will be the same as outlined for Phase 1.
- *Phase 3*. Finally, the same sequence that was used for the first two phases will be repeated in Phase 3. Phase 3, in the area above where the service center is to be constructed, consists of 6.3 acres, 2.9 acres of which will be graded, and includes the final basin, Retention Basin A.

Construction of Access Road and Internal Roads. As discussed in more detail in Section 2.3, the permanent main access road will not be in place when the solar array and substation are constructed. Consequently, the contractor will begin work by constructing a temporary construction access road. This temporary access road will start at a simple T-intersection at Kūhiō Highway that is centered on the permanent main access road. It will proceed uphill from that point before branching right into the service center site and left into the substation site. The stabilized construction entrance will consist of coarse aggregate and will drain to an adjacent retention pit. It will be approximately 30 feet wide and extend at least 50 feet from the edge of the pavement on Kūhiō Highway.

Once grubbing and mass-grading has occurred, the contractor will construct a main site access road extending *mauka* from Kūhiō Highway. Additional connector roads will be constructed as depicted in the conceptual site plan; these will include a 25-foot clearance around the perimeter of the solar farm to act as a maintenance buffer between the arrays and the new fence line. All roadways will be a minimum of 10 feet in width, with 4-foot grassed shoulders for the internal access roads inside the photovoltaic array. The access road from Kūhiō Highway to the entrance to the Service Center and substation will eventually be paved, while the secondary interior roads will be constructed of an all-weather material of gravel, recycled concrete or base rock.

Construction of Photovoltaic System and Mounts. The contractor will use a small pile-driver to install the galvanized steel posts which support the photovoltaic modules (see Figure 2.5(b) for illustration). The most likely installation device is a Pauselli 900 track-mounted pile-driver, an impact-style machine.[2] Once the piles are in place, galvanized metal pipe and rail frames will be bolted onto the array racking frames. Finally, the photovoltaic modules themselves will be affixed to the array racking frames.

Installation of Conduits and Wiring. The contractor will excavate two-foot (minimum) deep rectangular trenches in which it will place the conduits that will carry the electrical cables interconnecting the individual photovoltaic modules to the larger electrical system. The excavated soil will then be backfilled into the trench and the soil tamped back to the appropriate level of compaction, per code. All feeder wires installed in underground trenches will be placed within these PVC conduits. The excavation work for the conduits and wiring will be conducted with wheel- or track-mounted excavators followed by appropriate compaction equipment.

Electrical Equipment. In order to convert the DC power generated by the photovoltaic modules into AC power consistent with KIUC's electrical transmission system, the array will require the installation of inverters and transformers. For the inverters, Advanced Energy 500 kW Utility Interactive Inverters will be used. Each unit is capable of converting 500,000 watts of DC power into 3-phase, 60 Hz AC power. In total, 24 500 kW inverter units will be installed as part of the construction process, above ground on small concrete pads and metal skids. As noted above, the photovoltaic modules will be installed in 12 blocks, with two inverters per photovoltaic block. In addition to the inverters, 12 transformers will be installed, mounted on small concrete pads or metal

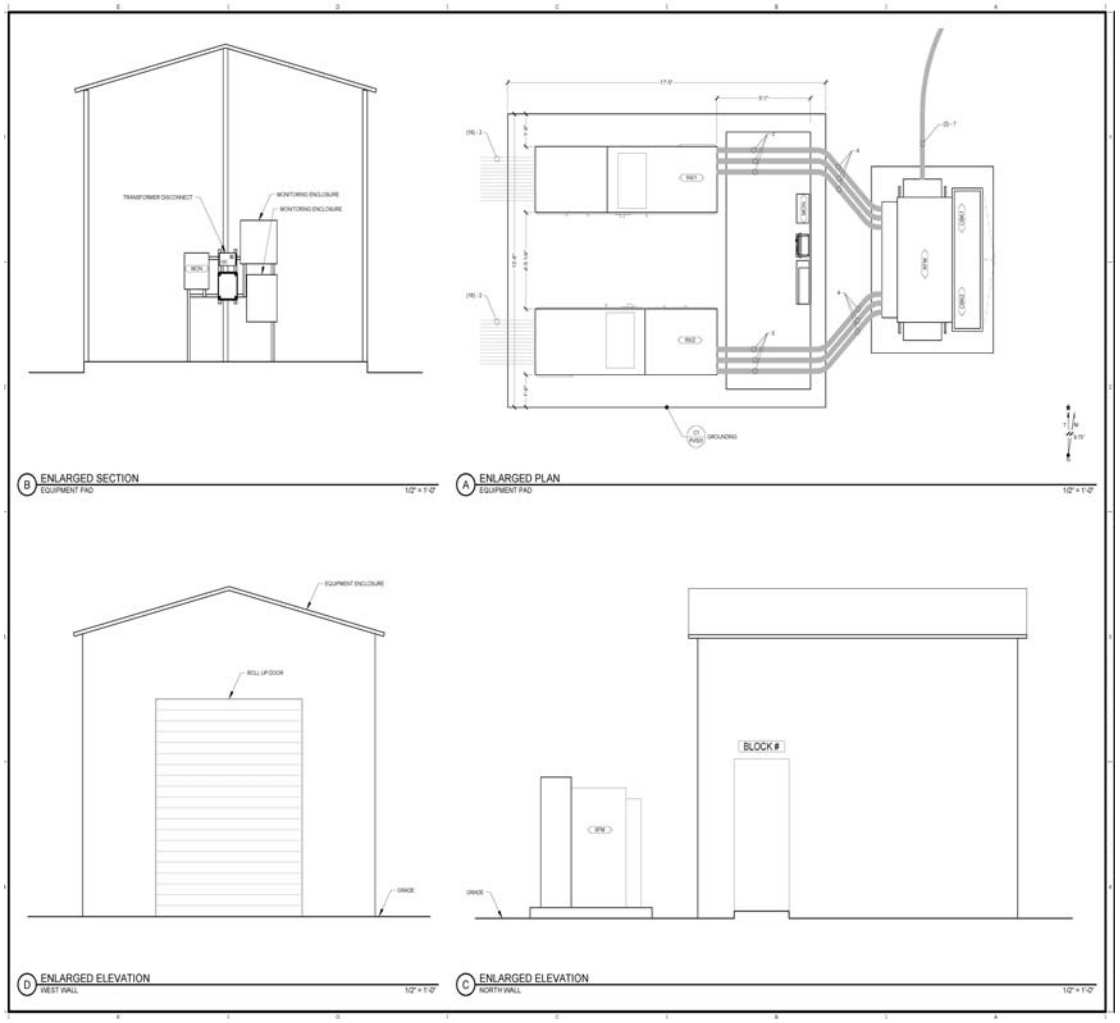
[2] This unit is powered by an air-oil-cooled, 64 horsepower/4-cylinder diesel engine. The INDECO 900 hydraulic-actuated hammer weighs ~1,200 pounds and produces impact energy of 1,060 joules. It can strike several hundred times per minute, although it typically operates below maximum speed. Maximum noise from the engine is 85 dBA.

skids. These transformers will step up the voltage of the solar array's electrical output; they are mineral-oil filled and housed in a green (or similar earth-tone) enclosure. Figure 2.6 contains conceptual plans (layout and elevations) for a typical equipment pad.

Figure 2.5 Illustration of Solar Array Construction Process

Description	*Illustrative Photograph*
 *(a) Erosion control measures have been set up, grubbing and grading is complete.*	 *(b) The pile driver drives the ground mount piles into the earth.*
 *(c) The horizontal mount structures are installed on their vertical foundations.*	 *(d) The photovoltaic modules are mounted on the horizontal rails.*
 *(e) Trenches are dug from the photovoltaic arrays to the inverter equipment pad location and conduits are laid.*	 *(f) The inverter and transformer pads are laid out, and the concrete foundation is poured and leveled.*
 *(g) The inverters, transformers, and other electrical equipment is placed on the pads.*	 *(h)The array is connected to the electrical grid and construction is complete.*
Note: These photographs are intended to illustrate major steps in the construction process and do not show every phase of the construction process.	
Source: All photos by REC Solar (2012) except for (b), retrieved from the web at: http://www.groundworkgroupltd.com/productdetails. php?prod=41&cat=48&par=45	

Figure 2.6 Conceptual Layout of Equipment on Each Equipment Pad



Source: REC Solar, Sheet PV401, 10/19/12, 95% design drawings.

Vegetation Management. Once graded, all disturbed slopes and bare land will be hydro-seeded with a grass seed mix as part of a comprehensive Vegetation Management Plan (VMP) designed in accordance with low-impact principles of site development.[3] This plan will be developed by the contractor's licensed horticultural staff and will emphasize non-invasive grass species, and be implemented in a manner that would discourage the incursion of noxious and invasive species during the construction and re-vegetation of the site. This plan will cover ongoing and long-term vegetation management practices, including invasive species countermeasures. A combination of mulch and a weed barrier fabric will be used under the solar arrays to control the growth of vegetation. In addition, once the grass is established, pre-emergent will be applied to areas directly underneath the solar arrays, so that the base of the array mount is free of low-lying grass and weeds. The area between the array rows will be planted with low vegetation, a combination of rye grass during the grow-in period and Bermuda grass for long-term soil stabilization with a maximum, mature height of

[3] In general, a Low Impact Development (LID) approach to site development works with existing topography and natural drainage patters, simultaneously addressing erosion, dust, and weed control.

10 to 12 inches. This vegetation will capture water and allow natural drainage to occur during and after the construction process.

2.1.3 SOLAR ARRAY: OPERATION AND MAINTENANCE

Photovoltaic Panel Cleaning. Typical maintenance of the photovoltaic modules themselves involves washing the surfaces with water containing no additive cleaners or chemicals as often as conditions require. KIUC work crews will obtain demineralized water from the Kapaia Generating Station's boiler feedwater and truck it to the solar array. They will clean dust and dirt which may accumulate on the module surfaces using a pressure nozzle. The frequency of washing will depend on the level and frequency of rainfall on the project site. This wash water would drain off and into the ground.

Electrical Equipment Maintenance. In addition to the above activities, periodic maintenance would include replacing air filters within the inverters when needed, testing connections with thermal imaging cameras and addressing any issues discovered, and sampling the mineral oil within the transformers. Once the solar array has been constructed, KIUC personnel will use the drive aisles to service and maintain the new equipment.

Vegetation Maintenance. Vegetation will be maintained and controlled throughout the life of the solar array. This maintenance program will consist of a combination of hand cutting, mowing using mechanized equipment, string trimming, and where required, application of localized herbicide. In addition, the site will require periodic reapplication of weed barrier fabric or sufficient mulch to maintain a 4-inch thick layer underneath panel arrays as a deterrent to vegetation growth. The complete Vegetation Management Plan is reproduced in Appendix C of this document.

2.1.4 SOLAR ARRAY: DECOMMISSIONING

The performance of the solar panels is guaranteed for a period of 25 years. It is likely that they will continue to perform adequately for a much longer period of time. Nonetheless, there will come a time when at least the panels will need to be replaced and eventually the system would be decommissioned and the site returned to its previous (or another not yet determined) use. Decommissioning the kind of photovoltaic system that KIUC has proposed is not something that has yet been done on any large scale. However, sufficient information is available to outline the activities that will have to be undertaken and the procedures most likely to be followed.[4]

The following facilities would be removed: (*i*) photovoltaic modules, panels and wiring; (*ii*) racking systems and support structures; (*iii*) inverters, transformers and generators; (*iv*) concrete foundations and underground infrastructure; (*v*) transformer and overhead/trenched electrical network; (*vi*) electrical poles; and (*vii*) safety fences.

In accomplishing this, KIUC would observe the following dismantling, demolishing, and disposal procedures for the above-ground structures:

- KIUC would disconnect the solar array system from the substation by first turning off the breaker switches and then severing the electrical cables.
- It would then disconnect the individual photovoltaic modules from the site electrical network and remove them from the support racks; it would re-use, recycle, or safely dispose of them offsite in accordance with applicable laws and regulations.

[4] Most of the materials in a solar power project are reusable or recyclable, and some equipment may have manufacturer take-back and/or recycling requirements. To the extent that these exist and are still in force, KIUC would avail itself of all of the opportunities that they present.

- KIUC would disconnect and remove the inverter and transformers; once this is done it would either send the components back to the manufacturer, re-use them, recycle them, or safely dispose of them offsite.
- KIUC would remove and demolish the transformer(s) and other electrical equipment in accordance with then-current standards and best practices.
- It would cut the ends of underground electrical lines, retrieve as much of the material as possible to reuse or recycle, and bury to the remaining conduits to approximately two feet below grade, leaving them in place.
- KIUC would remove underground infrastructure and protective electrical structures such as concrete electrical shelters and concrete pad foundations for inverters and transformers and backfill the area around them as necessary. Waste concrete would be recycled offsite by a concrete recycler.

KIUC will comply with all applicable regulatory requirements during the decommissioning of the solar array, including those which govern the handling and disposal of the disassembled components, some of which may require disposal according to toxic waste regulations (e.g., Resource and Conservation Recovery Act) unless they can be recycled.[5] KIUC intends that its decommissioning procedures will return the site to a state suitable for agricultural use.[6]

2.2 ANAHOLA SUBSTATION

KIUC is proposing to construct a new substation that would allow the Anahola photovoltaic system to feed power into the electrical grid by connecting it to the existing electrical power lines along Kūhiō Highway.[7] As depicted on Figure 1.3, the substation would be constructed on an approximately 2-acre portion of the land that DHHL has committed to KIUC. Access to the substation would be via Kūhiō Highway and the same new access road serving the solar array and the Anahola Service Center.

2.2.1 ANAHOLA SUBSTATION: PROPOSED FACILITIES

As illustrated on the conceptual site plan reproduced in Figure 2.7, the proposed substation would have several different types of equipment. These include switchgear, standard oil-filled ANSI/IEEE[8] transformers, voltage regulators, capacitors, and other electrical components. The transformers' purpose is to step the voltage up from the 12.47 kV voltage delivered from the solar array to the 69 kV voltage that is the standard for KIUC's island-wide transmission system. Each transformer would service two 12.47 kV circuits.

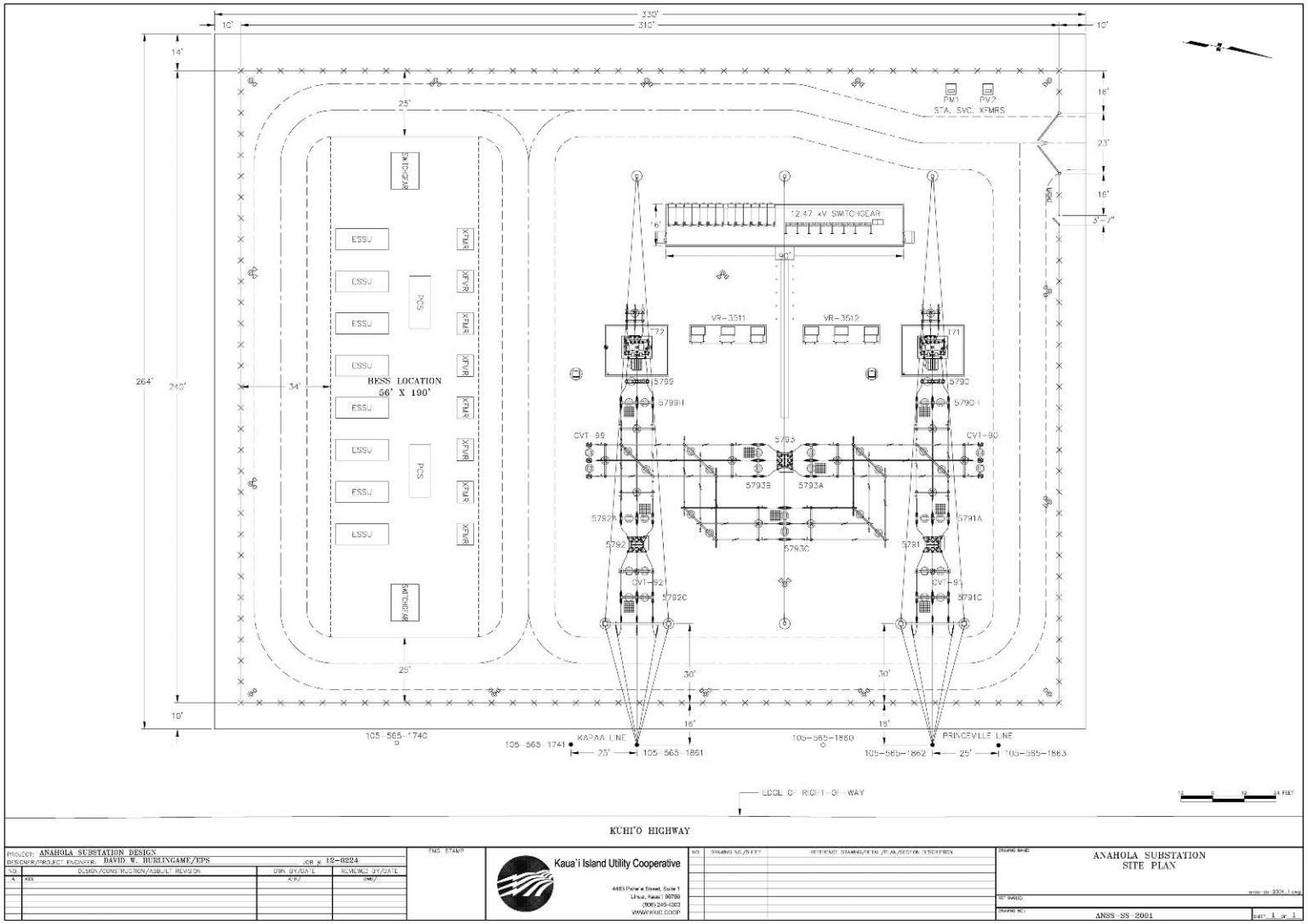
[5] The Resource and Conservation Recovery Act constitutes the primary set of rules governing wastes containing Cd, Se, Pb, Cu or Ag provided that these wastes are considered to be discarded material and are not included in any specific exclusions.

[6] KIUC believes that the agricultural capability/suitability of the great majority of the site will be as good as or better than its original state. This is because while a few areas where large chunks of concrete foundation remain may be more difficult to cultivate than was formally the case, this would be partially or wholly offset by the economic benefit to farming provided by the improved interior roadway system that would remain.

[7] Most of the power would be fed into the 69kV circuit, but some may also be routed directly into the 12.47 kV distribution circuit (composed of four wires) that is mounted on the same existing utility poles.

[8] American National Standards Institute (ANSI) is a private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States. Institute of Electrical and Electronics Engineers (IEEE) is a non-profit professional association which propagates standards for the electrical and electronics industries.

Figure 2.7 Plan View of Proposed Substation



While the principal purpose of the substation would be to serve the solar array, it would have the added benefit of allowing the 69 kV-capable circuit that now passes the site to be energized at 69 kV rather than the 12.47 kV to which it is now limited.[9] That would lessen the energy losses that KIUC incurs in providing power to the area and decrease the probability of customers situated from Anahola to Haʻena experiencing electrical power outages when there are problems with KIUC's 69 kV cross-island power line.

The substation would be connected to the existing wood pole 69 kV circuit crossing in front (East) of the substation via an in/out loop consisting of 559.5 size AAAC conductors[10]. KIUC will also construct two underground 12.47 kV circuits from the substation to risers installed on the existing (or relocated) poles in front of the substation. Finally, the substation control equipment will be connected to KIUC's existing overhead fiber-optic communications system that is mounted on the same poles as the existing overhead transmission line.

The conceptual plan for the substation provides a 16-foot by 90-foot by 12-foot pre-manufactured control building. This small structure would house the relaying and protective controls, station control batteries, communications equipment and other necessary monitoring and control equipment, tools, and maintenance supplies. An approximately 45' high A-frame supporting the interconnection wires would link the proposed substation with the existing transmission line on the *mauka* side of the Kūhiō Highway right-of-way. It would be the tallest structure in the substation and would be topped with a lightning protection wire. Other structures within the substation would be lower, with none of them exceeding a height of 25' above grade.

KIUC will install landscaping along the Kūhiō Highway and Anahola Service Center sides of the facility (i.e., on its eastern and northern sides). Figure 2.8 and Figure 2.9 show conceptual landscape plan for the Service Center, Substation, and solar array frontage south of the substation. Plants used for landscaping will be selected for minimal irrigation and fertilization requirements when grown. No potable water or sanitary wastewater treatment facilities will be constructed. (Note: The landscaping extends southward from the substation just *mauka* of the highway right-of-way to block views of the solar panels that will be installed in that area.)

In addition to the normal electrical substation equipment, the proposed Anahola Substation also contains space for a Battery Energy Storage System (BESS). Incorporating a BESS system into the solar array/substation complex will allow KIUC to smooth the power output by providing real and reactive power, compensating for sudden output fluctuations in a matter of milliseconds.[11] The amount of power from an intermittent generation source such as solar that can be tied into the KIUC grid without sacrificing reliability is limited by three factors: (*i*) the availability of spinning reserve of online generating units; (*ii*) the speed with which additional firm power units can be started and brought online; and (*iii*) the capacity of online power-storage devices.[12] KIUC's existing base load (Kapaia Generating Station at 26.4 MW) and cyclic generating units (Port Allen Generating Station at 30.6 MW) can operate at 65 percent load without making significant compromises in operational

[9] KIUC is in the process of switching over from the 57.1 kV standard to which the system was originally constructed to the 69 kV that is its present design standard. Once KIUC replaces the few remaining pieces of 57.1 kV-rated equipment with equipment that meets its present standard it will energize the transmission grid at 69 kV. While it must continue to energize its transmission system at 57.1 kV until the conversion is complete, this report will use the term 69 kV.

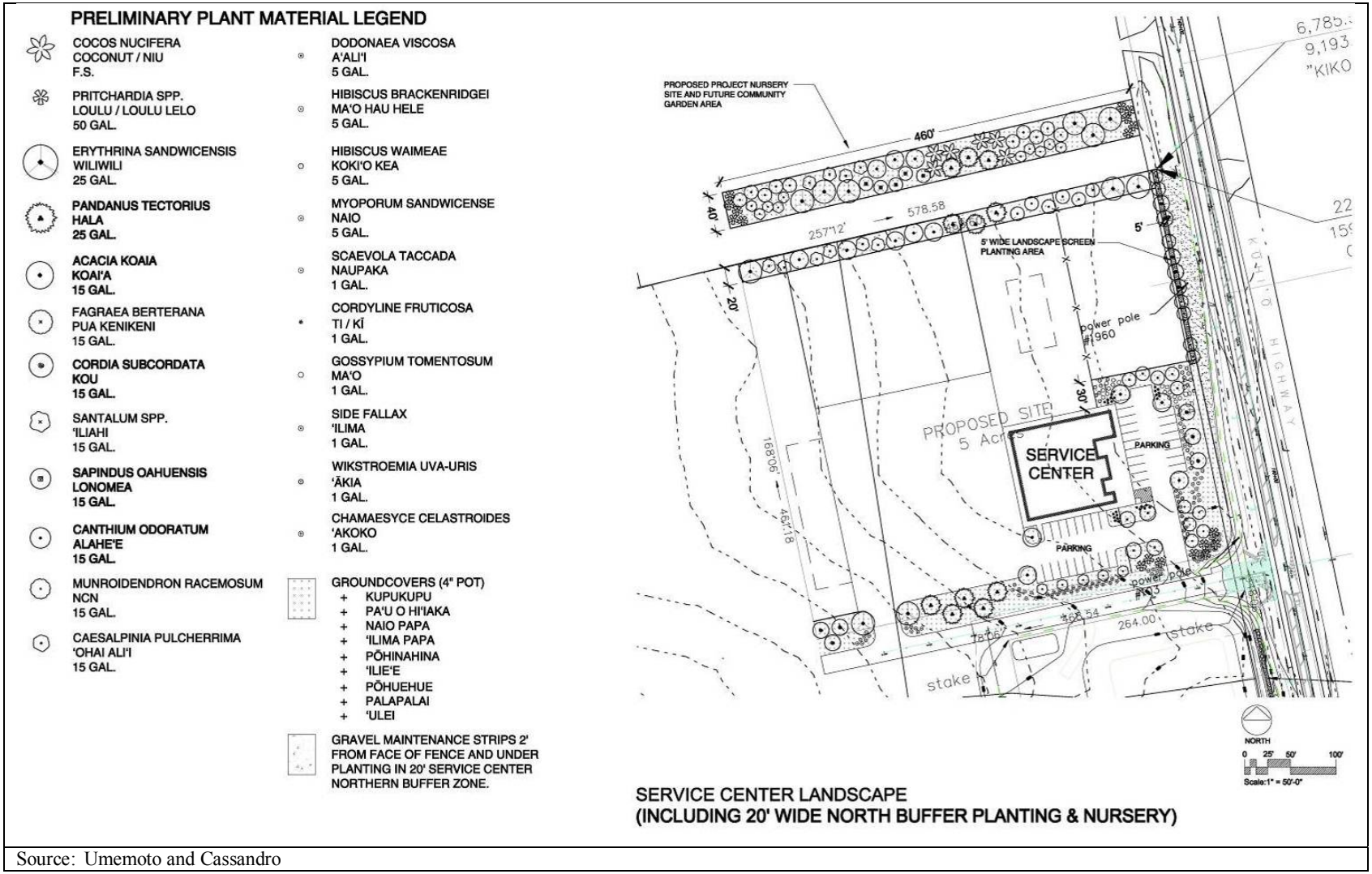
[10] These conductors (wires) are made of an aluminum alloy. Each wire is composed of 19 strands 0.1716 inch diameter strands, is 0.85 inches in diameter, and has a cross-sectional area of 0.4394 square inch.

[11] Power in an electric circuit is the rate of flow of energy past a given point of the circuit. In alternating current circuits, energy storage elements such as inductance and capacitance may result in periodic reversals of the direction of energy flow. The portion of power that averaged over a complete cycle of the AC waveform, results in net transfer of energy in one direction is known as real power. The portion of power due to stored energy, which returns to the source in each cycle, is known as reactive power.

[12] "Reserve" is the amount of generating capacity a central power system must maintain to meet peak loads; "spinning reserve" is the capacity of generating units connected to the electrical system that are immediately ready to provide power the grid sufficient to meet all users' needs.

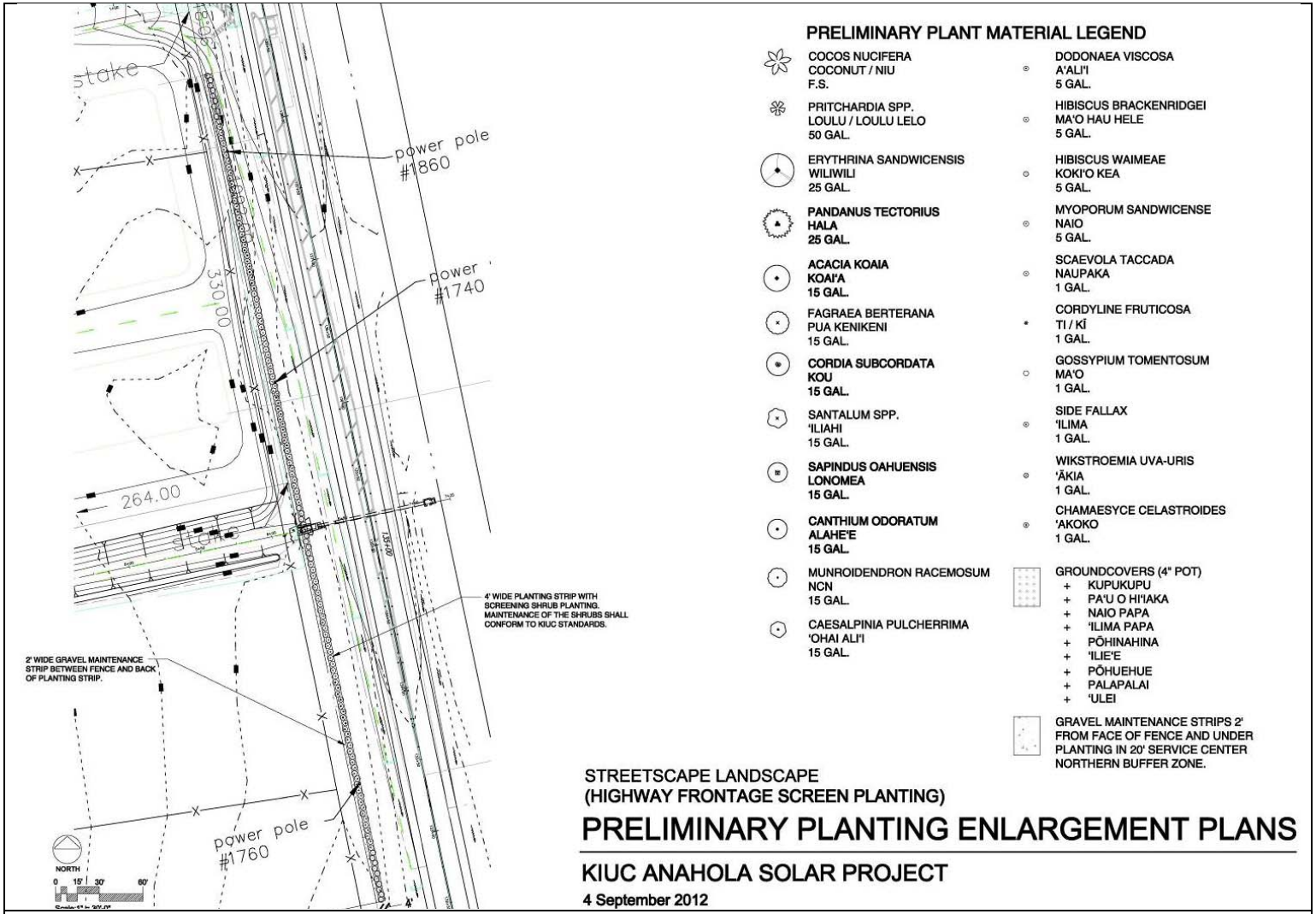
efficiency, and down to 50 percent load without violating air emissions limits. Consequently, KIUC's existing base and cyclic generation capacity can operate with a maximum of 20 MW of spinning reserve. The BESS system will provide buffering to ensure that the grid can accommodate the solar array's output without being compromised. The result is for a more predictable flow of power from the solar array to KIUC's electrical grid; this, in turn, will give KIUC the ability to respond to other system events, such as loss of generation and system faults.

Figure 2.8 Conceptual Landscape Plan: Service Center



Source: Umemoto and Cassandro

Figure 2.9 Conceptual Landscape Plan: Substation



Source: Umemoto and Cassandro

Figure 2.10 BESS 20-Foot Container Module

Typical module in 20-foot container.

Interior of battery module showing canisters that are part of fire protection system.

Source: http://www.rechargenews.com/multimedia/archive/00044/Acciona_baterias_de__44857b.jpg

As depicted on the site plan, the BESS system at Anahola would be comprised of several units, each contained in a separate 20-foot-long container. Each container holds: (*i*) a Lithium-ion battery, (*ii*) a supervisory and power management system, (*iii*) an active cooling system, and (*iv*) a fire prevention system. The modular design of this BESS system and the inclusion of a fire control system within each container minimizes the likelihood that a fire within a particular unit will catastrophically damage it. It also ensures that even if such damage were to occur it would be restricted to only one part of the overall BESS; the system is interconnected in such a way that other, undamaged units would continue functioning normally. The fire protection system helps insure that the kind of fire that occurred at the BESS serving one O'ahu wind farm (which consisted of all batteries within a single building with no fire protection system) cannot occur at Anahola.

2.2.2 ANAHOLA SUBSTATION: CONSTRUCTION ACTIVITIES

KIUC will begin construction of the substation by grubbing and grading the site, pouring the concrete footings for the major structures and the foundation of the control building described below, and laying down coarse gravel over most of the operations area to facilitate drainage and avoid pooling of storm water near the electrical equipment. This would be followed by construction of the control room and installation of the transformers, voltage regulators, A-frame, H-frames, and other electrical equipment. Irrigation of the landscaping would be done using water trucks as required during the early phases of growth, but this will be discontinued as the plantings mature.

Based on preliminary grading plans for the facility, KIUC anticipates that a substantial amount of fill will be needed on the substation site. Nearly all of this will be consist of material excavated during construction of the retention basins on the adjacent area where the solar array will be erected. However, some material (such as gravel) will need to be imported for use as structural fill and surface-finishing.

2.2.3 SUBSTATION: OPERATION AND MAINTENANCE ACTIVITIES

The Anahola Substation would be unstaffed, and electrical equipment within the substation would be remotely monitored and controlled by an automated system. Components of the substation will require periodic maintenance and may require emergency repair. In general, maintenance will entail

visual inspection, repainting of components, etc. Routine maintenance would include equipment testing, equipment monitoring, and periodic repair. KIUC personnel would generally visit the substation three to four times per month for routine maintenance that includes equipment testing, equipment monitoring, and repair.

Once established, substations typically have indefinite (i.e., very long) life spans, with even specific pieces of equipment such as transformers and switches typically performing satisfactorily for decades. Hence, little heavy maintenance work is typically required.

2.2.4 SUBSTATION: DECOMMISSIONING

Because the Anahola Substation would serve much more than just the Anahola Solar Project, its decommissioning is not anticipated in the foreseeable future. If and when KIUC does determine that there is no longer needed, the equipment would be removed and disposed of in accordance with the standards in place at the time. While it is possible to do so, KIUC does not presently envision removing the gravel that it would use as the surface cover over most of the substation. The continued presence of this material will prevent, or substantially reduce, the opportunity to use the area for nursery and other similar activities where use of the soil is necessary.

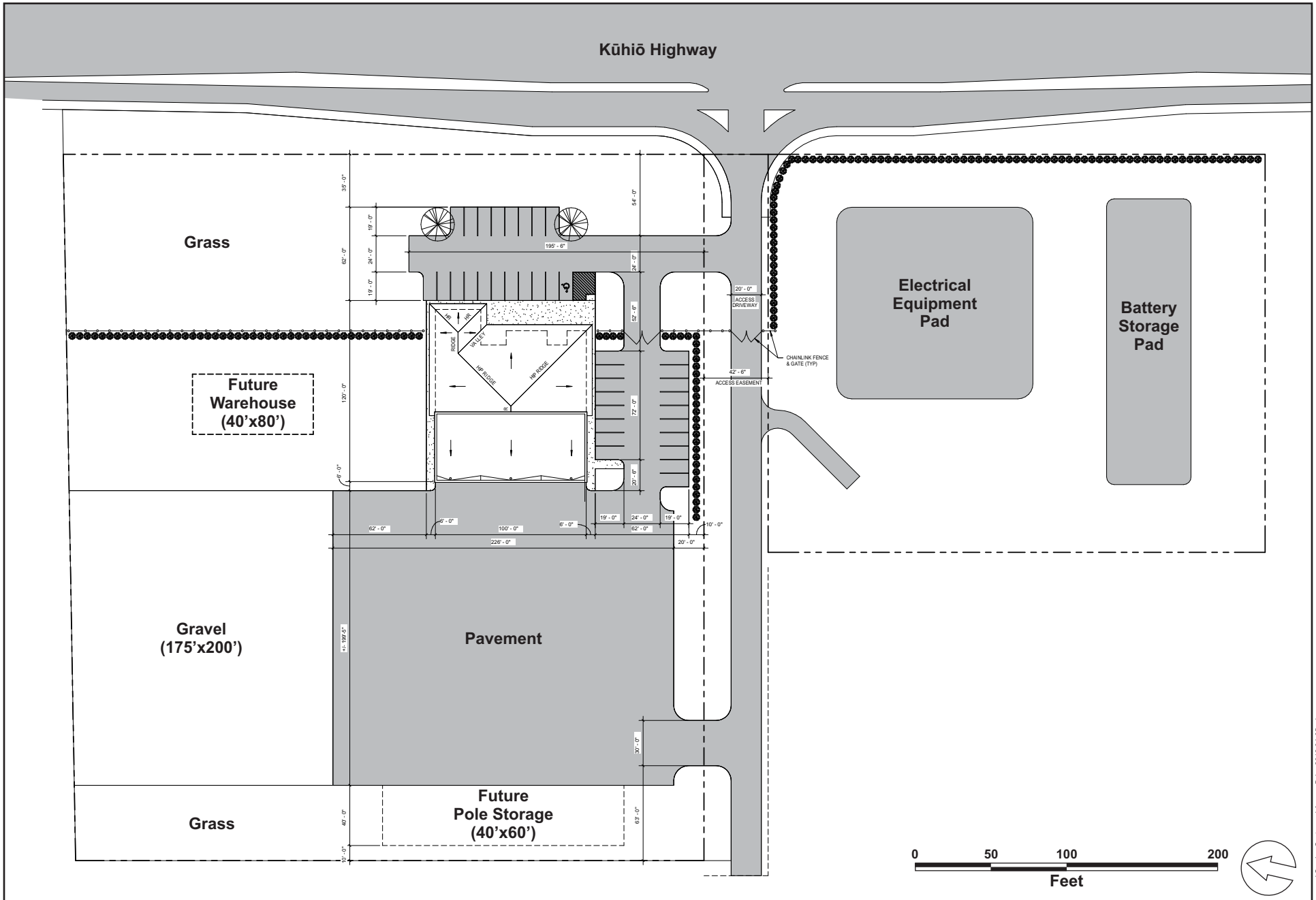
2.3 ANAHOLA SERVICE CENTER

The Anahola Service Center and the access drive serving the project will occupy 5 acres of the 60-acre lease area; 4.5 acres for the service center/transmission and distribution (T&D) Department baseyard and 0.5 acres for the access drive. This new service center will provide the following:

- A new structure containing approximately 4,230 square feet of space for planners and line crews. This would house office space, locker and restroom facilities, a small conference room, a storage room, a break room, and a 1,400 square-foot community meeting room for use by the public and the utility.
- 4,500 square feet of warehouse and garage space, including five enclosed truck bays; and
- An outside area or "baseyard" for storage of vehicles, equipment, and materials such as poles.

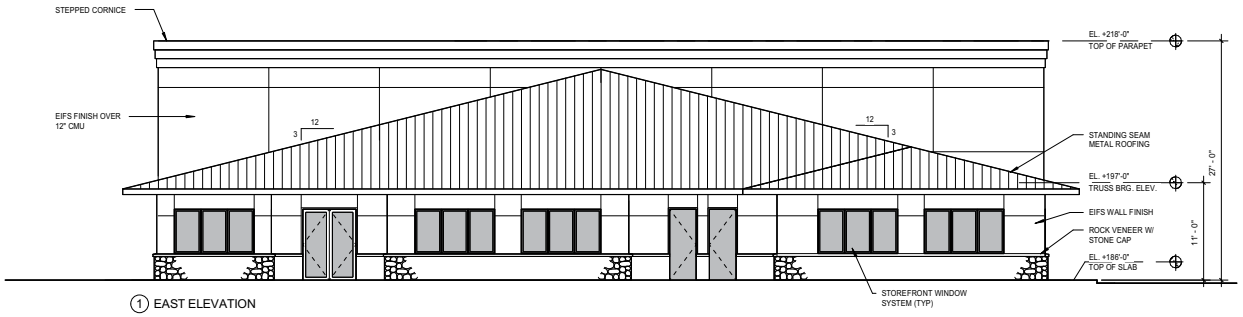
As noted in Section 3.2 below, new rules mandate proper containment areas and racks for the storage of utility poles, and a concrete warehouse area for the storage of transformers, which meet current EPA guidelines. Facilities designed to meet these federal standards are incorporated in the proposed service center.

KIUC will construct a new roadway to provide access to the Anahola Service Center. Figure 2.11 and Figure 2.12 show plan and elevation views of the proposed service center. Figure 2.13 is a conceptual rendering of the structure. The design of the proposed intersection with Kūhiō Highway is shown in Figure 2.14. It meets all State of Hawai'i Department of Transportation standards, and the project engineer has confirmed with the Department that the design concept is satisfactory. Both the temporary and permanent access road will be designed by a Hawai'i-licensed civil engineer. KIUC does not expect to be able to provide the final design until after the substation and solar array are completed. The contractors will develop an emergency vehicle access plan and share that with the relevant emergency response agencies.

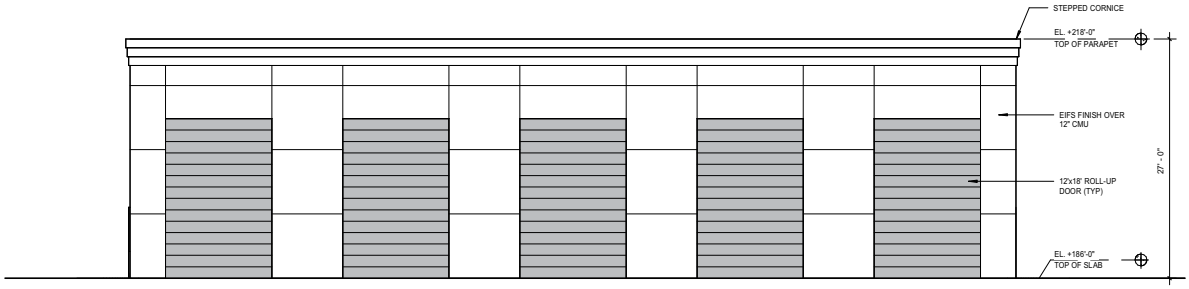


Prepared For:	Prepared By:	Source:	Project:	Figure 2.11:
Kaua'i Island Utility Cooperative	PLANNING SOLUTIONS	Marc Ventura, AIA, LLC	Anahola Solar Project	**Plan View of Service Center and Access Drive**

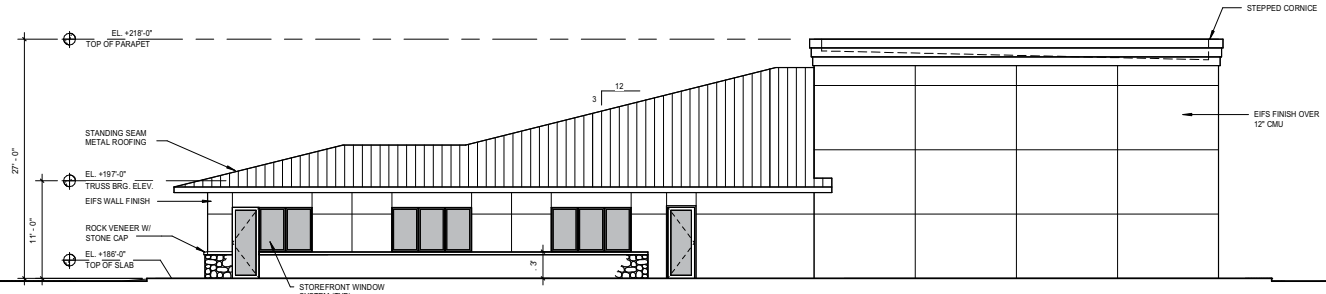
Figure 2-11 Site Plan of Proposed Service Center and Access Drive 2013-04-05.cdr



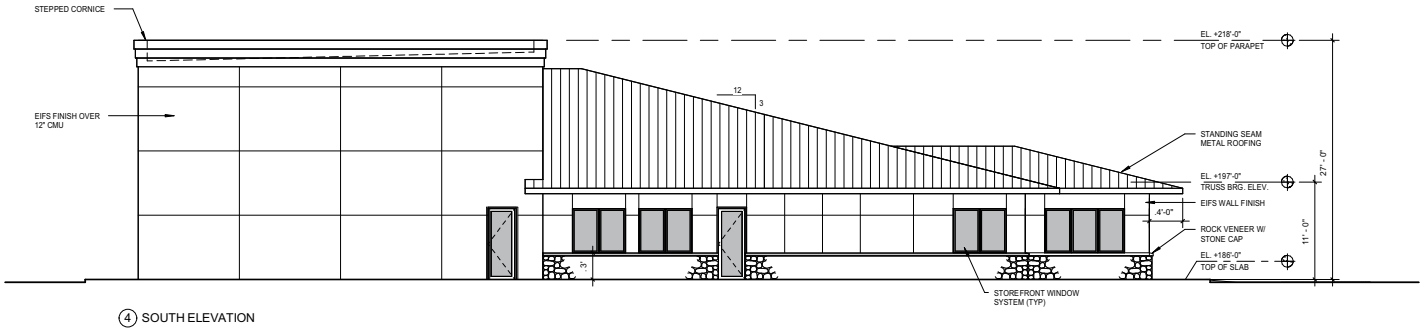
1 EAST ELEVATION



2 WEST ELEVATION



3 NORTH ELEVATION



4 SOUTH ELEVATION

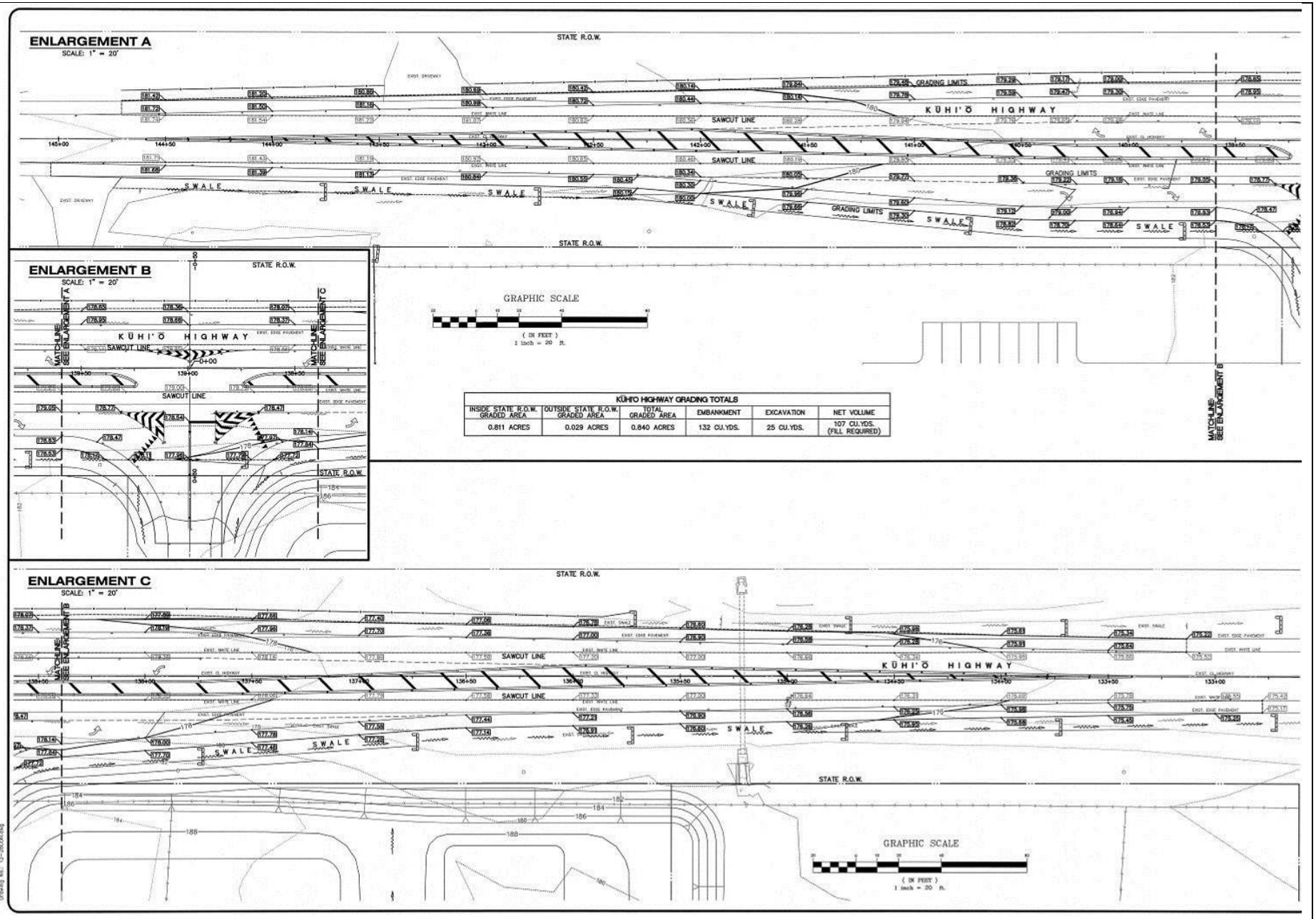
Prepared For:	Prepared By:	Source:	Project:	Figure 2.12:
KIUC	PLANNING SOLUTIONS	Marc Ventura AIA, LLC	Anahola Solar Project	**Elevation View of Proposed Service Center**

Figure 1-7 Elevation View of Proposed Service Center 2013-04-05.cdr

Prepared For:	Prepared By:	Source:	Project:	Figure 2.13:
Kauai Island Utility Cooperative	PLANNING SOLUTIONS	Mark Ventura, AIA, LLC	Anahola Solar Project	**Conceptual Rendering of Proposed Service Center**

Figure 2-13 Conceptual Rendering of Proposed Service Center 2013-04-05.cdr

Figure 2.14. Kūhiō Highway Site Access Road Intersection Design



KŪHI'O HIGHWAY GRADING TOTALS

INSIDE STATE R.O.W. GRADED AREA	OUTSIDE STATE R.O.W. GRADED AREA	TOTAL GRADED AREA	EMBANKMENT	EXCAVATION	NET VOLUME
0.811 ACRES	0.029 ACRES	0.840 ACRES	132 CU.YDS.	25 CU.YDS.	107 CU.YDS. (FILL REQUIRED)

Source: Esaki Surveying and Mapping

2.3.1 ANAHOLA SERVICE CENTER: CONSTRUCTION ACTIVITIES

Once use of the Service Center site as a laydown area for the solar array and substation is complete, construction of the new service center would commence with grading of the 5-acre site to create a level surface for the structure. Some additional select fill material will be brought into the service center site from elsewhere on island. The construction of the service center building will involve concrete structural walls, a concrete or metal roof, and interior plumbing and electrical work for the offices and other areas intended for use by personnel or the public. Other work will include installation of water, sewer, electrical, and communication connections, installation of equipment intended to meet fire control needs and the EPA's SPCC rules for storage of utility poles and electrical transformers, also paving for the external and internal parking areas. The entire frontage of the service center along the highway will be landscaped with native plants.

2.3.2 ANAHOLA SERVICE CENTER: OPERATIONS AND MAINTENANCE

Once constructed, the new service center will be kept in service indefinitely, with a projected lifespan of 40 years or more. This service center will replace the temporary facility at Kapa'a, which will be permanently decommissioned. The new service center will require a level of maintenance typical for similar office buildings. In general, maintenance will entail visual inspections, repainting, and regular care of surrounding landscaping.

2.3.3 ANAHOLA SERVICE CENTER: DECOMMISSIONING

If and when it is decommissioned, it is possible that the building could be put to an alternative use. If that does not occur, the buildings would be demolished. At that time, the site could be returned to its original condition.

2.4 IMPLEMENTATION SCHEDULE

The estimated construction start date and duration for the photovoltaic array and substation are presented in Table 2.2. The implementation schedule for the service center is shown in Table 2.3.

Table 2.2 Preliminary Project Schedule: Solar Array and Substation

Task	*Estimated Start Date*	*Estimated Duration (in months)*
Final Design	January 2012	12
Construction of Solar Array	Q3 2013	9
Construction of Substation	Q3 2013	6
Source: KIUC (2012)		

Table 2.3 Preliminary Project Schedule: Service Center

Task	*Estimated Start Date*	*Estimated Completion Date*
Design Engineering	September 1, 2011	January 31, 2013
PUC Approvals	February 1, 2013	November 30, 2013
Environmental Planning	July 1, 2012	December 31, 2013
RUS CWP Amendment	December 31, 2012	December 31, 2013
Permitting	July 1, 2014	January 31, 2015
Procurement & Construction	April 1, 2015	December 31, 2016
Source: KIUC (2012)		

2.5 PROJECT COSTS

KIUC has prepared preliminary construction cost estimates based on the facility concepts presented above. These estimates are summarized in Table 2.4.

Table 2.4 Estimated Project Costs

Component	*Cost ($)*
Solar Array	**38,585,831**
Substation and BESS[1]	**14,900,000**
Service Center	**5,400,000**
Other Costs[2]	**1,500,00**
Total	**54,985,831**
Note 1: This consists of $7,400,000 for the Switchgear and transformers and $7,500,000 for the BESS. Note 2: These costs include landscaping, the Homeowner's Benefit Agreement (HBA) and legal fees associated with the project.	
Source: KIUC (2012)	

3. PURPOSE & NEED OF THE PROPOSED PROJECT

3.1 NEED FOR PHOTOVOLTAIC ARRAY AND SUBSTATION

KIUC's need for the proposed facilities stems from its: (*i*) obligation to meet the requirements of the State of Hawai'i's Renewable Portfolio Standards (RPS) law; (*ii*) desire to improve the reliability of electrical service in the area between Kapa'a and Anahola and on the North Shore; and (*iii*) commitments as a publicly-regulated utility and as a not-for-profit cooperative.

Renewable Standards. KIUC's need for the proposed facilities stems from its obligation to meet the requirements of the State of Hawai'i's Renewable Portfolio Standards (RPS) law. The State of Hawai'i's RPS law, Hawaii Revised Statues §269-91, sets minimum requirements for the use of renewable sources of energy for electrical generation such as wind, solar, and biofuels. The law requires that 40 percent of generation be met by renewable resources by 2030, with several interim goals to be met prior to that date. The RPS goals and their target dates are summarized in Table 3.1 below. In addition, Act 234 of the Session of Laws for 2007 establishes a framework for reducing greenhouse emissions to the levels emitted in 1990 by the year 2020. Thus, there is a growing legal mandate for the exploration of clean, renewable energy generation in the State of Hawai'i.

Table 3.1 Renewable Portfolio Standards Dates and Targets

Year	*Target as a Minimum % of Total Sales*	*Energy Savings Included*
2010	10%	Sale of electricity plus energy savings via efficiency programs and solar water heaters included.
2015	15%	Through sales of electricity only.
2020	25%	Through sales of electricity only.
2030	40%	Through sales of electricity only.
Source: KIUC Strategic Plan 2010-2025 (KIUC, 2009)		

During the past several decades, the KIUC system has grown increasingly dependent on imported fossil fuels. This, due to the slow decline of the sugar industry, which in the 1980s provided over 50 percent of Kaua'i's energy from biomass and hydropower combined with an increase in the use of electrical power. In 2010, for example, KIUC consumed 30 million gallons of oil to generate 92 percent of Kaua'i's electricity. The remaining 8 percent was generated solely by hydropower, since Kaua'i's last sugar industry biomass boiler shut down in late 2009. Some of that hydropower was from KIUC-owned facilities and some of it was generated by others who have Power Purchase Agreements (PPAs) with the utility. In view of this situation, KIUC faced a clear need to increase the amount of electricity that it obtains from renewable sources.

KIUC's Strategic Plan responded to the challenge by setting a renewables target that is even more ambitious than that required by the State's RPS. It calls for renewable resources to generate 50 percent or more of Kauai's electricity by 2023, and directs its portfolio approach to developing additional renewable energy resources. KIUC has taken the following actions to ensure that it meets the RPS requirements and Strategic Plan Goals:

- Signed a Power Purchase Agreement (PPA) with Green Energy LLC for a 6.7 MW biomass plant.
- Signed PPAs for seven MW of solar-voltaic power at two other locations (1 MW at Kapa'a and 6 MW at Port Allen).

- Negotiated a contract with SolarCity to build a 12-megawatt solar photovoltaic project on land that KIUC has agreed to lease from Grove Farm Co.; the 30-40 acre facility would be constructed on a 67-acre site just east of Kōloa on Māhāʻulepū Road, between the Kōloa Bypass Road and the old Kōloa Mill.
- Investigated whether additional biomass or hydro-power can be obtained, either through the development of KIUC-owned facilities or through PPAs with Independent Power Producers (IPPs).
- Actively worked to determine whether additional hydro development is feasible, either through additions to its own facilities or through new or modified PPAs with IPPs.

As it has pursued these projects, KIUC has learned that most renewable options have relatively long development timelines. None of the hydro and biomass proposals that have been investigated by KIUC in the past two decades have yet come to fruition, largely due to the extensive permitting requirements and community opposition. Wind power, a renewable option that is being developed on all of the other islands, is currently not feasible due on Kauaʻi due principally to the substantial populations of endangered seabirds that are present on the island. The regulatory process, which includes preparing Habitat Conservation Plans and acquiring Incidental Take Permits under Section 10 of ESA and the equivalent State of Hawaiʻi laws and regulations (Chapter 195D, Hawaiʻi Revised Statutes) is time-consuming and likely to result in very high monitoring and mitigation costs. Furthermore, most of Kauaʻi's prime wind locations are on private land whose owners have indicated that they are not interested in developing wind farms.

Hundreds of small residential and commercial solar installations have been installed and connected to the KIUC electrical grid in accordance with the provisions of the State of Hawaiʻi Public Utility Commission-approved "KIUC Tariff No. 2".[13] These systems are all privately owned and operated, but their construction and operation has been greatly facilitated by the existence of this standardized tariff. They have helped to reduce Kauai's overall dependence on oil, but they are too small to have had more than an incremental effect (see the bottom row in Table 3.2 below).

Table 3.2 Kauai's Power Generation Fuel Mix: 2003-2011

Fuel Mix Percentage	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Biomass	0.3%	0.4%	0.5%	0.4%	0.3%	0.2%	0.5%	0.0%	0.0%
Fossil Fuel	94.5%	92.0%	91.6%	91.8%	94.2%	91.4%	90.5%	90.9%	89.0%
Hydro	5.2%	7.6%	7.9%	7.8%	5.4%	7.6%	7.9%	7.8%	8.8%
Photovoltaic	0.0%	0.0%	0.1%	0.1%	0.1%	0.8%	1.1%	1.4%	2.1%
Source: Kauai Island Utility Cooperative (2013)									

In mid-2011, with few options to rapidly and assuredly increase the percentage of electricity generated from renewable resources to meet the legal requirements for renewable energy, KIUC decided to take a more direct approach. Solar pricing had become competitive with oil, and KIUC determined that permitting solar projects involved less risk than other renewable options. At that time KIUC began developing a solar project large enough to allow it to make significant steps towards its

[13] Tariff No. 2 establishes the policies and procedures that must be followed by both KIUC and distributed generation units connected with KIUC's electric system. In doing so, KIUC utilized as its starting point in preparing these Policies and Procedures the standard procedures issued by the Federal Energy Regulatory Commission ("FERC") on May 12, 2005, as amended, to govern the interconnection of generators no larger than 20 MW. These Policies and Procedures were approved by the Commission in Decision and Order No. 24238, issued on May 22, 2008, in Docket No. 2006-0498, as subsequently approved by Order issued on June 26, 2008.

Strategic Plan and RPS targets while not being so large that it would adversely impact system reliability due to the intermittent nature of solar energy. Ultimately, KIUC determined that a solar project in the 10 to 14 MW (AC) range represented the appropriate balance between those two objectives, a size which would provide approximately 5 to 6 percent of the energy used in KIUC's system. A 10 to 14 MW solar facility would also make a significant contribution to KIUC's efforts to meet or exceed its RPS and Strategic Plan goals and fulfill its responsibilities to its members as a not-for-profit cooperative.

Reliability of Electrical Power Supply . In addition to meeting the renewable energy standards discussed above, KIUC must also ensure that all its members receive reliable electrical service. While the Anahola Solar Project is in and of itself sufficient reason to construct a substation in the planned location, its presence there will also benefit the KIUC electrical system by improving the reliability of electrical service in the region.

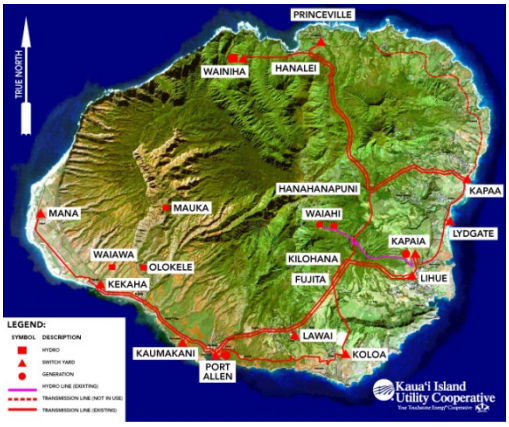
From a customer perspective, the reliability of an electric utility system includes two components: (*i*) continuity of service and (*ii*) power quality.

- *Power reliability* (i.e., continuity) is the capacity to deliver electricity to customers within accepted standards and in the amount desired. The degree of reliability is measured by the frequency, duration, and magnitude of outages. Reliability indices typically consider aspects such as the number of customers, the connected load, the duration of the interruption, the amount of power interrupted, and the frequency of interruption. Fewer and shorter outages are superior to more frequent and/or longer outages.
- *Power quality* is the capacity to maintain a steady frequency (60 Hz) and nominal circuit voltage. Power quality often involves safety issues (e.g., grounding and elevated neutral voltages). Today's electronic loads are susceptible to momentary interruptions and other disturbances (e.g., spikes). In turn, these power quality problems have a huge economic impact on KIUC's customers.

The two measures are related; if a utility cannot maintain the proper voltage, the situation can trigger an outage. KIUC tracks the performance of its system with respect to this criterion, and its records show that electrical service to the portion of the island that is served only by the 12.47 kV distribution lines emanating northward from the Kapa'a Substation and outward from the Princeville Substation Anahola is less reliable than is desirable.

In addition to these two factors, KIUC's system planning must also take into account forecast increases in the amount of electricity used by its customers in the corridor served by the transmission and distribution facilities. In this case, it is peak use that is of principal concern, because it is peak use (rather than average) that determines the capacity of the electrical transmission and distribution facilities that are needed.

The only electrical power line presently serving the northern part of the island that is energized at transmission line voltage is the 12.6-mile long "69 kV Cross-Island Line" (see Figure 1.1 and the sketch at right), which begins at the Hanahanapuni Tap in the mountains above Kapa'a and ends at the Princeville Substation. This single transmission-voltage circuit has left the North Shore area vulnerable to outages and service disruptions by not giving the utility dual transmission-voltage paths to serve the area. Instead, as a backup the Princeville Substation must rely on a 20-mile long 12.47 kV distribution voltage line that connects it and the Kapa'a Substation. When only this 12.47 kV feed is in service and customer use of



electricity is high, the voltage level drops, adversely affecting power quality or causing a complete power outage.[14] To the extent that electrical power use along the corridor served by the line increases, the situation will tend to get worse over time.

If the Anahola Substation is constructed as planned, it will allow the portion of the 69 kV-capable power line that was installed between the Kapa‘a Substation and the eastern side of Kalihiwai Valley during 1989-1991 to be energized at it full 69 kV capacity from Kapa‘a to Anahola. Electricity used by customers located between the Anahola and Kapa‘a substations will then receive power through the path with the least electrical resistance (and, therefore, with the lowest line losses). Customers to the west of Anahola will receive power through a shorter distribution circuit as well. In normal circumstances this will lower line losses and make it easier to maintain the required voltage; in situations where the cross-island line circuit is out of service, KIUC is much more likely to be able to fully meet the electrical needs of customers on the northern side of the island.

Cooperative Commitment to Community and Sustainable Development. In addition to KIUC’s responsibilities to provide safe, reliable, and affordable power, as a cooperative, KIUC must also adhere to the seven (7) cooperative principles, which includes a concern for community and its sustainable development. In furtherance of this commitment, KIUC and DHHL signed an Energy Charter in 2009, which stated that they would collaborate to enable native Hawaiians and the broader community to work together in leading Hawai‘i’s efforts to achieve energy self-sufficiency and sustainability. The Charter requires that KIUC and DHHL identify sustainable renewable energy projects for DHHL’s available lands, with preference to projects that provide benefits to the trust lands, native Hawaiian community, the DHHL, and KIUC. By siting projects on DHHL lands, KIUC would provide revenue to the local economy and further engage the native community in sustainable development efforts. KIUC therefore determined that siting of the proposed solar facility on DHHL lands would be preferred, though sites off of DHHL lands would be considered.

3.2 NEED FOR THE SERVICE CENTER

KIUC’s Transmission and Distribution Department has not added any additional construction or line personnel since 1988, and currently services all its customers across the island from just two service centers, including the ‘Ele‘ele Service Center located in the Southwest of Kaua‘i and the Kapa‘a Service Center, located on the East coast in Kapa‘a Town. In 2005, KIUC conducted an assessment of the existing support facilities, entitled “KIUC Service Center Study”, which is reproduced in Appendix H. The study identified customer service issues associated with the inaccessibility of the existing infrastructure for the growing communities of the North and Eastern Shores. It also identified existing operational issues at the existing Kapa‘a Service Center, including access for customers and KIUC employees which results in safety issues from heavy traffic congestion.

Customer Service Issues. The study identified customer service issues associated with the inaccessibility of the existing infrastructure for the growing communities of the northern and eastern shores. There are two particularly important aspects of this. The first is that the location of the existing facilities makes it difficult (because of overly long distance and/or traffic congestion) for customers who need service to reach them. The second is that the relatively great distance between

[14] In the mid-1980s, KIUC’s predecessor, Kaua‘i Electric (KE) received PUC permission (D&O 9134 issued on May 5, 1987) to install a 20-mile transmission circuit connecting the Kapa‘a and Princeville Substations. Construction began in 1989, but settlement of a court suit caused KE to suspend construction just short of the intersection of Kūhiō Highway and the eastern end of Kalihiwai Road (4.5 miles short of the Princeville Substation). As a result of the settlement, the entire circuit between the Kapa‘a and Princeville Substations has never been energized at more than 12.47 kV, preventing it from carrying all of the power it was designed to transmit.

the existing baseyards and the facilities and customers whom they must serve make it difficult to conduct service calls quickly and efficiently.

Kapa'a Service Center Operational Issues. There is no left turn off of Kūhiō Highway into the Kapa'a Service Center, nor is there an acceleration-deceleration lane. Once there, the Kapa'a Service Center is surrounded by a locked security fence, leaving customers to conduct their business with KIUC representatives in a portable trailer outside the perimeter fence. Access is a problem for KIUC employees as well; workers need to stand in the middle of the highway, blocking traffic, to allow trailer trucks to enter and exit the facility. The continuing difficulties associated with moving large trucks and pieces of equipment in, and out of, the Kapa'a Service Center, increases response times for service calls to the North Shore. This problem is further exacerbated by the heavy traffic congestion which frequently occurs in Kapa'a Town. In addition, KIUC would have difficulty meeting the U.S. Environmental Protection Agency's (EPA) newly instituted and more stringent Spill Prevention, Control, and Countermeasure (SPCC) rules at the Kapa'a Service Center, which require KIUC to upgrade the spill containment capability of its pole and transformer storage facilities due to the limited area that is available to make improvements. Also, the Kapa'a Service Center warehouse and storage areas are in the tsunami inundation zone; during tsunami warnings personnel and emergency response equipment (e.g., service trucks) need to be moved to higher ground.

KIUC ultimately determined that construction of a new service center was required to address the customer service and accessibility issues for the benefit of both KIUC staff and members. A location nearer (than Kapa'a) to the North Shore would allow KIUC employees responding to service calls in that area to act more rapidly and efficiently, by basing personnel, equipment, and materials closer to the areas where they will be needed. It would also create a point of service for customers coming from North Shore communities which would be closer, easier, and safer to access. Finally, it would create a spacious and modern facility outside of the tsunami evacuation zone which is designed in accordance with the latest federal Spill Prevention Controls and Countermeasures (SPCC) regulations.

3.4 OBJECTIVES & PURPOSE OF THE PROPOSED PROJECT

Table 3.3 lists KIUC's objectives for each component of the proposed project. Achieving these objectives would benefit DHHL beneficiaries as well, and the lease arrangements would provide an income stream to DHHL that would not otherwise be available.

Table 3.3 Project Objectives

12 MW Photovoltaic Solar Farm
• Provide safe reliable power to KIUC's consumers at the lowest possible cost. • To help KIUC meet or exceed the State of Hawaii's RPS requirements. • To make significant progress towards KIUC's Strategic Plan to achieve 50 percent renewable generation by 2023. • To reduce Kauai's dependence on imported fossil fuels. • Improve system stability and provide voltage support to the North Shore during contingencies.
Substation
• To step up electrical power generated by the solar facility for interconnection with the KIUC transmission system. • Break the Kapa'a-Princeville transmission line into two independent segments, improving reliability.
Service Center
• To distribute KIUC staff and facilities more efficiently, with infrastructure closer to the growing North Shore community. • To improve customer access to KIUC planners. • To create additional material and equipment storage in a facility designed for this use. • To reduce response times for line crew responding to service calls.
Source: Kaua'i Island Utility Cooperative (2012).

4. ALTERNATIVES EVALUATED IN THE EA

The NEPA statutes require the evaluation of the alternatives to the proposed action, 42 USC 4332 (1)(c)(iii). The CEQ's implementing procedures further define this process, by stating that the NEPA document must evaluate a range of all reasonable alternatives to the proposed action, 40 CFR § 1502.14). RUS's bulletin for the preparation of EAs, entitled, *Bulletin 1794A-601 Guidance for Preparing an Environmental Report for Projects Requiring an Environmental Assessment*, provides further guidance to define this range of alternatives, through the following subject areas that should be addressed:

(1) Alternative corridors, routes, or locations (sites);

(2) Other methods to provide service;

(3) Alternative construction methods and materials;

(4) Alternative designs;

(5) Load management and energy conservation;

(6) Alternative generation technologies; and

(7) Combinations of the above technologies.

At the State level, Title 11, Chapter 200 of the Hawai'i Administrative Rules (HAR §11-200) contains the Department of Health's environmental impact rules. This section: (*i*) defines the assessment process for "applicant actions" such as the one that KIUC is proposing; (*ii*) requires that the approving State of Hawai'i agency (in this case the Department of Hawaiian Home Lands) analyze alternatives, in addition to the proposed project in its environmental assessment; and (*iii*) establishes the required contents of environmental assessments. Among the requirements listed is the identification and summary of the impacts and alternatives considered.

In accordance with those Federal and State requirements and as part of its continuing review of its operational and facility needs, KIUC considered a number of alternatives before choosing the proposed project. This process consisted of defining the objectives of the project (see Table 3.3), identifying possible alternatives (including those specifically mandated by NEPA and Chapter 343), and evaluating each alternative with respect to the project's objectives.

As discussed in Section 3.1, KIUC's analysis of other renewable energy technologies (e.g., wind, biomass, hydropower, etc.) showed that they were not viable alternatives and would not allow KIUC to meet the project alternatives outlined in Table 3.3. Because of these considerations, and because the solar facility and the substation are inextricably linked, KIUC focused its analysis of alternatives on alternate sizes, locations, and timetables for photovoltaic facility development.

KIUC determined that the solar array and substation were inextricably linked, such that the substation would be required to step up the generated energy to 57.1 kV to feed into the existing KIUC transmission system. Locating the substation elsewhere would require a longer run of the lower-voltage feeder from the solar farm. The increased distance would, in turn, increase both the cost of installing the connection and the energy lost as the electrical power travels through the wires. Therefore, the solar facility and the substation were sited as a singular unit.

KIUC evaluated a number of different solar power alternatives during the planning process for the Anahola Solar Project; however, only two merit review under the environmental impacts section: (*i*) the proposed project, a 12 MW photovoltaic facility in Anahola, Kaua'i; and (*ii*) the "no action" alternative as mandated by NEPA and Chapter 343 requirements. The reasons why the other alternatives failed to meet the project's purpose and need are discussed in Section 4.2.

4.1 NO ACTION

Solar Array. Under the "No Action" alternative, the proposed solar array would not be constructed. Without this facility, KIUC would be unable to meet the increasing demand for electricity on Kaua'i with renewably sourced energy and would not be able to meet the RPS requirements instituted by the State of Hawai'i. It would continue to use existing (and potentially other planned) power sources, the great majority of which rely on fossil fuels.

Substation. Under the "No Action" alternative, the new substation would not be constructed. The principal need for the substation is to connect the solar farm, which would not be built under the "No Action" alternative, to KIUC's transmission system. However, the presence of a substation at Anahola would also allow KIUC to: (*i*) substantially reduce line losses that it now experiences in transmitting power at 12.47 kV over the full 22-mile distance from Kapa'a to Princeville and (*ii*) improve the reliability of service to North Shore communities from Anahola onward.[15]

Service Center. "No action" for this component of the project means that all T&D activities on the eastern and northern sides of the island will continue to be based at the existing, and inadequate, facility in Kapa'a. It also means that the nearest point where North Shore residents and businesses will be able to conduct business with KIUC will remain in Līhu'e.

In sum, the "No Action" alternative would not achieve the objectives of the proposed project. Consequently, it is not considered a feasible or desirable alternative, and is included in this EA solely to fulfill the legal requirements of NEPA and its implementing regulations and the comparable State requirements (Chapter 343, Hawai'i Revised Statutes/Hawai'i Administrative Rules §11-200) and to provide a baseline against which to measure the impacts of the proposed project.

4.2 SOLAR ARRAY AND SUBSTATION ALTERNATIVES CONSIDERED AND ELIMINATED

4.2.1 ALTERNATE LOCATIONS

As discussed Section 3.1, KIUC considered the possibility of locating the proposed solar project at several locations before deciding upon Anahola. KIUC determined between 45 and 63 acres would be required for a 10-14 MW photovoltaic, and began the selection process by identifying sites of an appropriate size. A review of solar resource maps for Kaua'i Island, land ownership and land use classification information, proximity to substations and transmission lines, the needs of the electric grid as a whole, and the potential benefit to the community were all used to identify a limited number of areas that could be candidates for a large solar photovoltaic project. Solar resource maps for the island of Kaua'i show that almost any site not located in the central part of the island possesses relatively abundant solar resources. This is contrary to popular perception, which is that the west side of the island is the sunniest, and hence best for generating solar power. KIUC also considered land costs, construction costs, and access to nearby transmission lines as they potentially significantly impact the cost of energy from a solar photovoltaic project. Three potential areas were identified through this screening process as most suitable, including Wailua, Kekaha, and Anahola.

Wailua. The Wailua area was identified as preferable given its proximity to KIUC's load center, which is between Līhu'e and Kapa'a (as noted in Section 3.1). Placing a source of generation near to the load center would limit the amount of electrical line loss, since the power would not have to be transmitted very far prior to use. The project site is a privately-owned parcel KIUC identified a privately owned parcel in Wailua that site possesses adequate solar energy resources to meet the

[15] This benefit accrues from the fact that it would generally be possible to serve users from the Anahola Substation northward with the existing 12.5 kV circuits even when the 69 kV cross-island line is out of service.

desired requirements for photovoltaic energy generation (see Figure 4.1). KIUC's analyses indicated that the. Though located in a favorable location for connectivity to the electrical grid, several other factors contributed to making this location less desirable than the preferred alternative (Anahola), including the following:

Figure 4.1 Alternate Locations Considered.

Wailua Site Considered | *Kekaha Site Considered.*

Source: KIUC October 17, 2011, Briefing to the Hawai`i Public Utilities Commission and Consumer Advocate,

- The site contained marshy soil, and this was judged likely to complicate construction and, in all likelihood, increase the construction cost.
- The site is on an east-facing hillside, which has less sun exposure.
- In order to use this site, KIUC would have had to construct a new segment of transmission line so that it could connect the solar array with the existing KIUC transmission grid.
- Lastly, the asking price of the parcel of land was very high considering the limitations of the site.

<u>*Kekaha.*</u> Solar maps indicate that the Kekaha area is among the best areas on the island of Kaua'i in terms of solar energy resources. KIUC evaluated two parcels in Kekaha, both belonging to a private trust. The first is in the foothills between Kekaha and Waimea towns. It is limited by several environmental factors including terrain, soil conditions, and shading. The second site, also between Kekaha and Waimea towns, has suitable topography, but has high potential for flooding due to the low elevation (below sea level). The construction costs for the second site would also be high due to the silty soil conditions. A substantial transmission line extension for interconnection to the KIUC grid would also be required for both of these sites. Finally, at the time of site selection, KIUC was talking with two independent power providers (IPPs) contemplating projects of 5 MW each in this same area. In light of this possibility, KIUC felt that it would not be prudent to consider building a 12 MW facility in the same locale, as the concentration of solar projects could adversely affects grid reliability during cloud cover or line faults. While KIUC ultimately opted not to enter into agreements with the two IPPs, these factors did influence the site selection process for the solar facility.

<u>*Preferred Alternative (Anahola).*</u> The Anahola site was determined to be the preferred alternative due to the site's suitability for solar development, easy integration and potential benefits to the electrical

grid, zoning, and ownership and associated community benefit. Solar suitability maps indicate that the Anahola is slightly less insolation (i.e. the intensity of solar radiation energy on a given surface) than Kekaha, but the level is more than sufficient to produce high levels of output from a solar installation.

The solar facility and substation on the Anahola site will be easily integrated into the existing electrical grid, such that an existing transmission line runs along the Kūhiō Highway, adjacent to the project site. This allows the substation serving the solar farm to connect directly to the existing transmission system without requiring the installation of additional poles. Interconnection to the transmission system, as opposed to the distribution system, is essential for a project of the desired size because a project feeding only into lower voltage (in this case 12.47 kV) local distribution systems would be limited in output to avoid unacceptable fluctuations and resultant reliability issues. Another advantage of the preferred site is its location far from existing generation sources; inserting power into a point in the system that is presently served only by distant generating sources will help to reduce line losses as electricity travels along the transmission circuit, improving the overall efficiency of the KIUC system.

There are also indirect benefits to the electrical system in selecting the Anahola site for construction of the solar facility and substation in improving reliability in underserved areas. By construction of the substation at the Anahola site, KIUC will be able to energize the existing 69-kV-ready power line that runs from the Kapa‘a Substation to Kalihiwai at its design voltage rather than at the 12.57 kV distribution-level voltage at which it is presently limited. This will allow KIUC to improve system reliability for the entire Kapa‘a-Princeville transmission corridor. KIUC will also be able to extend high voltage power beyond Kapa‘a area, which is not currently possible. Construction of the substation would also create an opportunity to sectionalize the transmission grid; sectionalizing a transmission line strengthens a systems protection against line faults and enables faults to be detected more quickly when they occur. The site will allow for the creation of a final link in a transmission circuit between Kalihiwai and Princeville and therefore allowing KIUC to transmit power to the North Shore via cross-island or North Shore transmission corridors. Overall, the Anahola solar site’s location at the southern edge of the North Shore area offers an opportunity for KIUC to improve system stability and provide voltage support to the North Shore, particularly during contingencies.

The agricultural zoning of the area allows the property to be developed for the proposed use without undue uncertainty or delay, and discussions with the landowner (the Department of Hawaiian Home Lands) showed an eagerness to make the land available for the type of project that KIUC was contemplating. As a publicly-regulated utility and as a not-for-profit cooperative, KIUC has a responsibility to not only focus on the members’ needs for reliable service, but to also work towards sustainable development of the communities that KIUC serves. In light of this commitment to community, DHHL and KIUC signed an Energy Charter in 2009, which stated that DHHL and KIUC would collaborate to, “identify suitable renewable energy projects for the Department’s available lands.” The Anahola site represents a commitment to KIUC’s cooperative responsibilities to the community and the 2009 DHHL/KIUC Energy Charter. The Anahola site would provide revenue for the community via the DHHL and the Anahola Homestead Community Development Corporation (HCDC) through the lease agreement and the creation of local jobs during construction, operation, and maintenance of the proposed project. The proposed project, as the first of its kind, represents a commitment to the Native Hawaiian community by establishing a model for future partnerships between KIUC, Native Hawaiian organizations, and the State of Hawai‘i. KIUC believes that such partnerships are important to maintaining its place in the community that it serves.

4.2.2 ALTERNATE SIZES

KIUC’s proposed Anahola Solar project was sized at 12 MW principally because this scale represented a balance between reaching the Strategic Plan and RPS targets without being so large as

to threaten system reliability. KIUC considered constructing a smaller solar array, however, choosing to do so would have reduced the extent to which KIUC would have been able to take advantage of the very significant tax incentives that were due to expire at the end of 2011. It would also have led to higher per-megawatt costs for the transmission interconnection (i.e., for the substation). Because KIUC's analysis indicated that the 12 MW facility could be readily accommodated in its system, there were no apparent advantages to a smaller facility. The proposed sizing of the substation was determined to match the proposed 12 MW solar facility; any reduction would leave it too small to accommodate both the required electrical switching and transformer equipment and the BESS.

4.2.3 ALTERNATE TIMING (DELAYED ACTION)

A delayed action would mean that KIUC would not lease the Anahola parcel from DHHL and would not construct a solar project there at the present time, instead delaying construction until some later date. There were several compelling reasons why a delayed action would not meet KIUC's immediate project goals or its broader strategic objectives. The most immediate concern is the effect that a delay would have on KIUC's ability to capitalize on the opportunity presented by §1603 of the American Recovery and Reinvestment Act of 2009 (the "ARRA"). Under the conditions imposed by this act, tax incentives were made available that average 25-28 percent of the total project cost. The ARRA Tax Grant has no volume cap, but it does impose deadlines which dictated the project's timeline to a substantial degree.

- In order to qualify for this incentive, safe harbor requires non-refundable investment of 5 percent of the qualifying cost of the project by December 31, 2011. KIUC and its subsidiary KRS One met this requirement by purchasing photovoltaic panels and inverters.
- The ARRA further stipulates that the facility be in service by January 1, 2017.
- The deadline for applying for ARRA tax grants (which KIUC and its subsidiary have met) was October 1, 2012.

Delaying action past the point at which KIUC made the tentative decision to proceed with the proposed Anahola Solar project would have made it unable to take advantage of the tax incentives, which the cooperative estimated would increase the cost by at least $10 million. Such a sharp increase in cost would have substantially reduced the net benefit of the project, possibly even bringing the viability of the project into question.

In addition to the financial penalty the delay would impose, it would deprive KIUC's customers of the substantial benefits that substituting solar energy for fossil fuel has for the natural environment and for Kaua'i's economy. The cooperative estimates that each month the project is delayed its customers spend $250,000 more for electricity produced with fossil fuels than they would were it produced with solar. KIUC believes that the sooner that additional solar energy is brought online and reduces Kauai's dependence on fossil fuels, the sooner the economic and environmental benefits described in this report can be realized. Extending development over a longer period of time tends to escalate costs and increase the potential for erosion and other adverse effects on the natural environment, and would prevent KIUC from meeting. Finally, delaying the construction of the proposed Anahola Solar Project would jeopardize the utility's ability to meet the goals of its Strategic Plan and the State of Hawai'i RPS requirements.

4.3 SERVICE CENTER ALTERNATIVES CONSIDERED AND ELIMINATED

4.3.1 ALTERNATE SIZE/LOCATION

The 2005 KIUC Service Center Study evaluated potential site based on six criteria, including: (*i*) availability of land for purchase or lease; (*ii*) associated cost of procuring that land; (*iii*) proximity to the highway for ease of access by customers and employees; (*iv*) location in relationship to the

identified need for additional service infrastructure on the east and north shores of the island; (*v*) proximity to existing or planned KIUC infrastructure; and (*vi*) the relative availability of existing municipal water supply. KIUC evaluated several possible locations for the proposed service center.

Keālia Site. KIUC entered into discussion with Sleeping Giant Sotheby's International Realty to scope possible property owners with land available and appropriate for a service center in the Keālia area. A developer in the area was identified, with land available near the rodeo and historic post office. Ultimately, the site was determined not to be viable as there was insufficient flat acreage and there were constraints on maintaining the historic post office in its original form.

Old Līhu'e Plantation Mill Site. KIUC discussed the possibility of leasing a portion of the Old Līhu'e Plantation Mill site, owned by Grove Farms Co., Inc. This site was eliminated from consideration due to budgetary constraints and the cost of a potential lease.

Makai Anahola Site. In 2006, KIUC spoke with DHHL representatives about the possibility of a service center in Anahola, on a 4-acre parcel on the *makai* side of Kūhiō Highway, just north of the proposed site. This site was subsequently eliminated from consideration, and the present site selected instead, to better conform to DHHL's Anahola Regional Plan, published in June 2009.

Preferred Alternative (Anahola). DHHL directed KIUC to the location that is being proposed as it fits well with the Department's plans for its extensive landholdings in the region, and it offered an attractive lease price as well. The location adjacent to Kūhiō Highway simplifies access by customers and employees, and the spot is well placed in relationship to the identified need for additional service infrastructure on the east and north shores of the island and to existing and planned KIUC infrastructure. The site is also adjacent to the existing Anahola water system, making an extension of that system to serve the potable water needs of the service center a relatively simple proposition. The selection of this site also further supports the relationship between KIUC and DHHL as described above. KIUC assessed numerous locations within the parcel, but ultimately determined the proposed location was best due to the following reasons: (*i*) placing the facility on the eastern edge of the selected parcel minimized the need for additional access roadways and infrastructure; (*ii*) the terrain found further west and south on the parcel was steeper and included some natural drainage ways that would obstruct the construction process; and (*iii*) shifting the service center site farther north within the parcel would place it closer to the residential community in Anahola.

4.3.2 ALTERNATE TIMING: DELAYED ACTION

The Anahola Service Center has been in the planning stages since 2005, when the need for a shift in utility infrastructure was first clearly identified. As such, the proposed project is equivalent to a "delayed action", the service center having been delayed several times since then. Under this alternative, KIUC would not construct a new service center in Anahola and would continue to operate out of its two existing service centers, in 'Ele'ele and Kapa'a. This would mean that KIUC would not be able to meet the project objectives identified in Table 1.2. Service to the east and north sides of the island would not be expedited and customer access to KIUC planners would not be improved.

5. AFFECTED ENVIRONMENT, ENVIRONMENTAL IMPACTS, & MITIGATION MEASURES

This chapter describes the potential environmental effects of the proposed Project. The term "project site" refers to the entire 60-acres on which KIUC would develop facilities, unless stated otherwise. The chapter is organized by resource area (e.g., air quality, noise, geology and soils, water quality, etc.). The discussion under each topic begins with an overview of existing conditions. The scale of this discussion is dependent on the resource; where appropriate, the larger environmental context (e.g., Northeast Kaua'i) is discussed, and in other cases the focus is narrower (e.g., the project TMK parcel). The discussion also distinguishes between short-term construction impacts and those that may result from the facilities' continuing long-term presence, including impacts associated with operation, maintenance, or decommissioning. As discussed previously in Chapter 2, the substation and service center facilities which are part of the proposed project do not have a predetermined service life expectancy and are expected to remain in operation indefinitely. Consequently, the discussion of potential decommissioning impacts is limited to the photovoltaic solar array. Where appropriate, the discussion includes the measures that KIUC proposes to take to minimize or mitigate potential adverse effects.

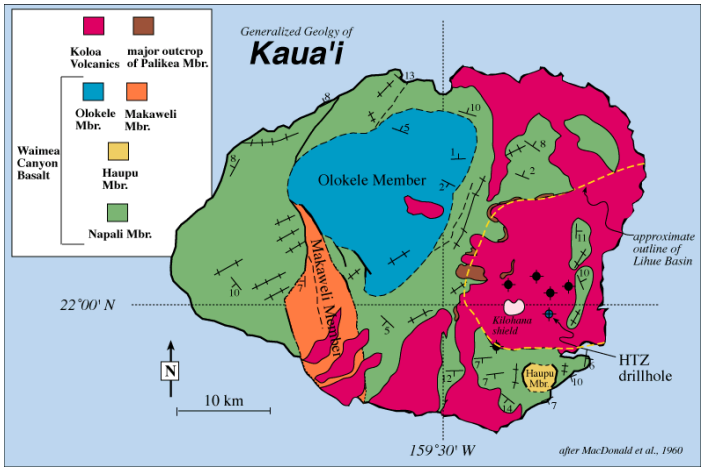
5.1 TOPOGRAPHY, GEOLOGY, AND SOILS

5.1.1 EXISTING CONDITIONS: TOPOGRAPHY, GEOLOGY, AND SOILS

Kaua'i has a land area of slightly more than 550 square miles. Roughly circular in shape, its most striking physiographic features are a high central plateau topping out at over 5,000 feet at the summits of Wai'ale'ale (5,148 feet) and Kawaikini (5,243 feet), steep cliffs and deeply incised valleys along the northern Nāpali coast; the 3,600 foot deep Waimea Canyon; the broad Līhu'e Basin on the southeastern quadrant of the island; and extensive coastal plains. It consists of a single great shield volcano, which is deeply eroded and partly veneered with much later volcanics.

Kaua'i, like the other Hawaiian Islands, was formed by magma that erupted from a hotspot on the earth's crust. Over time, the eruptions formed a typical Hawaiian shield volcano. Kaua'i is thought to have been formed by two or more shield volcanoes.

Figure 5.1 Generalized Geology of Kaua'i Island



The main mass of Kaua'i is believed to be about 3 to 5 million years old, although there were a few small eruptions on the island as late as about 400,000 years ago. Figure 3.1 illustrates the major rock units that are present. The oldest is the Makaweli member of the Waimea Series lavas and is shown in green (Clague & Dalrymple, 1988). The Olokele Member of the Waimea Series (shown in blue) occupies a large area in the center of the island. The Waimea Canyon scarp probably represents a major collapse at the beginning of the post-shield (or declining) stage. Post-shield-building volcanic soils of the Olokele Member of the Waimea Canyon Basalt may have in filled a major caldera-like collapse structure to form the present day broad summit area of Mt.

Wai‘ale‘ale and the Alaka‘i Swamp. The Makaweli series volcanics fill a graben-like feature in the southern part of the island. The major east-west trending Haupu Mountain ridge, between Po‘ipū and Līhu‘e, is composed of the Haupu Member of the Waimea Canyon Basalt. This is thought to be a structural remnant of the original shield-building and/or post-shield volcanic stage of the island.

After a long period (probably about 0.5 to 1.5 million years) of no eruptions and great erosion of the Waimea Series lavas, eruptions began again. Lavas from this second period of great eruptive activity formed the Kōloa series volcanics. The surface expression of these lavas, which underlie the Anahola site, are depicted in red on the map. This post-erosional stage of volcanism on Kaua‘i is particularly well-developed, especially on the eastern side of the island. Very late stage explosive volcanic vents and cones of the Kōloa Volcanics such as Kilohana Crater, Kīlauea Crater, and 35-40 other smaller but similar features are present throughout the eastern portion of the island. The very steep eastern facing scarp of Wai‘ale‘ale was formed in part by the collapse of the Līhu‘e Basin.

The proposed Anahola Solar Project is located approximately one-half-mile (~2,700 feet) inland from the shoreline at its closest point to the shore. The land on which the PV arrays would be constructed stretches from an elevation of approximately +180 feet above mean sea level (msl) near Kūhiō Highway to an elevation of approximately +250 feet above msl at its upper end. The Substation site, which is adjacent to the highway, lies between +180 and 190-fee msl.

No exceptional slopes are present on the area where the solar facilities, substation, or Service Center would be developed. Of the 53 acres of the solar array site, 7 acres are 0-2 percent slope, 36 acres are 2-5 percent slope, 8 acres are 5-10 percent slope, and only 2 acres are greater than 10% slope. All of the land on the 2-acre substation site has a slope of 5 percent or less; the same is true of the proposed Service Center site. According to the USDA Web Soil Survey (2011) and the USDA Soil Survey (1972), all the soil present on the project site is classified as Līhu‘e Silty Clay (LhB), with moderately rapid permeability appropriate for commercial agriculture.

The Land Study Bureau’s Detailed Land Classification rates the agricultural suitability of soils using a 5-class productivity rating. The rating is expressed using the letters “A”, “B”, “C”, “D” and “E”, with “A” representing lands of the highest productivity, and “E” the lowest or very poorly suited for agricultural production. The Land Study Bureau productivity ratings for the areas on which the proposed facilities will be located is “B”. The project site is located entirely on land designated as “Prime” agricultural land by the Agricultural Lands of Importance to the State of Hawai‘i (ALISH) map. Prime agricultural land is land best suited for the production of food, feed, forage, and fiber crops. The land has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated properly and managed according to modern farming methods.

5.1.2 PROBABLE CONSTRUCTION IMPACTS ON TOPOGRAPHY, GEOLOGY, AND SOILS

Construction of the Anahola Solar Project would involve extensive grubbing and vegetation removal, but it entails only a modest amount of actual earthmoving and would have little effect on the overall topography. The estimated cut and fill for the project components are identified in Table 5.1. Not all of the material that is cut will be suitable for use as structural fill. Hence, the contractor may need to import up to 100 cubic yards of material (such as gravel, rock, sand, etc.) capable of creating a strong and stable foundation for key project components. The excess material, i.e., the difference between the volume that will be removed and the amount that will be added to achieve the desired finish grade will either be spread on nearby areas within DHHL’s property or trucked off-site to a location where it can be used or disposed of properly. Minimal grading will be required in most areas of the project site, but grading will be required in areas where the existing slope greater than 10 percent and some depressions will need to be filled. By far the most extensive earthwork in the PV areas will be for the three storm water runoff retention basins that are planned.

Where practicable, material excavated from grading will be used as substrate for the concrete pads under the electrical inverters and transformers, and for the substation area where it will level out areas around a mound on that site. Estimated quantities for these cut and fill volumes are provided in Table 5.1 below.

Table 5.1 Estimated Earthmoving Volumes

Facility	*Estimated Volume (in cubic yards)*		
	Cut	*Fill*	*Import (+)/Export (-)*
Solar Array Phase 1	-16,400	887	-15,513
Anahola Substation	-2,842	14,557	+11,715
Phase 1 Total	-19,242	15,444	-3,798
Solar Array Phase 2	-11,075	3,216	-7,859
Solar Array Phase 3	-8,248	148	-8,100
Anahola Substation	See Note 2.	14,500	-11,715
Anahola Service Center	-6,192	3,762	-2,430
Total	-63,999	52,514	-11,485
Note 1: Access and internal roads are included in the solar array grading phases. Note 2: 1,690 c.y. of cut for the substation are included in Phase 1 calculations.			
Sources: REC Solar (October 17, 2012) Grading Plans Sheets C-3, C-4, and C-5 for Solar Array and Internal Access Roads; Esaki Surveying and Mapping, Inc. Substation Grading Plan dated May 18, 2012, Sheet C-6 for Substation; dated 11/13/2012.			

The soil composition will be altered on over half of the property. In a few areas where select fill will be required (e.g., roadbeds, foundations, substation, etc.), the existing soil composition of the property will be altered in ways that will discourage its return to agricultural use following decommissioning of the solar facilities. However, the areas where this would occur represent just a few percent of the 60-acre project site. The changes that would occur over the vast majority of the property will leave its agricultural potential unchanged.

The vast majority of the project site would be occupied by the solar array, which will be emplaced with racking systems mounted on piles, directly on the existing pasture without need for excavation or foundations which could compromise future agricultural use of the lands beneath. Pursuant to the requirements of the Farm Policy Protection Act (FPPA), KIUC consulted with the Natural Resources Conservation Service (NRCS) on behalf of RUS, filing two USDA Form AD-1006 Farmland Conversion Impact Ratings (one for the PV arrays and the Anahola Substation and one for the Service Center) (see Appendix D). The consultation was required because the project will involve the use of federal funds for the conversion of prime agricultural lands to non-farmland use. Based on the impact ratings, RUS and NRCS concluded that this project was wholly consistent with the FPPA. As no significant geologic resources (e.g., sand or gravel) are present, the proposed project does not have the potential to lessen their availability for other uses. All of the soils and underlying rock that would be affected by the proposed project are suitable for construction of the proposed facilities as they are designed.

5.1.3 PROBABLE OPERATIONAL IMPACTS ON TOPOGRAPHY, GEOLOGY, AND SOILS

The ongoing operation and maintenance of the facilities covered by this report do not involve activities that have the potential to significantly affect topography, soils, or geologic resources.

Maintenance of good ground cover and the use of appropriate vegetation management procedures are essential to preventing substantial soil loss over the long term. That, in turn, will maintain the health and productiveness of the soils so that they can, if deemed appropriate, be returned to agricultural use when the PV arrays are decommissioned. The vegetation management plan that is included in Appendix C describes the methods that will be used to maintain the protective cover in good health for the life of the project. KIUC believes they are adequate to achieve that purpose. Moreover, it will carefully monitor conditions on the site once it assumes responsibility for the solar arrays and stands ready to take immediate corrective action should that be necessary.

5.1.4 PROBABLE DECOMMISSIONING IMPACTS ON TOPOGRAPHY, GEOLOGY, AND SOILS

As indicated earlier in this report, the system is expected to remain in operation for a minimum of 25 years, and it is likely that it will perform adequately for a much longer period of time. When the decision is made to decommission it, the work can be done without any substantial effect on topography or soils, and the area will be returned to much the same condition it is in at present. Manually dismantling the panels and the associated racking and removing the vertical supports using a backhoe and chocker chain would cause minimal soil disturbance. Removing the buried conduits would involve slightly greater disturbance (including mixing of soil profiles (i.e., topsoil with subsoil), compaction, and rutting, but immediate backfilling and revegetation would prevent unnecessary erosion/soil loss. The potential for erosion would be reduced if the buried conduits were left in place, but this would constrain subsequent agricultural use of the strips within which the buried conduit is located.

5.2 HYDROLOGY

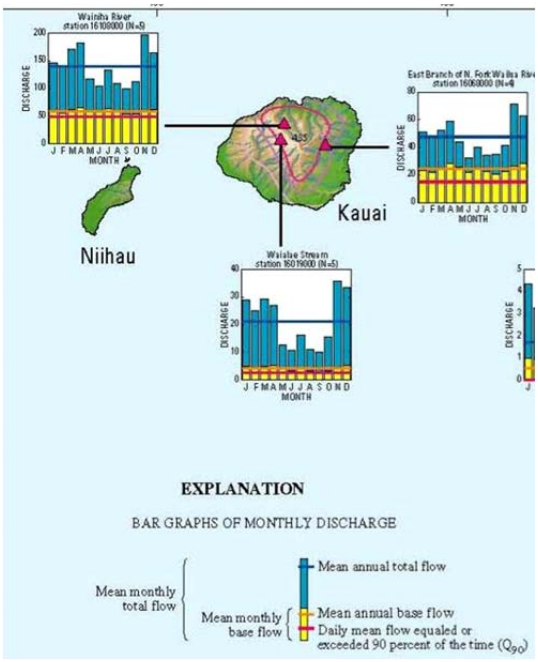
5.2.1 EXISTING CONDITIONS: HYDROLOGY

This section describes the existing movement, distribution, and quality of surface and groundwater on Kaua‘i and in and around the project site. It begins by broadly describing the existing conditions on the island and then narrowing the focus to the project site and the project’s likely impacts to water resources. The subject is broken into two related parts. The first addresses surface water resources, such as ponds, rivers, streams, and their floodplains; the second describes the origin and movement of groundwater through the permeable lavas that underlie the project site.

5.2.1.1 Existing Conditions: Surface Water

Kaua‘i’s surface water hydrology differs somewhat from the other main Hawaiian Islands. Most of the streams radiate out from the Wai‘ale‘ale-Kawaikini massif in all directions, cutting through intrusive dikes that retard the groundwater movement toward the ocean from high rainfall areas in the interior. In the process they tend to receive large influxes of groundwater throughout their length. Thus, unlike most Hawaiian streams, many of those on Kaua‘i actually gain flow as they descend (i.e., they are gaining streams). As a result of this, in some parts of Kaua‘i more than 65 percent of mean annual rainfall becomes stream runoff. This proportion is far higher than the 30 percent of mean annual rainfall that the U.S. Geological Survey estimates runs off as streamflow throughout the State of Hawai‘i.

Even on Kaua‘i, the percentage of rainfall that directly runs off varies spatially among basins and temporally within a basin. Within a basin, the percentage of rainfall that runs off varies temporally among individual storms, and may range from less than 5 to greater than 90 percent. The percentage of rainfall that runs off is generally highest in areas which have relatively high average rainfall, experience high-intensity rainfall, have low-permeability soils, have steep slopes, possess a water table at or near the land surface, or where the antecedent soil moisture is high.



As illustrated by the examples shown to the left, there are substantial differences between different drainages with respect to the seasonality of streamflow, base flow, total discharge, and other factors. At 19.5 miles, the Waimea River-Po'omau Stream is the longest stream on Kaua'i. Other long rivers on the island include the Makaweli River (15.1 miles), the Wainiha River (13.8 miles), the Hanapepe River (13.3 miles), and the Wailua River (11.8 miles). At 140 million gallons per day, the Hanalei River has the highest average discharge. Occupying 424 acres, the Waita Reservoir, which is located on the southern side of the island near Kōloa, is the largest surface water body.

The project site is situated within the 0.9 square-mile Kamalomalo'o watershed. One perennial waterway, Kamalomalo'o Stream, runs along the southern boundary of the project site. Hōmaikawa'a Stream (~1,650 ft. away) and Anahola Stream (~3,000 ft. away) are more distant. Selected characteristics of the Kamalomalo'o watershed are shown in Table 5.2 below.

Table 5.2 Selected Characteristics of Kamalomalo'o Watershed

Name	***Drainage Area***	***Percent by State Land Use District***		
		Conservation	***Agricultural***	***Urban***
Kamalomalo'o	0.9 sq. mi.	2.6%	97.4%	0%
Source: *Atlas of Hawaiian Watersheds & Their Aquatic Resources* (2008)				

Observations during sites visits and a review of data from the State of Hawai'i GIS system, records from the State of Hawai'i Commission on Water Resource Management, the U.S. Geological Survey 1:24,000 scale topographic map and the U.S. Fish and Wildlife Service (http://www.fws.gov/wetlands/data/ mapper.html), indicate that there are no lakes or wetlands in the project site. During plantation days, a pair of irrigation water storage ponds fed by the Lower Anahola Ditch and Kawaho Ditch was situated in a depression approximately one-thousand feet directly west of the Anahola Solar Project site. Examination of recent satellite photography of the area shows that water is no longer impounded.

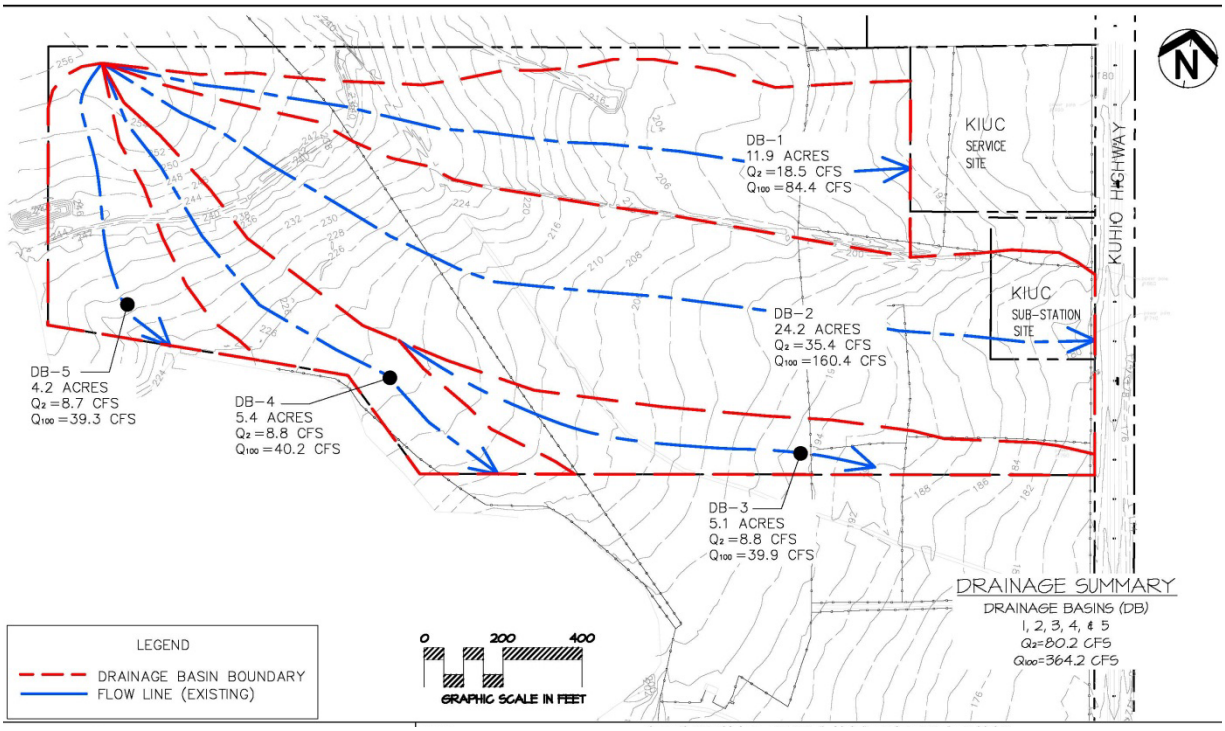
According to the *Atlas of Hawaiian Watersheds and Their Aquatic Resources* (2008), the affected reach of Anahola Stream (the only one of the waterways near the project site listed in the Atlas) does not have a significant level of abundance of native insects or other fauna. There are no known federally-listed threatened, endangered, or candidate species in Anahola Stream; there were however some species of native macrofauna.

Based on the latest available (2007) Flood Insurance Rate Map (FIRM) for the area, the entire project site lies in Flood Zone X. Zone X is defined as the flood insurance rate zone that corresponds to: (*i*)

areas outside the 500-year floodplain; (*ii*) areas within the 500-year floodplain where the water depth resulting from the 100-year flood is less than 1 foot; (*iii*) areas where the contributing drainage area is less than 1 square mile; and (*iv*) areas protected from the 100-year flood by levees. Because of the low probability of flooding, no base flood elevations or depths have been defined within the zone.

Honua Engineering Inc. has prepared a more detailed delineation of drainage basins within the area that would be used for the proposed PV facilities and substation (see Figure 5.2); each drainage basin concentrates storm water runoff to its respective downstream outlet to neighboring downstream properties. Based upon the current coverage of the property of pasture grass and brush with fair coverage, Honua Engineering used a runoff coefficient of 65 for the runoff calculations. Estimates of the existing peak flows from these areas are shown on the drawing for recurrence intervals of 2 and 100 years and are summarized in Table 5.3.

Figure 5.2. Existing Drainage Basins: Project Site



Source: Exhibit 2, Honua Engineering Inc., *Preliminary Drainage Analysis Report* dated September 19, 2012.

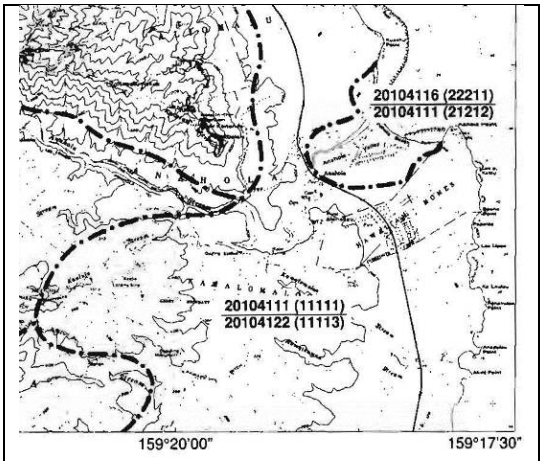
Table 5.3. Existing Peak Discharge (in cfs) for Design Storms

Drainage Basin	*2-year Event – 7*	*100-year Event – 18*
DB-1 (11.9 acres)	18.5	84.4
DB-2 (24.2 acres)	35.4	160.4
DB-3 (5.1 acres)	8.8	39.9
DB-4 (5.4 acres)	8.8	40.2
DB-5 (4.2 acres)	8.7	39.3
PV SITE TOTAL	***80.2***	***364.2***
Note: Volumes are measured at downstream end of drainage areas. Discharge rates are in cubic feet per second (cfs).		
Source: Tabulated by Planning Solutions, Inc. from Exhibit 2, Honua Engineering Inc. *Preliminary Drainage Analysis Report* dated September 19, 2012.		

5.2.1.2 Existing Conditions: Groundwater

The Makaleha Mountains inland of the project site are exposures of the Nāpali formation. A formation is a grouping of basaltic lavas produced by the shield volcano that forms the island. A large remnant of the Nāpali rises above the Koʻolau platform near Papaʻa, which is a short distance north of Anahola. Where the mountains plunge beneath the lavas that make up the Koloa platform (on which the site is situated) an unconformity of old alluvium occurs. The Koloa formation carries poorly permeable perched aquifers while the Nāpali contains high level dike aquifers.

Figure 5.3 Aquifer Designation



Source: Mink and Lau (September 1992).

The State of Hawaiʻi Commission on Water Resource Management (CWRM) has established ground-water hydrologic units to provide a consistent basis for managing ground water resources. The units are primarily determined by subsurface conditions, with each island divided into regions that reflect broad hydro-geological similarities while maintaining hydrographic, topographic, and historical boundaries where possible. As shown in Figure 5.3, the project site overlies the Anahola Aquifer (20104) of the Līhuʻe Hydrologic Unit.[16] Mink and Lau (September 1992) classified the aquifer according to its development stage, utility, salinity, uniqueness, and vulnerability to contamination using a system based on the U.S. Environmental Protection Agency groundwater classification system (see Table 5.4). Because the upper and lower formations beneath Anahola differ from one another, there are two numbers applicable for Anahola. The CWRM has determined that the sustainable yield of the aquifer is approximately 17 million gallons per day. In cases where CWRM has determined that special limits are required in

[16] The southern boundary of the aquifer is the Wailua drainage divide; the northern boundary is the Hanalei-Kawaihau District line and reaches the sea just north of Moloaʻa Bay; and the interior boundary follows the crest of the Makaleha Mountains. Total area is 45 square miles.

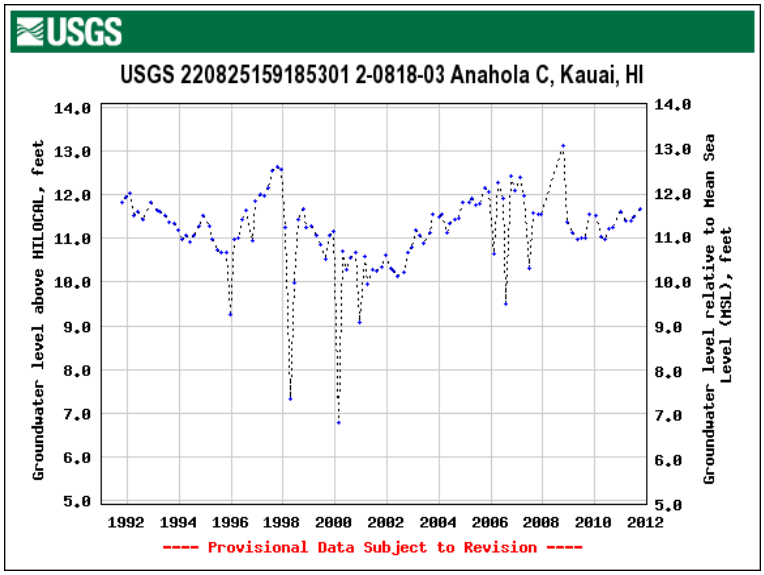
order to properly manage the resource, it has established Water Management Areas. To date, CWRM has not established any groundwater management areas on Kaua'i.

Table 5.4 Anahola Aquifer Classification

Factor	*Upper Formation (20104111)*	*Lower Formation (20104122)*
Development Stage	Currently Used	Currently Used
Utility	Drinking Water	Drinking Water
Salinity (mg/l) Cl^-	Fresh (<250)	Fresh (<250)
Uniqueness	Irreplaceable	Irreplaceable
Vulnerability to Contamination	High	High
Source: Mink and Lau (September 1992)		

The Kaua'i County Department of Water Supply owns and operates three wells (Anahola Wells A, B, and C) that are located a short distance north of the project site. Its 2010 annual report on the quality of the water from the wells showed that there is no contamination. The State of Hawai'i Department of Health maps showing areas where the groundwater is known to be contaminated also indicate that there is no contamination in the Anahola area.[17] The U.S. Geological Survey's monitoring data from the Anahola C well shows that the groundwater levels fluctuate over time, but do not appear to have a significant upward or downward trend (see Figure 5.4).

Figure 5.4 Water Levels in the Anahola C Well: 1992-2011



Note: The well is located at 22°08'14.5" north/ 159°18'43.7" west (NAD83).
Source:http://nwis.waterdata.usgs.gov/usa/nwis/gwlevels/?site_no=220825159185301

[17] See http://hawaii.gov/health/about/admin/health/environmental/water/sdwb/conmaps/pdf/conmaps05.pdf.

5.2.2 PROBABLE IMPACTS: HYDROLOGY

None of the actions associated with the proposed project would require alterations of existing stream channels, wetlands, or other surface water bodies, nor would the actions occur within or near the 100-year flood plain (Zone A). The proposed project will not involve any "critical action" [18] in the 500-year floodplain, and is consistent with the applicable regulations and guidance pertaining to floodplain management. In order to meet the requirements of the County of Kaua'i *Storm Water Runoff System Manual, 2001*, the existing drainage pattern will be maintained and peak storm water flows will not exceed the current discharge to the downstream properties. The following descriptions of the facility-specific measures describe how the proposed project has been designed to ensure that this regulatory requirement is met, and surface water is protected.

5.2.2.1 Effects on Surface Runoff Volumes

Roadways and Substation. The site access roadways and the Anahola Substation would have gravel or other similarly permeable surfaces.[19] The runoff coefficients for such areas are equal to or lower than those for the existing groundcover. Hence, they do not have the potential to increase runoff. In fact, under certain rainfall intensities, they would tend to increase infiltration/recharge relative to the existing conditions.

PV Arrays and Related Equipment. Upon completion, approximately 60 percent of the site consists of the open grassed and/or graveled access areas between the panels. Engineers anticipate that storm water runoff from these areas will be approximately the same as it is now, as the materials which will be placed there are intended to allow water to both infiltrate at the same rate as they do now.

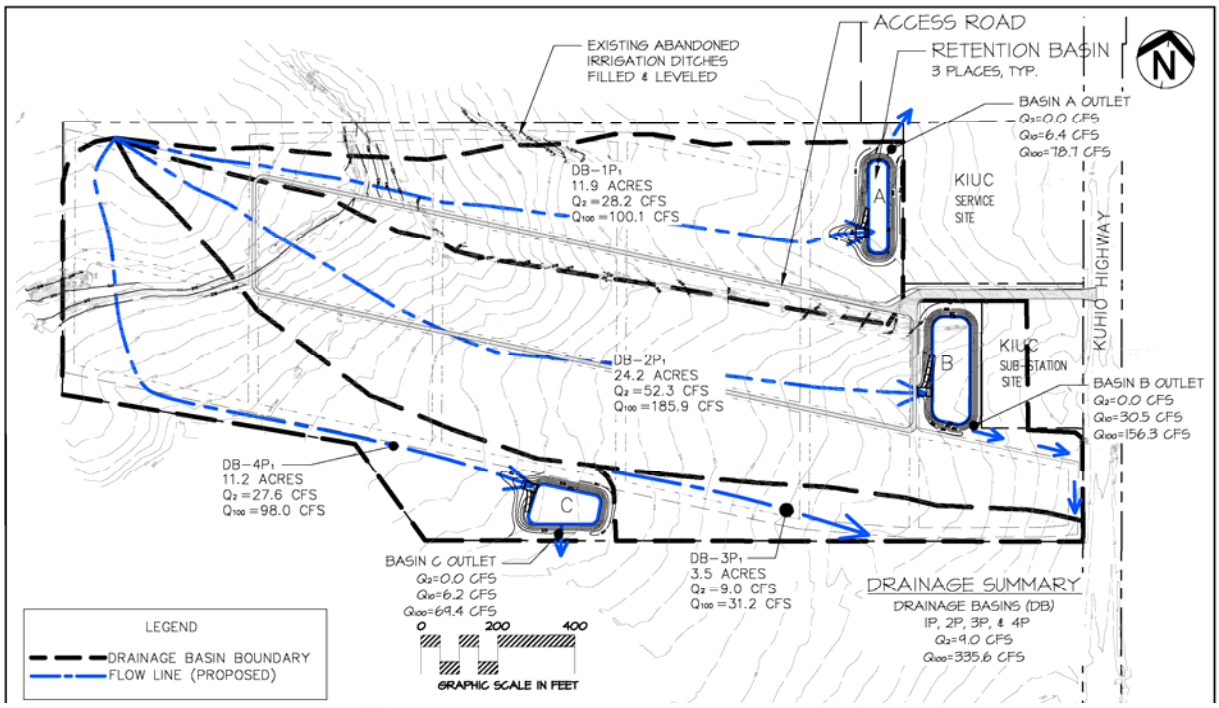
PV arrays and related equipment would cover approximately 40 percent of the site—mostly with the panels themselves—and would have a more substantial effect. Rain falling on impervious glass surfaces of the PV modules will run down the panels, drip off the edges, and fall onto the ground; when it reaches the soil, the water will be more concentrated than it is under existing conditions. As a result of this concentration, a smaller proportion of the water will percolate into the ground than is presently the case and surface runoff will increase. In addition, the inverters and some of the other equipment serving the PV arrays would be mounted on pads which would also introduce new, impermeable surfaces where water previously could percolate into the ground. However, their relatively small size (less than 500 square feet each), limited number (12), and dispersed location means that they will not measurably alter runoff from the 53-acre solar site.

In order to prevent the increase from affecting off-site properties, drainage swales will intercept the runoff and channel most of it into one of three large retention basins. The configuration of these basins is shown in Figure 5.5. The basins will capture runoff from the solar array and are sized to retain all of the runoff resulting from a 24-hour rainfall event with recurrence intervals of less than 10 years (which is estimated as being 12 inches). Runoff from larger, less frequent rainfall events will exceed the storage capacities of the basins and they will start to overflow. Discharges from retention basins resulting from those larger rainfall events (the 10-year and 100-year storms) are shown in Table 5.5.

[18] 24 CFR § 55.2(b)(i) Critical action means any activity for which even a slight chance of flooding would be too great, because such flooding might result in loss of life, injury to persons, or damage to property.

[19] The exceptions to this generalization are the concrete pads that will form the foundations of equipment pads and the BESS units. Because these would occupy a small percentage of the overall surface and would drain directly onto the highly permeable surrounding areas, the general point holds true.

Figure 5.5. Proposed Drainage Plan: PV Array



Source: Honua Engineering, Inc. Exhibit 3, *Anahola Solar Array Drainage* Report dated December 20, 2012.

Table 5.5. Estimated Peak Discharge (cfs) for Design Storms

Drainage Basin	*Peak Discharge by Recurrence Interval*		
	2-year	*10-Year*	*100-year*
DB-1P (11.9 acres)	28.2	*n.a.*	100.1
DB-2P (24.2 acres)	52.3	*n.a.*	185.9
DB-3P (3.5 acres)	9.0	*n.a.*	31.2
DB-4P (11.2 acres)	27.6	*n.a.*	98.0
TOTAL	***117.1***	***n.a.***	***415.2***
Retention Basin A	0	6.4	78.7
Retention Basin B	0	30.5	156.3
Retention Basin C	0	6.2	69.4
DB-3P (3.5 acres)	9.0	12	31.2
TOTAL	***9.0***	***55.1***	***335.6***
Note: n.a. = not available because these were not calculated as part of the drainage analysis. 24-hour rainfall intensities used in calculations were 7" for 2-year; 12 inches for 10-year; and 18" for 100-year storm events.			
Source: Tabulated by Planning Solutions, Inc. from Exhibit 3, Honua Engineering Inc. *Drainage Report* dated December 20, 2012.			

Table 5.6 compares existing and "with PV Array" runoff; it shows that the three retention basins will decrease peak runoff from all of the drainage basins that they serve. Runoff leaving the narrow strip

of land along the southeastern edge of the site (DB-3P as depicted in Figure 5.5) will decrease as well because minor grading will reduce the size of the area that drains off-site (from 5.1 to 3.5 acres).

Table 5.6 Change in Peak Discharge from PV Array Site

	2-year	*10-year*	*100-year*
Total Existing Discharge	80.2	n.a.	364.2
Total Post-Project Discharge	9	n.a.	335.6
Change in Runoff	-71.2	n.a.	-28.6
Note: 24-hour rainfall intensities used in calculations were 7" for 2-year and 18" for 100-year storm events.			
Source: Tabulated by Planning Solutions, Inc. using estimates contained in Honua Engineering Inc. *Preliminary Drainage Analysis Report* dated September 19, 2012.			

Anahola Service Center. The design of the drainage system for the Anahola Service Center site is less advanced than that for the PV arrays. Estimates based on conceptual plans for the facility assume that on-site storage basins will be created along the northeastern side of the site. Assuming the system complies with the County's storm drainage standard mandate not to increase runoff. Runoff following construction of the Service Center and related facilities would be as shown in Table 5.7. This would continue to enter the drainage swale along Kūhiō highway and continue from there along existing flow paths.

Table 5.7 Peak Discharge from Service Center Site

	Peak Discharge (in cfs) by Recurrence Interval		
	2-year	*10-year*	*100-year*
Total Existing Discharge	4.86	n.a.	20.25
Total Post-Project Discharge	26.57	n.a.	56.70
Change in Runoff	+21.71	n.a.	+36.45
Note: 24-hour rainfall intensities used in calculations were 7" for 2-year and 18" for 100-year storm events. Without the retention basin that is part of the Service Center design, 2-year and 100-year runoff volumes would be higher (26.57 cfs and 56.70 cfs, respectively).			
Source: Tabulated by Planning Solutions, Inc. using estimates contained in KIUC transmittals dated December 12, 2012 and January 1, 2013.			

5.2.2.2 Adequacy of Kūhiō Highway Storm Drainage System

While the total volume of water leaving the area will be reduced relative to pre-project conditions, it will reach Kūhiō Highway differently than is now the case. For storms with a recurrence interval of 2 years or less, most of the surface runoff will never reach the highway, instead being captured in one of the retention basins and either percolating into the ground or evaporating into the atmosphere. Only very small amounts falling on areas that cannot be diverted into a retention basin will continue to reach the swale along the *mauka* side of the highway will continue as it does now. As a result, the volume of water in the swales will be substantially lower than at present.

For storms with a recurrence interval greater than 2-years, some overflow from the basins will reach Kūhiō Highway; its total volume will be less than the present total runoff from the site, but the discharge will be more concentrated.

The flows (from northernmost to southernmost) are:

- Overflow from Basin A, which is immediately above the service center site. This will be spread into the area immediately north of the site and will flow overland from there down to the swale along the *mauka* side of the highway.
- Overflow runoff from the Service Center site, which will be discharged from a retention basin along the *makai* side of the 5-acre site into the swale along the *mauka* side of Kūhiō Highway.
- Runoff from the lower portion of the new access road that cannot, because it originates lower on the hillside, be diverted into one of the retention basins. This will be captured and diverted into the swale along the side of the highway.
- Runoff from the substation site, which will be released into the same swale along the *mauka* side of Kūhiō Highway.
- Overflow from Basin B, which will be released through an overflow just to the south of the substation site and will reach the swale along the highway over a relatively narrow front.
- Overflow from Basin C, which will be spread along the gulley immediately south of the site.

Under the most common conditions, very little runoff will reach the existing drainage facilities along Kūhiō Highway, thereby assuring that they will perform satisfactorily. Infrequently, storm runoff reaching the existing highway drainage swale may exceed the capacity at a given point. To the extent that this occurs, some overflow could cross the highway. KIUC's engineers believe that this will be a rare event and that the volume is sufficiently small that it will not damage the highway or interfere substantially with the normal flow of traffic.

5.2.2.3 Effects on Surface Water Quality

Constructing and Maintaining PV Arrays and Related Equipment. While the amount of earthmoving required to erect the PV arrays is relatively small in terms of cubic yards, it involves stripping existing vegetation from approximately 53 acres of land during the site preparation phase of construction, and there is the potential for storm events that occur during the construction period to cause erosion and soil loss.[20, 21] The key to minimizing the adverse water quality effects of this is to limit the area that is exposed at any one time, to quickly re-establish vegetative cover, and to ensure that the cover is permanently maintained. REC Solar and KIUC have prepared a detailed erosion control/vegetation management plan with "Best Management Practices" (BMPs) for the project site that is intended to do that. That plan is reproduced in Appendix C of this report, and the measures that are included in it are expected to be conditions of approval of the NPDES construction Permit (NOI-C) that will be required from the State of Hawai'i Department of Health.

In accordance with that plan, the solar arrays and support equipment will be installed in three phases as a means of limiting the soil area that is exposed at any one time.

[20] This would not be an entirely new experience for the area. On the contrary, during the period of intense sugar cane cultivation, the vegetation was stripped completely bare and the fields ploughed at least once every two years. Nonetheless, the increased sediment in nearshore waters that resulted from these practices was one of the detrimental side effects of the sugar industry, and it is not a model that is to be emulated.

[21] Because of its size (greater than one-acre), construction this project will require coverage for the discharge of storm water under the State of Hawai'i NPDES General Permit program (HAR §11-55, Appendix C).

- Work will begin by grading about half (8.4 of 17.4 acres) the Phase 1 area at the Southeast corner of the site. The majority of the grading for this phase will be to create a pad for the KIUC sub-station site and the excavation of the first of three storm water retention basins on the site. In addition, the primary construction access road to Kūhiō Highway, the interior access drives for the array blocks, the swales to direct runoff to the retention basin, and all the abandoned irrigation ditches will be filled and/or graded. Upon completion of the grading operations the disturbed areas will be hydro-seeded with mixture of rye grass for short term erosion protection and Bermuda grass for long term protection. All vegetation removed from the graded areas will be shredded on-site and used as mulch on the non-graded areas to provide weed control and minimize dust from the installation of the array blocks.
- Once the Phase 1 portion is stabilized, grading operations and revegetation will commence upon the Phase 2 portion of the site following a similar progression as Phase 1.
- Upon stabilization of the graded areas on Phase 2, work will then commence on the final third phase of the PV installation.

Operating and Maintaining the PV Arrays. The planned retention basins will intercept the vast majority of the surface runoff originating on the land where the PV arrays are to be located. Suspended soil particles will settle out and be retained within the basins. As a result, under most conditions the quality of runoff from the area will be substantial better than at present. Even during the rare periods when rainfall is sufficiently intense and prolonged to cause the basins to overflow, larger soil particles will settle out in the basins, with only the smaller particles remaining in the water that spills over the discharge weirs. The weirs themselves are designed to have cross-sectional areas that are sufficient to keep discharge velocity below erosive levels.

In order to maintain the PV modules, workers must ensure that there is sufficient ground cover to prevent excessive erosion while at the same time keeping vegetation from growing so tall that it shades the arrays, thereby reducing their output. To prevent shading, workers will periodically mow the pasture grass between the array modules; this will keep it at a height that is both sufficiently tall to absorb the impact of falling raindrops and retard the lateral movement of surface runoff and sufficiently low to avoid shading the PV panels.

Two factors prevent a similar approach to the area beneath the modules. First and foremost, because the array modules shade the ground beneath them, grass grows poorly, if at all. Even if the grass could be made to grow there, it could not be used because the presence of the vertical supports prevents effective mowing. The contractor is investigating two possible methods of overcoming the challenges this presents; both are described in the project's Vegetation Management Plan (VMP).

- The first is to place a layer of organic mulch beneath the panels that protects the soil from erosion and inhibits weed growth. By maintaining the existing pasture grass throughout the arrays and by covering bare soil areas underneath the modules with regular applications of mulch, the impact on the runoff coefficient will be minimized which is the primary variable that impacts the amount of storm water runoff from the project. A composite runoff curve number was developed for each of the drainage basins that varied slightly depending on the various uses in each drainage basin with a typical value of 75.
- The second is to use a geotextile fabric that inhibits weed growth but still allows water that runs off the panels to infiltrate into the ground. A preliminary analysis of this method is focused on using a fabric that provides a similar composite runoff curve number as mulch.

The PV portion of the project does not require the storage or discharge of hydrocarbons, chemicals, or other potential contaminants. Except for the possibility of a fuel spill during construction, chemical releases from the ongoing operation of the solar farm have virtually no potential to affect water quality adversely.

Constructing, Operating, and Maintaining the Anahola Substation. The retention basin that is planned within the PV Area immediately above the substation will intercept all runoff originating uphill of it. The gravel that will cover the two-acre Substation site is highly resistant to erosion; that, together with landscaped and grassed berm on the eastern edge of the substation site virtually eliminates the potential for the substation site to introduce suspended sediment into the runoff.

None of the exposed equipment at the substation (e.g., transformers, circuit breakers, cabling, etc.) contains hazardous materials or other sources of hazardous pollutants that could enter the runoff. Some hazardous materials are present within the BESS, but they are totally enclosed and here is no potential for them to be picked up by storm water runoff.

Constructing, Operating, and Maintaining the Anahola Service Center. The BMPs that will be employed during construction of the Anahola Service Center will limit the potential for construction activities to adversely affect water quality. These will include the same general measures provided for in the BMP for the PV portion of the project. As construction of the Anahola Service Center involves the disturbance of more than 1 acre of land, it will require NPDES General Permit coverage from the State of Hawai'i Department of Health. Certain uses on the service center site (e.g., storage of solvents, diesel fuel, and motor oil) involve industrial activities that are subject to regulation by the State of Hawai'i Department of Health. In accordance with this requirement, KIUC will incorporate all components of the Anahola Solar Project into its Master Storm Water Pollution Prevention Plan (SWPPP) and take all necessary steps to implement its stipulations.

5.2.2.4 Effects on Groundwater

Recharge. As discussed above, the proposed facilities will result in portions of the project site having more impermeable/less-permeable surfaces than is presently the case. Groundwater recharge beneath those areas will be reduced. However, this will be more than offset by the increased recharge that will occur through the retention basins. Assuming these are well maintained to prevent the buildup of excessive fine sediments, more recharge will occur after the proposed facilities are constructed than is presently the case.

Groundwater Withdrawals. Once in operation, neither the PV array nor the substation will require or lead directly to sustained groundwater withdrawals. However, water will be required during the approximately 9- to 12-month construction period for dust control (~20,000 gallons per day) and to facilitate the grow-in of ground cover (~100,000 per day). In order to meet this need, KIUC plans to create a temporary on-site well. The well would be drilled to a depth of approximately 400 feet, and be equipped with a 20 horsepower, three-phase 460-volt electrical motor supplied by an onsite electrical generator. The well will have an 8-inch casing and a pump capable of providing 150-200 gallons per minute, a flow rate which would be sufficient to meet all of the dust control and irrigation needs. The well will be drilled, cased, pump tested, and permitted to meet all State of Hawai'i and County of Kaua'i well construction standards.

Over the long-term, the only water use requirement for the PV arrays and substation will be water for periodic washing of the PV panels. KIUC and its contractor estimate that this would require an average of no more than a few thousand gallons per day, and only on those days when cleaning was being conducted. As indicated, KIUC would obtain this supply from the stock of demineralized feedwater at the Kapaia Generating Station, and represents only a small fraction of the amount available.

Anahola Service Center. All of the water used at the service center will be obtained from the Kaua'i County Department of Water Anahola System. As discussed in Section 5.10.1 the DWS Anahola water system has adequate supplies for this use.

5.2.2.5 Sanitary Wastewater Disposal

Neither the PV arrays nor the substation will generate sanitary wastewater. Sanitary wastewater generated at the service center will be collected and piped to an on-site treatment and disposal system designed in accordance with the State of Hawaii Department Administrative Rules §11-62 governing wastewater systems.

5.3 CLIMATE/MICRO-CLIMATE

5.3.1 EXISTING CONDITIONS: CLIMATE/MICRO-CLIMATE

Climate encompasses variable factors including temperature, humidity, wind, precipitation, and other meteorological measurements in a given region over time. Climate can be contrasted to weather, which is the present condition of these elements and their variations over shorter periods. A microclimate is a local atmospheric zone where the climate is distinct from the surrounding climate. In the present case the area of concern with respect to microclimatic effects is the area on and immediately adjacent to the 60-acre project site where such things as air temperature, wind speed/direction and humidity could be altered by construction and operation of the proposed facilities.

The Hawaiian Island chain is situated south of the large Eastern Pacific semi-permanent high-pressure cell, the dominant feature affecting air circulation in the region. This high-pressure cell produces very persistent winds over the islands called the northeast trade winds. During the winter months, cold fronts sweep across the north central Pacific Ocean, bringing rain to the Hawaiian Islands and intermittently modifying the trade wind regime. Thunderstorms, which are rare but most frequent in the mountains, also contribute to annual precipitation. There is great climatic variation across the island. Selected temperature and rainfall averages for different towns (arranged according to elevation above sea level) are shown in Table 5.8. The extremes reached in other locations can be much greater. For example, the average annual rainfall atop Mount Waiʻaleʻale (+5,148 msl) is probably about 400 inches per year while at Barking Sands (Polihale), which is less than 20 miles away, average annual precipitation is on the order of 10 inches.

Table 5.8 Average Elevation, Temperature, and Annual Precipitation on Kauaʻi

Station	*Ground Elevation (ft. +msl)*	*Average Temperature (°F)*		*Average Annual Precipitation (inches)*
		Coolest Month	*Warmest Month*	
Kekaha	9	64.5	84.8	20.66
Poʻipū	50	69.3	82.6	34.35
Līhuʻe Airport	103	69.8	81.1	40.81
Kīlauea Town	320	67.1	79.5	67.92
Kōkeʻe	3,600	51.1	67.3	66.26
Source: Dept. of Business, Economic Development, and Tourism *2010 State of Hawaii Data Book*				

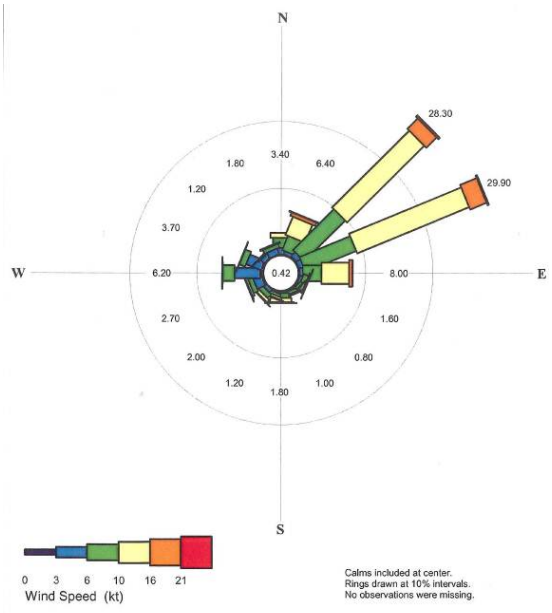
5.3.1.1 Wind

The northeast trade winds are the most important determinant of Kauaʻi's climate. The trade wind zone moves north and south seasonally with the sun, so that it reaches its northernmost position in the summer. Consequently, the trade winds are strongest and most persistent from May through September, when the trades are prevalent 80 to 95 percent of the time. From October through April, Hawaiʻi is located to the north of the heart of the trade winds, and their frequency decreases to about

50 percent (as a monthly average). Kaua'i's topography interacts with the winds to produce large variations in conditions from one locality to another. Air blowing inland as part of the trade wind flow is redirected horizontally and vertically by the mountains and valleys. This complex three-dimensional flow of air results in marked wind speed and directional differences from place to place in wind speed, cloudiness, and rainfall.

Figure 5.6 shows a wind rose diagram based on wind data recorded at Līhu'e Airport between 1950 and 1995. It indicates that the winds there come from the east through northeast approximately two-thirds of the time. No site-specific wind information is available for the project site. However, as its exposure is similar to that of the airport, the wind rose is believed to be reasonably representative of conditions there.

Figure 5.6 Wind Rose: Līhu'e Airport, 1950-1995



Source: R.M. Towill & Associates

As part of work aimed at updating building codes throughout the State of Hawai'i, Chock, et al. have prepared "Micro-zoned Design Maps of Topographic Wind Effects and Exposure in the State of Hawaii". The islandwide wind-exposure map that they prepared for use in amending the building code show that there are no special topographic or other features that would cause winds on the project site to be particularly severe (see Figure 5.7). Chock, et al. recommend using the standard wind design speed (105 miles per hour) in designing structures for the area on which the facilities are proposed.

5.3.1.2 Rainfall

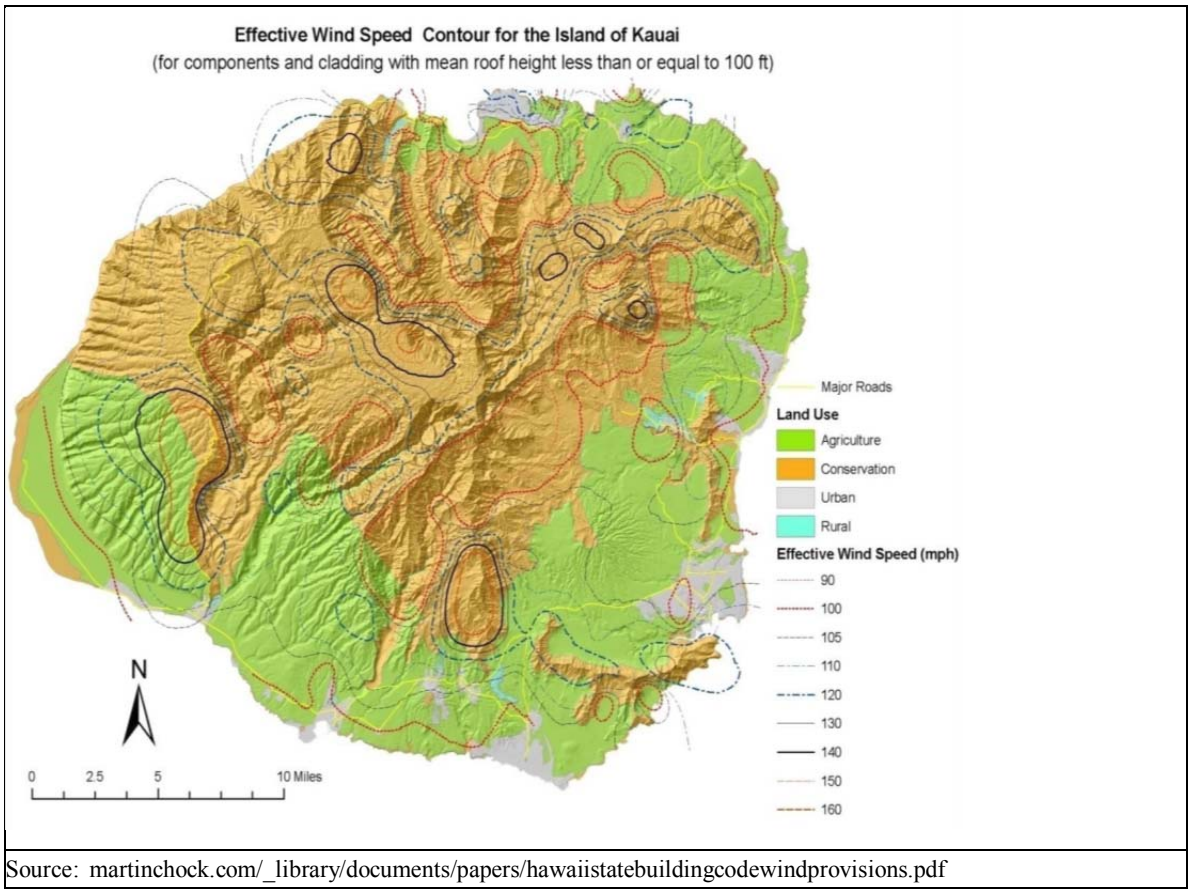
The nearest rain gauging station to the proposed project site is at Anahola (Station 1114), just a few hundred feet to the north of the project site. The average annual precipitation at this location between 1930 and 1995 was just under 50 inches. With average monthly rainfall of 5.9 inches and 6.0 inches, respectively, December and January were the wettest months during that period. With 1.4 inches, June was, on average, the driest month. Average annual rainfall data is summarized in Table 5.9 below.

Table 5.9 Average Annual Rainfall: Anahola Station 1114, 1930-1995.

Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Year*
6.0	4.8	5.7	4.6	3.4	1.7	2.4	2.5	2.1	4.5	5.2	5.9	49.1

Source: http://www.worldclimate.com/cgi-bin/data.pl?ref=N22W159+2200+510145C; ANAHOLA 1114, KAUAI data derived from NCDC Cooperative Stations. 50 complete years between 1930 and 1995.

Figure 5.7 Effective Wind Speed: Island of Kaua‘i.



Source: martinchock.com/_library/documents/papers/hawaiistatebuildingcodewindprovisions.pdf

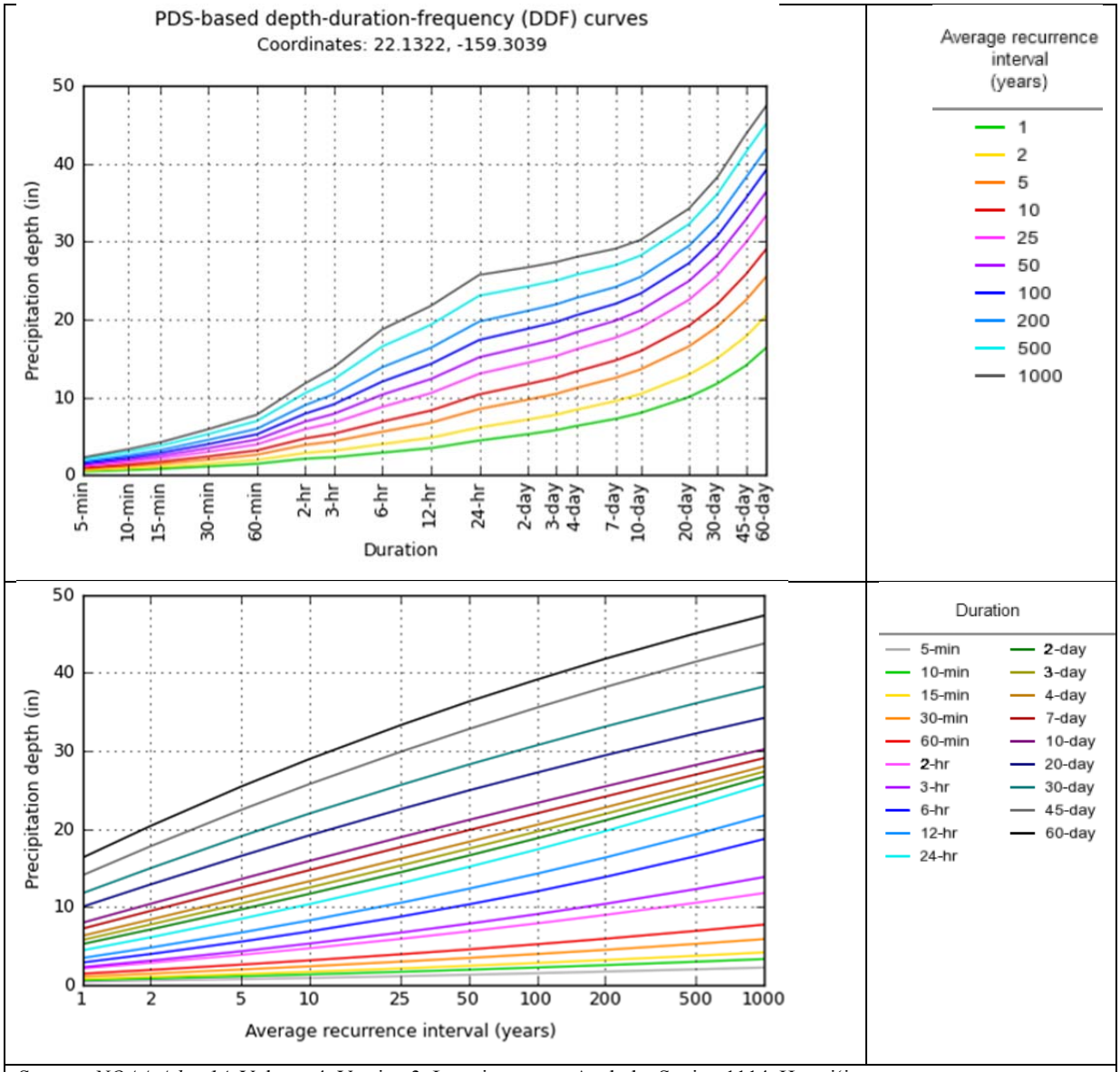
While the average rainfall amounts at Anahola are modest, storms can produce extremely heavy rainfall events. As can be seen in the plots reproduced in Figure 5.8, the 24-hour rainfall with a recurrence interval of 25 years (the lifetime of the project) is about 13 inches. The 100-year/24-hour rainfall event is approximately 18 inches.

5.3.1.3 Temperature

Temperatures in the project site are moderate. Data from the Līhu‘e Airport, which is at a slightly lower elevation but otherwise similar to the Anahola area, is reproduced in Table 5.10. The average temperature there during the coolest month of the year (February) is 71.6°F; during the warmest month of the year (August) it is 79.7°F. The average monthly minimum temperature is lowest in January and February, when it is 65.5°F. The average monthly maximum temperature during the

warmest month (August) is 84.8°F. The highest temperature ever recorded at the station is 91°F; the lowest temperature is 46°F, which occurred on January 14, 1930. [22]

Figure 5.8 Rainfall Depth-Duration Frequency Curves, Anahola, Kaua'i.



Source: *NOAA Atlas 14*, Volume 4, Version 3, Location name: Anahola, Station 1114, Hawai'i.

Table 5.10 Average Temperatures, Līhu'e Airport: 1981-2010.

Temperature (deg F.)	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Year*
Average	71.7	71.6	72.6	74	75.8	78.1	79.2	79.7	79.5	78.1	75.7	73.2	75.8

[22] Interestingly, that extreme high temperature has been recorded six times over the past 90 years, but the most recent occurrence was in 1936 (9/4/1936; 10/4/1930; 10/21/1926; 10/26/1925; 7/4/1918; and 7/2/1918.

Temperature													
Avg. Minimum Temperature	65.5	65.5	67.0	68.8	70.4	73.0	74.1	74.6	74.1	72.9	70.7	67.6	70.4
Avg. Maximum Temperature	78.0	77.8	78.4	79.2	81.2	83.2	84.2	84.8	84.8	83.4	80.8	78.8	81.2
Source: http://www.nws.noaa.gov/climate/xmacis.php?wfo=hnl													

5.3.2 EFFECTS ON CLIMATE

There is increasing agreement among atmospheric scientists that emissions of what have come to be known as "greenhouse gases" from fossil fuel-fired power plants are contributing to a heating of the earth's atmosphere.[23] Generally referred to as climate change, a continuation of this trend has the potential to alter atmospheric circulation and climate worldwide, with a host of consequences. The electricity produced by the proposed PV arrays will allow KIUC to reduce the output and fuel combustion at its existing fossil fuel-fired generating facilities while still meeting the needs of its customers. Since burning oil at power plants produces carbon dioxide, methane, and other greenhouse gases, this will lower KIUC's emissions of those pollutants.

The proposed project will produce an estimated 23,525 megawatt-hours (MWh) of electricity per year. If emissions from KIUC facilities were equivalent to the national average for oil-fired generation of 1,672 pounds of carbon dioxide per MWh[24] and if power from the PV arrays could be substituted one-for-one for the power from the existing oil-fired facilities, the project would reduce CO_2 emissions by 19,669 tons per year. This is far too small to have a measurable positive effect on global warming in and of itself; however, the initiative represents a positive step forward towards meeting renewable energy standards in Hawaii that have been established to reduce the dependence on fossil fuels and reduce CO2 emissions.

5.3.3 EFFECTS ON MICROCLIMATE

None of the activities or work required to construct the proposed project involve substantial heat or moisture emissions or would alter shade/reflectivity in ways that have the potential to affect microclimate. Neither do they entail the erection of tall structures or re-grading of land sufficient to alter wind flow within the project site or surrounding areas to any measurable extent. The substation and service center do not contain or provide significant sources of shade, heat, or moisture sources. Neither do they contain substantial structures that might serve as windbreaks or large masses of material that would serve as heat sinks. Consequently, they do not have the potential to measurably affect the microclimate of the area.

Because PV arrays tend to cover relatively large areas, some have expressed concern about the extent to which they might affect the microclimate in and around the immediate areas in which they are constructed. For reasons discussed below, the Anahola project is not expected to cause a noticeable change in the microclimate beyond the boundaries of the project site.

5.3.3.1 Background

Sunlight that reflects off the surface of a solar panel cannot be used to produce electricity. Consequently, manufacturers go to great lengths to minimize reflection and maximize the amount of solar energy that the panels absorb. The two most common methods of limiting reflection off the panels are to apply an anti-reflective coating to the module and to texture the surface of the modules.

[23] Gases that trap heat in the atmosphere are called greenhouse gases. The primary greenhouse gases are carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), and Fluorinated gases. The first three are emitted when fossil fuels are burned to produce electricity (though there are many other sources of these gases as well).

[24] U.S. Environmental Protection Agency , http://www.epa.gov/cleanenergy/energy-and-you/affect/oil.html

The modules that would be used in the proposed project are constructed using a glass whose surface has an anti-reflective treatment so sunlight striking it is directed towards the silicon photovoltaic cell, limiting reflection.[25]

The sunlight that the panels do absorb is either converted into electricity or raises the temperature of the panels. In order to maximize the efficiency of electricity production, photovoltaic manufacturers design their panels to minimize the latter, striving to keep panels from reaching temperatures greater than 20 degrees F. above that of the surrounding air. (As a point of comparison, automobiles sitting in the sun at a parking lot can reach temperatures more than 40 degrees F. higher than that of the surrounding air.)

Residents living near some much larger solar farms on the Mainland have expressed concern that the presence of the panels would create microclimatic effects on air temperatures in and around the facility. Because of this, KIUC has evaluated the extent to which the proposed Anahola Solar project might increase air temperatures on and immediately around the project site. In the course of these investigations it also reviewed evidence concerning possible effects on soil temperature and soil moisture content within the area where the PV arrays would be constructed. Both factors are relevant to the long-term maintenance of vegetative groundcover in the area.

5.3.3.2 Effect on Air Temperature

Many researchers argue that theory tells us that PV panels are not likely to increase temperature in the area immediately around the proposed solar farm. Specifically, they note that:

- The amount of the sun's heat absorbed by a solar panel is similar to the amount of the sun's heat absorbed by the earth.
- Because solar panels are thin (the glass is approximately 0.12 inches thick), lightweight, and surrounded by airflow (because it's mounted above the ground), they store less heat than the solid earth. The same physical characteristics mean that PV panels dissipate heat more quickly than solid earth does. This means that nighttime temperatures may be slightly lower where they are present.
- The other equipment associated with the arrays (e.g., the inverters) does not generate a significant amount of "waste heat".

In order to understand if temperature effects were likely to be of concern for the Anahola Solar project, KIUC reviewed the results of several recent studies of the phenomena. The results, which confirm that project-related temperature changes will be insignificant, are summarized below.

Lawrence Berkeley National Laboratory Modeling. Computer modeling by researchers at the Lawrence Berkeley National Laboratory (Millstein and Menon, July 1, 2011) examined the extent to which modifications to the surface albedo of the earth through the widespread deployment of cool roofs and pavements (reflective materials) and photovoltaic arrays (low reflection) have the potential to change radiative forcing, surface temperatures, and regional weather patterns.[26] The huge hypothetical solar arrays used in that part of the analysis produce about 8,000 times more power than the proposed Anahola Solar project. Even with such an exaggerated source, the modeled local afternoon temperature increases were less than three-quarters of a degree Fahrenheit. Based on these

[25] One measure of the reflectivity is albedo, the ratio of solar radiation across the visible and invisible light spectrum reflected by a surface. Albedo varies between 0, a surface that reflects no light, and 1, a mirror-like surface that reflects all incoming light. Solar panels with a single anti-reflective coating have a reflectivity of around 0.10 to 0.3. By comparison, sand has an albedo between .15 and .45 and agricultural vegetation has an albedo between .18 and .25. In other words, the solar panels have a lower reflectivity.

[26] The analysis used the Weather Research and Forecasting (WRF) model (a fully coupled regional climate model) to investigate feedbacks between surface albedo changes, surface temperature, precipitation and average cloud cover.

results, it is apparent that the size of the several orders of magnitude smaller array field proposed for Anahola would have no discernible effect on ambient temperature. Millstein and Menon's modeling results indicated that a vast field of solar arrays could have a small effect on local and regional wind, but they indicate that the much smaller-scaled project that is proposed at Anahola would not affect winds in any measurable way.

Tokyo Simulation. Genchi et al. (2003) conducted a simulation of the effects of large-scale PV panel deployment in the urban setting of Tokyo. From their simulation results, they conclude that the impact of large-scale installation of PV panels on microclimate—in particular the building canopy temperature—would be negligible. The much smaller alteration that is proposed at Anahola has even less potential to affect building canopy temperatures.

CVSR Solar PV Project. Donovan (July 6, 2010) assessed the extent to which a large solar project in California's Central Valley (the CVSR Solar PV Project) might change one aspect of the area's microclimate (ambient air temperature under) above and around the solar field). The analysis, which was applicable to PV arrays between 1 and 300 acres in size, compared conditions with and without such an array. In addition to changes in the albedo, there are other factors which could result in heat impacts. Drawing on work done on urban heat islands, Donovan discusses three factors that could lead to an effect from large-scale PV arrays. They are: (*i*) use of materials which absorb more solar radiation, (*ii*) use of massive materials which store more heat and dissipate heat slowly, and (*iii*) waste heat from energy usage, such as appliances, engines, and HVAC, which run on electricity, natural gas, and oil. He then discusses each of these, reaching the following conclusions:

- With regards to factor (*i*), he concluded that while the PV array's slightly lower (relative to natural conditions) albedo (reflectivity) will cause it absorb slightly more heat than a field with no PV, PV panels dissipate heat more quickly than the earth. The fact that this increased heat is being absorbed by the PV panels and not the earth means that there will be no net gain in heat caused by the albedo change.
- With regards to second factor, the amount of heat released during periods when solar insolation is low (e.g., at night) is related to the mass of those materials and the amount of heat absorbed when the sun is shining on them. While PV modules can reach relatively high operating temperatures, they are thin and lightweight (rather than massive) and therefore do not store a large amount of heat. Because of this, they cool to air temperature shortly after the sun sets and do not affect air temperatures thereafter.
- With regards to the third factor, the only heat that would be emitted by equipment at the Anahola Solar Project would be from the inverters that are scattered throughout the PV arrays. Even for the Central Valley PV system that Donovan studied (which included tracking motors and other heat-releasing equipment that would not be present at Anahola), the waste heat was less than 0.21 MWh/acre/day, or about 1% of total solar energy impacting the plant within a day.[27] To put this in perspective, this is about 250 times less per acre than the energy loads imposed by a large urban area and suggests that waste heat from energy loads would not have a significant temperature effect.

In summary, while it is not possible to scale the results of the modeling and calculations that have been done elsewhere linearly to the situation at Anahola, together the theoretical analyses indicate that the 12 MW array that is planned would not have a measurable microclimatic effect.

The preceding discussion is based largely on theory. Some field research has been conducted as well. While the data are still limited, in order to address concerns about possible temperature changes

[27] In comparison, a study of the Urban Heat Island effect in New York City [1] showed that waste heat from energy usage in that city is about 250% of solar energy throughout the year.

associated with large PV arrays, meteorologists working on the Sarnia Solar Power Plant in Ontario, Canada, obtained detailed air temperature data in and around the first (approximately 100-acre) phase of that project. As discussed below, the results of their measurements provide empirical evidence that PV arrays do not have a significant effect on ambient temperatures in nearby areas.

Temperature data at the Sarnia facility was gathered using nine automated weather stations recording 30-minute averages of air temperature, relative humidity, global horizontal insolation[28], wind speed and direction, and barometric pressure. Six of the stations were installed around the Sarnia project property and three stations were installed in nearby corn fields as controls. The sensors were positioned approximately 8 feet above ground, and are accurate to about ±0.5°C (sensor) and ±1 °C (in the data-logger system). One of the stations (SH #2) was approximately 100 feet from the western edge of Block #2 of the operating solar panels. All of the other monitoring stations are located at least 0.6 mile from the nearest operating or installed portion of the power plant.

The influence of module heating was measured by observing time-point by time-point (30 minute average) temperature differences between the various weather stations. The analysis focused on differences between the suspected "hot" station, SH #2 and nearby short-term controls (SH #7, #3, #9) and on differences between the controls themselves (#7, #3, #4, #9). The temperature differences, binned by hour over the period of record, between SH #2 and its two nearest undisturbed neighbors, or controls (SH#3, 0.81 mile to the North and SH#7 1.2 mile to the South) are shown in Table 5.11.

Table 5.11 Air Temperature Difference Measurements Associated With Large PV Arrays

	Hawks #2- #7	***Hawks #2 - #3***	***Hawks #3 - #7***
Mean Difference ± 1 std (all hours of day)	- 0.02 ± 0.5 °C	+ 0.04 ± 0.5 °C	- 0.05 ± 0.6 °C
Maximum Mean Difference (night)	+ 0.26 °C @ 23:00	+ 0.26 °C @ 24:00	+ 0.03 °C@ 10:00
Maximum Mean Difference (day)	- 0.34 °C @ 15:00	- 0.22 °C @ 11:00	- 0.18 °C @ 14:00
Source: *Topaz Solar Farm Final Environmental Impact Report*, Appendix 8B, Sarnia Air Temperature Analysis, Interim Results, March 15, 2010.			

In summary, analysis of the data collected during the first eleven months of operation (April 1, 2009, through February 28, 2010) of the first 20 MW of the First Solar installation (Blocks #1 and #2) showed the following:

- There is no statistically significant mean temperature difference between the monitoring stations.
- Hint of an average diurnal variation of about 0.6 °C between the controls and the single station adjacent to the array, a value within the measurement error of the sensors.
- Only winter measurements available for comparing center-of-array to outside-of array measurements; more data needed to analyze long term trends.
- No measurable effect of wind.

While the interim report notes that additional data are needed to confirm these preliminary results, the preliminary findings provide strong evidence that the presence of large PV arrays does not have a significant effect on air temperature.

[28] Solar radiation is usually measured with an instrument mounted horizontally, so that it sees the whole sky (direct plus diffuse) and such data is termed "global horizontal insolation" (GHI).

5.3.3.3 Effect on Soil Temperature and Soil Moisture Content

While not strictly speaking a "microclimatic effect", changes in soil temperature and soil moisture content are so closely tied to microclimate that they are discussed here. The broad surfaces of the photovoltaic modules will create substantial shade over a substantial portion of the project site. This would lower daytime soil temperatures relative to un-shaded conditions (e.g., in a ploughed field), but it is not clear whether this difference would be (*i*) similar or different from that caused by the presence of shading vegetation (*ii*) or sufficient to affect the soil microenvironment in any substantial way. A search of the literature failed to uncover substantive research on this topic.[29] While periodic washing of the photovoltaic modules may briefly increase surface moisture in localized areas, this will only occur when rainfall is scarce and would not measurably alter the climate or regional microclimate.

5.4 AIR QUALITY

5.4.1 EXISTING CONDITIONS: AIR QUALITY

The U.S. Environmental Protection Agency (EPA) has set national ambient air quality standards (NAAQS) for ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, 2.5-micron and 10-micron particulate matter ($PM_{2.5}$ and PM_{10}), and airborne lead. These ambient air quality standards establish the maximum concentrations of pollution considered acceptable, with an adequate margin of safety, to protect the public health and welfare. The State of Hawai'i Department of Health (DOH) has also set ambient air quality standards for some pollutants; in some cases, these are more stringent than the Federal standards. At present, the State has set standards for five of the six criteria pollutants (excluding $PM_{2.5}$) in addition to hydrogen sulfide (DOH 2005). Hawai'i Administrative Rules (HAR), Title 11, Chapter 59 *Ambient Air Quality Standards* and Chapter 60 *Air Pollution Control* establish these standards. Table 5.12 presents the state and national ambient air quality standards for selected pollutants.

Both State and national air quality standards consist of two parts: (*i*) an allowable concentration of a pollutant and (*ii*) an averaging time over which the concentration is measured. The allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops, and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposure to a high concentration for a short time (one hour, for instance), or to a lower average concentration over a longer period (e.g., 8 hours, 24 hours, or a year). For some pollutants there is more than one air quality standard, reflecting both its short-term and long-term effects.

The State DOH maintains monitoring stations in those parts of the state where it believes that there is a potential for air quality standards to be exceeded. As there are no significant human fixed sources of air pollutants on Kaua'i and it is far from the Big Island volcanoes whose eruptions have produced natural emissions that have affected air quality on other islands during recent years, the State DOH did not operate any air quality monitoring stations on Kaua'i until recently. In 2010, it established an air monitoring station at Niumalu, Kaua'i to monitor ambient cruise ship emissions; no exceedances of ambient air quality standards have been recorded to date (http://hawaii.gov/health/environmental/environmental/air/cab/cab/cab_notification/notification_pdf/exceedances_2012_10_22.pdf). Because of its location far from significant pollutant sources, ambient air quality at Anahola is almost certainly even better.

[29] However, soil temperature is one of the factors on which the Brookhaven National Laboratory is planning on collecting data (http://www.bnl.gov/energy/files/nserc/BNL_Solar_Research_Overview_and_ NSERC_ Plans_with_Input.pdf).

Table 5.12 State and National Ambient Air Quality Standards

Pollutant	Unit	Averaging Period	NAAQS	SAAQS
CO	ppm	1-hour	35[b]	9
		8-hour	9[b]	4.4
Pb	µg/m^3	Quarterly	1.5[h]	1.5
NO_2	ppb	1-hour	100	None
	ppm	Annual	0.053[c]	0.04
H_2S	ppm	1-hour	None	0.025
PM_{10}	µg/m^3	24-hour	150[d]	150
		Annual	None [e]	50
$PM_{2.5}$	µg/m^3	24-hour block avg.	35	None
		Annual	15[f]	None
O_3	ppm	8-hour rolling avg.	0.075[g]	0.08
SO_2	ppm	3-hour	0.5[a]	0.5
		24-hour	0.14[b]	0.14
		Annual	0.03[c]	0.03

Notes:
a. Federal Secondary Standard.
b. Not to be exceeded more than once per year.
c. Average of all 1-hour values in the year may not exceed the level of the standard.
d. May not be exceeded more than one day per year.
e. EPA revoked the annual PM_{10} standard effective December 17, 2006 due to a lack of evidence linking health problems to long-term exposure. The State still has an annual standard.
f. The 3-year average of 24-hour values must not exceed the level of the standard.
g. The 3-year average of the fourth highest daily maximum value must not exceed the level of the standard.
h. Average of all 24-hour values in any calendar quarter may not exceed the level of the standard.

Source: State of Hawai'i Department of Health (2010)

5.4.2 PROBABLE AIR QUALITY IMPACTS

5.4.2.1 Construction Period

The heavy construction equipment that will be used for this work (e.g., bulldozers, dump trucks, pile drivers, etc.) will be powered by internal combustion engines that emit a variety of air pollutants, all in small quantities and over a relatively limited period of time (several months).[30] None of these equipment emissions will add substantially to existing area sources of these pollutants, which consists principally of vehicles traveling on Kūhiō Highway (one of the island's major roadways). However, heavy construction activities such as those needed for site preparation can result in fugitive dust emissions from earth-moving activities, use of unpaved haul-roads, etc. The amount of grubbing, grading, and vegetation removal that will be required to prepare and maintain the area where the PV

[30] Construction equipment emissions result from the following sources and activities: (*i*) construction equipment engine exhaust; (*ii*) motor vehicle exhaust, brake, and tire wear; (*iii*) entrained dust from material delivery trucks; (*iv*) entrained dust from roadways; (*v*) entrained dust from construction worker vehicles; (*vi*) fugitive dust from bulldozing, grading, and scraping, and from the handling of excavated material, such as depositing material into haul trucks; and (*vii*) fugitive dust from wind erosion of disturbed areas.

modules would be located has the potential to lead to substantial amounts of airborne particulates (dust) if it is not carefully implemented.

Grubbing and grading the photovoltaic solar array site involves the use of large, diesel-fueled construction equipment that is listed. However, the number of pieces of equipment operating at any one time is too low, and their distance from sensitive receptors too great, for combustion emissions, such as NO_x and diesel particulate matter (diesel PM), from this equipment to have a significant effect on air quality. Much more importantly, the soil disturbance caused by grubbing and grading work generates fugitive dust that can have a more substantial (albeit temporary) effect on air quality than emissions from the engines.[31] The potential for adverse effect continues until the replacement vegetation has become established or material is placed over the exposed ground.

Over the long-term, changes in ground cover that lead to the emergence of bare soil areas can lead to an increase in aeolian soil erosion and airborne particulate matter. The vegetation management plan reproduced in Appendix C is intended to ensure that good ground cover is maintained, thereby minimizing the potential for such an occurrence.

Specific information concerning the construction equipment that would be used will not be available until a construction contractor is selected.[32] Consequently, overall construction emissions were estimated using screening emission rates and procedures recommended in the most recent edition of the *Air Quality Handbook: A Guide For Assessing the Air Quality Impacts for Projects Subject to CEQA Review (*San Louis Obispo Air Quality Control District, December 2009). The results of the calculations are shown in Table 5.13.

Table 5.13 Screening Emission Rates for Construction Operations.

Pollutant	***grams/Yds^3 of Material Moved***	***Lbs/ Yds^3 of Material Moved***	***Yds^3 of Material Moved***	***Emissions***
Diesel PM	2.2	0.0049		43 lbs
Carbon Monoxide (CO)	138.0	0.304		2,675lbs
Reactive Organic Gases (ROG)	9.2	0.0203		179 lbs
Oxides of Nitrogen (NOx)	42.4	0.0935		823 lbs
Sulfur Oxides (SOx)	4.6	0.010		88 lbs
Fugitive Dust (PM10)	0.75 tons/acre-mo. of Constr. activity		54 acre-months	40.5 tons
Note: These rates assume an average of 0.27 gallons of diesel fuel is burned for each cubic yard of earth moved.				
Sources: *CEQA Air Quality Handbook, A Guide for Assessing the Air Quality Impacts for Projects Subject to CEQA Review*, December 2009 - April 1996, and EPA-AP 42.				

[31] The piles are installed using hydraulic pile-driving equipment that minimizes earth disturbance and, therefore, the potential for construction dust. The pile-driving equipment and the vehicles delivering the piles, panels, and other materials used to erect the arrays travel slowly and tend not to disturb the soil and produce substantial quantities of airborne particulates.

[32] As discussed elsewhere in this report, water for use during construction may be obtained from a new on-site well. The well pump would be powered by a Generac QuietSource Series 36 kW Generator or equivalent. KIUC calculates that this generator would produce a maximum hourly heat input of slightly over 0.5 MMBtu per hour; because this is less than the one MMBtu per hour standard, it qualifies for an exemption from the requirement to obtain a non-covered source air permit under HAR §11-60.1-62(d)(4).

The emission estimates from Table 5.13 were then used together with the fuel use estimate presented above to assess whether or not mitigation might be appropriate.[33] Table 5.13 shows the approximate level of construction activity that would require mitigation for each pollutant of concern and compares these with the estimated emission from the proposed project. The results indicate that special mitigation is not needed for the construction phase of the proposed project except in the case of particulate matter (PM_{10}). In the case of that pollutant, the fact that such a relatively large area will be disturbed by grubbing and/or grading puts the proposed project over the 4.0-acre threshold.[34]

Table 5.14 Level of Construction Activity Where Mitigation May be Appropriate.

Pollutant of Concern	*Thresholds (1)*		*Amount of Material Moved*		*Threshold Exceeded?*
	Tons/Qtr	*Lbs/Day*	*Cu. Yds/Qtr*	*Cu. Yds/Day*	
Reactive Organic Gases	2.5	185	247,000	9,100	No
	6.0	185	593,000	9,100	No
NOx	2.5	185	53,500	2,000	No
	6.0	185	129,000	2,000	No
PM10	2.5	n/a	Any project with a grading area greater than 4.0 acres of continuously worked area will exceed the 2.5 ton PM10 quarterly threshold.		**YES**
Note: Thresholds were approximated using the screening level emission rates from Table 5.13. Daily emission thresholds are based upon the level of daily emissions that may result in a short-term exceedance of the ozone standard.					
Source: Planning Solutions, Inc.					

Minimization Measures. As part of its contract with REC, KIUC is requiring the contractor to implement the following standard minimization measures, as well as whatever additional measures may be required by the grading and grubbing permit that the contractor must obtain from the County of Kaua‘i.

- Maintain all construction equipment in proper tune according to manufacturer’s specifications.
- Fuel all off-road and portable diesel powered equipment, including but not limited to bulldozers, graders, cranes, loaders, scrapers, backhoes, generator sets, compressors, auxiliary power units, with motor vehicle diesel fuel.
- Maximize to the extent feasible, the use of diesel construction equipment meeting the latest certification standard for off-road heavy-duty diesel engines.
- Minimize the extent disturbed area where possible.
- Use water trucks or sprinkler systems in sufficient quantities to minimize the amount of airborne dust leaving the site.
- Cover or continuously wet dirt stockpile areas containing more than 100 cubic yards of material.

[33] Guidance from San Louis Obispo, California. Because it is a “non-attainment area” with respect to national and State ambient air-quality standards, the emission limits there are quite restrictive and, therefore, provide a conservative benchmark against which to judge the Anahola project.

[34] Readers should note that the California threshold is not a regulatory one in Hawai‘i. It does, however, provide a means of judging the extent to which project-related activity deserves attention when developing detailed construction plans and developing pollution control measures.

- Implement permanent dust control measures identified in the project landscape plans as soon as possible following completion of any soil disturbing activities.
- Stabilized all disturbed soil areas not subject to revegetation, paving, or development using approved chemical soil binders, jute netting, or other methods.
- Pave all roadways, driveways, sidewalks, as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.
- Limit vehicle speed for all construction vehicles moving on any unpaved surface at the construction site to 15 mph or less.
- Cover all trucks hauling dirt, sand, soil, or other loose materials.

5.4.2.2 Operation and Maintenance Activities

None of the equipment associated with the PV arrays and substation (e.g., inverters and control equipment, transformers, switches, etc.) emit air pollutants of any kind. Consequently, once the PV facilities are installed and the substation constructed, very little would occur that has the potential to affect air quality, so long as the land in and around the PV arrays is maintained in accordance with an effective vegetation management plan (included in full in Appendix C).

Some emissions will result from vehicles traveling to and from the service center, but as it is being installed in large part to shorten average travel times by KIUC service trucks and by members needing help, these are likely to be equal to or less than those that would occur if the new facilities were not constructed. In summary, when looked at cumulatively and over the long term, operations and maintenance of this project does not have the potential to harm air quality in the area.

The proposed project's beneficial effect will extend beyond the Anahola area. The electricity that the photovoltaic arrays would produce will allow KIUC to reduce the amount of electricity that it must generate using fossil fuels. This will allow a nearly proportionate decrease in the amount of pollutants emitted as a result of the combustion of fossil fuels elsewhere on the island.

Table 5.15 shows the pounds of each regulated pollutant that were emitted for each megawatt-hour of power that was generated at KIUC's two fossil-fuel-fired power plants in 2010. Present estimates are that the 12 MW capacity Anahola Sola Project will produce 23,693 megawatt hours in the first year of operation. This means that if fossil-fuel-fired generation was decreased by the same proportion at all the existing generating units, the proposed project would reduce KIUC's annual emissions by the amounts shown in Table 5.16. If the replacement could be slanted disproportionately towards replacing power generated at the older, Port Allen facility, the reduction in emissions would be proportionately larger.

Table 5.15. Air Pollutant Emissions in Pounds per Megawatt Hour from Fossil Fuel Use: 2010

Unit	*Power Generated (MWh)*	*Emissions, in pounds/MWh*					
		NO_x	*SO_2*	*CO*	*VOC*	*PM^{10}*	*CO_{2e}*
Port Allen Generating Station	204,744	15.9	0.4	2.8	0.8	1.0	1,591
Kapaia Power Station	219,626	0.41	0.01	0.09	0.01	0.07	1,276
Total All Units	***424,369***	***7.9***	***0.2***	***1.4***	***0.4***	***0.5***	***1,428.3***
Source: Kaua'i Island Utility Cooperative.							

Table 5.16. Emission Reductions: Anahola Solar Project.

Power Plant Whose Generation is Replaced	*Power Generated (MWh)*	*Emissions, (in pounds)*					
		NO_x	*SO_2*	*CO*	*VOC*	*PM^{10}*	*CO_{2e}*
Port Allen Generating Station	11,431	181,754	4,572	32,007	9,145	11,431	18,186,862
Kapaia Power Station	12,262	5,027	123	1,104	123	858	15,646,270
Total All Units	***23,693***	186,782	4,695	33,111	9,267	12,289	33,833,132

Source: Kaua'i Island Utility Cooperative.

The emission reductions at Port Allen and Kapaia, which are respectively approximately 25 and 13 miles away, will have no measurable effect on air quality in Anahola, due to their distance. It will, however, have a beneficial effect on pollutant levels near Port Allen in the south of the island and Kapaia on the east side.

While PV systems do not have any air pollutant emissions during normal operation, it is possible for emissions to occur if they are ignited, (e.g., by a wildfire). The panels themselves are not flammable; however a potential fire could begin if nearby vegetative material were to ignite, as is possible in a brush fire. So long as the vegetation beneath and around the solar array is kept well-trimmed (as is provided for in the vegetation management plan), the potential for this to occur is very low. If a sufficiently intense and prolonged fire were to occur, metals used in some types of PV panels could vaporize and escape into the atmosphere. However, because these materials (such as Cadmium, Selenium, or Tellurium) are either not present, or are present in only minute quantities, in the panels that KIUC will use, the danger from the fire itself would keep fire-fighters and others far enough away to avoid significant exposure to any of the toxins.

5.4.2.3 Decommissioning

Air quality effects of activities associated with decommissioning are negligible. Neither removing the panels from the mountings nor extracting the foundation posts from the ground disturbs soil will produce substantial quantities of dust. Emissions from the equipment used to perform the work are also very small. Some airborne particulate can be expected if the foundations for the electrical equipment (inverters) and/or conduit are removed.

5.5 BIOTA

5.5.1 EXISTING CONDITIONS

On January 16, 2012, Rana Biological Consulting, Inc. conducted a biological survey of the site (see Appendix B). The reconnaissance-level survey was intended to: (*i*) identify the botanical, avian, or mammalian species present on the site and; (*ii*) to assess the likelihood that species that have been listed as threatened or endangered or proposed for listing under either the federal or State of Hawai'i endangered species laws are present on the Anahola Solar site.[35] The applicable federal regulations are contained in the Endangered Species Act of 1973; 7 U.S.C. § 136, 16 U.S.C. § 1531 et seq. At the state level, Hawai'i Revised Statutes Chapter 195D govern the treatment of threatened and endangered species. The survey results are summarized below.

[35] There is no federally delineated Critical Habitat for any species present on or adjacent to the project site.

5.5.1.1 Flora Species

The vegetation at the project site is dominated by Guinea grass (*Panicum maximum*) with varying amounts of Christmas berry (*Schinus terebinthifolius*) and (in places) dense patches of lantana (*Lantana camara*). Individual Java plum (*Syzygium cuminii*) trees are dotted across the landscape. A total of 67 species of vascular plants was identified from the survey area; of these only three are native species. Of the total number of species recorded, 64 (95.5%) are naturalized or ornamental species. Two of three native species recorded - yellow wood sorrel (*Oxalis corniculata*), and *pōpolo* (*Solanum americanum*) - are Polynesian introductions and the third, *'uhaloa* (*Waltheria indica*) is an indigenous species. All three of these species are common on the island of Kaua'i, although all were rare or occasional on this site.

5.5.1.2 Mammalian Species

With the exception of the federally-listed endangered *'ōpe'ape'a* or Hawaiian hoary bat (*Lasiurus cinereus semotus*), all terrestrial mammals currently found on the island of Kaua'i are alien species, and most are ubiquitous. The three terrestrial mammalian species found on the site were three horses (*Equss c. caballus*) tethered to stakes; one pig (*Sus s. scrofa*) seen in the upper reaches of the site; and several dogs (*Canis f. familiaris*) heard barking from areas adjacent to the site. Additionally, scat, tracks and sign (hair and other biological material) of horses, dogs, and pigs were encountered at several locations within the project site.

The findings of the mammalian survey are consistent with the location of the property and the habitat currently present on the site. No Hawaiian hoary bats were recorded overflying the site. Hawaiian hoary bats are widely distributed in the lowland areas on the island of Kaua'i, and have been documented in and around almost all areas that still have some dense vegetation (Tomich, 1986; USFWS 1998, David, 2011).

Although no rodents were detected during the course of the January 2012 survey, it is virtually certain one or more of the four established alien muridae found on Kaua'i, including roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*), and Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the general project site. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

5.5.1.3 Avian Species

The avian diversity and densities were as to be expected given the location of the property and the habitat presently on the site. Three species, including Nutmeg Mannikin (*Lonchura punctulata*), Zebra Dove (*Geopelia striata*) and Chestnut Munia (*Lonchura atricapilla*) accounted for 60 percent of all birds recorded during station counts.[36] The most commonly recorded species was Nutmeg Mannikin, which accounted for slightly more than 28 percent of the total number of individual birds recorded. An average of 62 individual birds was recorded per station count; a number that is quite high for point counts in this area on the island of Kaua'i.

5.5.1.4 Aquatic Biota

Because there are no aquatic habitats (e.g., streams, ponds, wetlands, etc.) present on the project site, no aquatic biota are present.

[36] Station counts for avian surveys are consecutive counts in which a trained observer records all the birds seen and heard from a given point, or "station" for a set period of time. In the case of the survey conducted of the Anahola site, six minute point counts were made at each of 8 avian point count stations. Point counts were concentrated during the early morning hours, the peak of daily bird activity.

5.5.2 PROBABLE IMPACTS ON BIOTA

5.5.2.1 Impact on Flora

The grubbing, grading, and other vegetation removal that REC Solar and KIUC would carry out during construction of the solar array and substation would remove the great majority of the existing vegetation on the site. However, (as noted in Section 5.5.1.1 and elaborated on in Appendix B) only three of the sixty-seven species present are native, and only one of those, *'uhaloa* (*Waltheria indica*) is indigenous. All three of the native species are common on the island of Kaua'i, albeit rare or occasional on the project site. The absence of any rare or endangered plant species means that the grubbing, grading, and vegetation removal activities associated with the project do not constitute a significant adverse effect.

In order for the PV panels to continue to perform satisfactorily, KIUC must ensure that vegetation does not overgrow the PV panels, preventing solar radiation from reaching them. KIUC has developed the Vegetation Management Plan (VMP) reproduced in Appendix C to facilitate this. The key objectives of the plan are to: (*i*) ensure full solar access to solar array; (*ii*) ensure full access to solar equipment for maintenance and repair purposes; (*iii*) minimize on-site erosion and sediment transport; (*iv*) reduce airborne dust particles; (*v*) increase water infiltration; (*vi*) minimize the frequency of maintenance cycles (vegetation management); and (*vii*) minimize the need for herbicidal control measures.

The VMP is designed to eliminate/discourage the growth of vegetation that might adversely affect the performance of the solar arrays (which it refers to as "target vegetation) and to encourage the growth of vegetation that will help stabilize the soil on the site over the long term (which it refers to as "non-target vegetation).

- Vegetation targeted for removal or control includes all tree or shrub species as well as grass species that exceed 18-inches in height. Examples include, but are not limited to African Tulip, Christmas Berry, Guinea Grass, Haole Koa, Java Plum and Lantana. It also calls for eradication of climbing vines (such as Cat's-claw Vine, Trumpet Vine, and Wood Rose Vine) that may adversely affect the efficient operation of the solar array.
- Non-target vegetation includes herbaceous growth that matures at less than 18" in height, unless it is categorized as a climbing vine, and accepts periodic mowing. Examples include, but are not limited to Bermuda grass, Rye Grass, Hilo Grass, Kikuyu grass, St. Augustine Grass, and Wide-leaved carpet grass.

The ultimate goal is to eliminate tall growing grasses, woody trees and shrubs and other noxious weed species such as climbing vines and allowing desirable vegetation to remain.

The VMP is premised on the belief that if managed properly, non-target vegetation will become self-sustaining over time and require less maintenance (including less dependence upon herbicides). It entails the use of a variety of tools, including mowing and string trimming, hand removal of target species in difficult to access areas, mulch cover, weed barrier fabric, selective use of herbicides, and revegetation with low growing plant species. Mechanical and herbicidal controls work together to support the establishment and viability of naturally occurring and introduced low-growing vegetation. A combination of hand cutting, mowing, string trimming, selective pruning, selective foliar treatment, low volume basal treatments, mulching, weed barrier fabric, stump removal and cut stump treatments will be the primary methods of vegetation control. Treatment methods used will vary depending on the target species composition and density, site access, and topography.

In addition, portions of the site, outside of the photovoltaic solar array, will be landscaped using an assortment of native shrubs and trees (see Figure 2.8 and Figure 2.9). As a result of this effort, some portions of the project site will have a much higher proportion of native species ground cover than is presently the case and will prohibit the establishment of alien or invasive species.

5.5.2.2 Impact on Mammals

The change in habitat that will accompany establishment of the proposed solar array and substation will decrease the habitat available for the alien mammals (i.e., *any* mammal other than the Hawaiian hoary bat) that are now present on the site. It is likely that the number of individuals will decrease accordingly. It is not possible to quantify the decrease, either with respect to overall biomass or with respect to a possible shift in the species makeup. However, as all of the ground-dwelling species are introduced alien species, the change is not significant.

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), was not seen during the course of the survey, but they are widely distributed in the lowland areas on the island of Kaua'i. Operation of the proposed solar array does not entail any activities that have the potential to affect the species. For the most part, the same is true of construction-related construction activities. However, because it would entail clearance of some woody vegetation that could be used by roosting bats with pups and because such animals cannot always move safely of their roosts are disturbed, the contractor will refrain from clearing woody vegetation taller than 15 feet between June 1 and September 15, as called for under the terms of KIUC's system-wide Habitat Conservation Plan formulated in cooperation with the U.S. Fish and Wildlife Service. This will eliminate the potential for adverse effect on this species.

5.5.2.3 Impact on Avian Fauna

The proposed PV facilities are unlit and low to the ground. They are not in an area suitable for ground-nesting seabirds. No nighttime construction work that requires lighting is envisioned. Consequently, they do not have the potential to adversely affect seabirds that overfly the site.

The extent to which the proposed project could affect other bird species that may nest, feed, or loaf in the area is a function of which of the revegetation alternatives that KIUC is considering it selects. Ones that depend largely or entirely on geotextile fabrics will provide little habitat suitable for the avian species that are present. Other options are superior in this regard. However, regardless of the option that is selected, the project is likely to have fewer birds present than is true at the present time.

5.5.2.4 Impact on Aquatic Fauna

The absence of physical contact between the proposed project and the nearest streams in the area, together with the distance from the ocean, means that the proposed project does not have the potential to directly affect aquatic resources. The retention basins that are being constructed as part of the project will retain all runoff produced by storms with a recurrence interval of less than 10 years, and they are designed to keep peak storm water runoff below existing volumes for 24-hour rainfall events up to those with a recurrence interval of 100 years. KIUC will require the contractor to use best management practices as necessary during construction to prevent contaminants such as sediment, petroleum products, and debris from leaving the area via storm water runoff. It will also require the contractor to attempt to schedule any excavation work for periods of minimal rainfall and to place permanent erosion control measures on any land denuded of vegetation as quickly as possible. In view of the foregoing, the proposed project is unlikely to have any indirect effect on aquatic species.

5.5.2.5 Consultation with U.S. Fish and Wildlife Service

KIUC used the results of these surveys as the basis of its consultation with the U.S. Fish and Wildlife Service, seeking its concurrence with its consultant's finding that the proposed Anahola Solar Facility and Service Center would not adversely affect the federally threatened Newell's shearwater (*Puffinus auricularis newelii*), endangered Hawaiian petrel (*Pterodroma sandwichensis*), and a candidate for listing, the band-rumped storm-petrel (*Oceanodroma castro*), (collectively referred to as Hawaiian seabirds), and the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). The Service's February 11, 2013, response letter (reference 2013-I-0113) concurred that so long as KIUC did not clear woody vegetation suitable for bat roosting between June 1 and September 15; the proposed project may affect, but is not likely to adversely affect these species.

5.6 NOISE

In order to ensure that it would be able to avoid and/or mitigate adverse noise effects, KIUC commissioned an in-depth acoustic study for the proposed project. The study forecast the future noise levels and potential noise impacts associated with construction and operation of the proposed facilities, including project-related traffic. The full report is reproduced in Appendix G.

5.6.1 NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn).[37] This descriptor incorporates a 24-hour average of instantaneous A-Weighted sound levels as read on a standard Sound Level Meter. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA.[38]

The maximum A-Weighted sound level occurring while a noise source such as a heavy truck or aircraft is moving past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value". The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level", or Lse, which is analogous to the energy of the time-varying sound levels associated with a single event.

Table 5.17, categorizes the various DNL levels of outdoor noise exposure with severity classifications. According to *the Guidelines for Considering Noise in Land Use Planning and Control* published by the Federal Interagency Committee on Urban Noise (June, 1980) a consensus has developed among federal agencies whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 DNL. This value of 65 DNL is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made. For the purposes of determining an acceptable level of exterior noise for residences, federal agencies have determined that an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration, Department of Defense, Federal Housing Administration, Housing and Urban Development, and Veterans Administration. For air-conditioned office, commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 70 to 75 DNL are generally considered acceptable. When the spaces are naturally ventilated a lower threshold of 65 DNL is typically applied.

---

[37] The DNL values represent the average noise during a typical day of the year. DNL exposure levels of 55 or less are typical of quiet rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways.

[38] Definitions of two important technical terms used in the discussion are as follows:

- A-Weighted Sound Level (dBA). The sound level, in decibels, read from a standard sound-level meter using the "A-weighting network". The human ear is not equally sensitive in all octave bands. The A-weighting network discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear at moderate sound levels.
- Decibel (dB). This is the unit that is used to measure the volume of a sound.[38] The decibel scale is logarithmic, which means that the combined sound level of 10 sources, each producing 70 dB will be 80 dB, not 700 dB. It also means that reducing the sound level from 100 dB to 97 dB requires a 50 percent reduction in the sound energy, not a 3 percent reduction. Perceptually, a source that is 10 dB louder than another source sounds about twice as loud. Most people find it difficult to perceive a change of less than 3 dB.

Table 5.17. Exterior Noise Exposure Classification (Residential Land Use)

Noise Exposure Class	*Day-Night Sound Level*	*Equivalent Sound Level*	*Federal Standard*
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL but not Above 65 DNL	Above 55 Leq but not Above 65 Leq	Acceptable
Significant Exposure	Above 65 DNL but not Above 75 DNL	Above 65 Leq but not Above 75 Leq	Normally Unacceptable
Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation. (2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.			
Source: Y. Ebisu and Associates, December 2012, Table 1.			

As a general rule:

- Rural areas and areas which are removed from high volume roadways have noise levels of 55 DNL or less.
- Urbanized areas with moderate exposure to traffic noise generally have DNL levels in the 55 to 65 DNL range.
- Residences which front major roadways can be exposed to levels of 65 DNL or more, while interior lots that are shielded from the street by intervening structures are usually exposed to 3 to 10 DNL lower noise levels than the front lots.

The State of Hawai‘i Department of Health (SDOH) regulates the noise levels from fixed machinery by imposing maximum allowable sound levels at the property boundaries for various zoning categories as shown in Table 5.18. Because of the Agricultural Zoning of the parcel within which the proposed facilities are located, the allowable noise levels from fixed machinery at or beyond the project site boundaries is 70 dBA during the daytime and nighttime periods. Noise produced by portable or movable equipment (such as trucks, front end loaders, fork lifts, etc.) are not subject to the 70 dBA limit under DOH noise regulations.

Table 5.18 Hawai‘i Administrative Rules §11-46 Noise Limits

Zoning District	*Noise Limit (in dBA)*	
	Daytime (7:00 a.m. to 10:00 p.m.)	***Nighttime (10:00 p.m. to 7:00 a.m.)***
Class A: Areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type	55	45
Class B: All areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C: All areas equivalent to lands zoned agriculture, country, industrial, or similar type.	70	70
Source: Hawai‘i Administrative Rules §11-46 “Community Noise Control”		

Hawai‘i Administrative Rules §11-46 regulates construction noise levels above these limits using a curfew system whereby noisy construction activities are not normally permitted during the nighttime periods, on Sundays, and on holidays. Construction activities (which could typically exceed the limits established for fixed machinery) are normally allowed during the normal daytime work hours on weekdays and on Saturdays using a system involving the issuance of construction noise permit.

5.6.2 NOISE IMPACT ASSESSMENT METHODOLOGY

Computer noise modeling was used to forecast the noise levels associated with Anahola Solar Project activities at the closest noise sensitive receptors to the north. The noisiest activities are expected to occur during construction, with operations of the facilities being much quieter. In the case of the solar array and the substation, noise from the operation of the electrical equipment will be so low as to be inconsequential. The service center and baseyard activities (e.g., equipment and vehicle storage and maintenance), and the vehicular traffic associated with them, are somewhat noisier, and were the focus of the analysis. Given the fact that the baseyard activities are not new but are instead being relocated from the existing Kapa‘a Baseyard made it possible to use measurements made at that facility as a basis for modeling the noise levels of the noisy equipment expected to be most frequently used at the Service Center Site. The noise from these equipment and operations at the proposed facility and from motor vehicles traveling along the primary access road to the proposed facility were evaluated. Risks of adverse noise impacts from future baseyard operations at the Service Center Site, traffic, and short term construction noise were determined, and possible noise mitigation measures were provided as applicable.

Traffic noise measurements were obtained along Kūhiō Highway to validate the traffic noise model, and to describe background ambient noise levels during low and high volume traffic conditions. The U.S. Federal Highway Administration Traffic Noise Model (TNM) Version 2.5 was used to calculate existing and future traffic noise levels, with the traffic noise measurements used to validate the reasonableness of the traffic noise predictions provided by the TNM. As described in detail in Appendix G, the measurements show that the model results are quite accurate.

Based on the measurements of the trucks at the KIUC Kāpa‘a Baseyard, noise level predictions were made at the noise sensitive receptors closest to the service center/baseyard facility. The noise modeling was performed using inverse square law for hemispherical spreading of a sound from a source at or near the ground, with inclusion of molecular absorption and anomalous excess attenuation effects.

Traffic on Kūhiō Highway is the primary background noise source in the area. KIUC estimates of project-related traffic were used in TNM Version 2.5 to estimate project-related effects on traffic noise.

5.6.3 EXISTING NOISE LEVELS

Traffic on Kūhiō Highway controls the background noise levels at noise sensitive receptors closest to the proposed project. Existing peak-hour traffic noise levels along Kūhiō Highway are estimated to range from 69 to 71 Leq(h) at 50-foot distance from the centerline. Existing background ambient noise levels on the eastern boundary of the site are relatively high at 69 to 71 Leq(h), or DNL, because the project site abuts the Kūhiō Highway Right-of-Way. Kūhiō Highway is also adjacent to the first row of existing residences within the Hawaiian Homes Anahola Subdivision north of the project. For this reason, and particularly during the normal working hours, background ambient noise levels at the closest noise sensitive receptors which front Kūhiō Highway are relatively high. This existing traffic noise will tend to mask noise originating from facilities related to the Anahola Solar project.

Existing traffic (and background) noise levels decline with increasing distance from Kūhiō Highway; from 65 Leq(h) at 90 from the highway centerline; to 58 Leq(h) at 200 from the highway centerline; to 49 Leq(h) at 500 from the highway centerline; and to 42 Leq(h) at 1,000 feet from the highway centerline. At distances in excess of 500 feet from Kūhiō Highway, other background noise sources (e.g., barking dogs, foliage moving in the wind, birds, distant surf, local motor vehicle traffic, and human activities) begin to control the background noise levels. At those locations, measured background noise levels are well below the 65 DNL FHA/HUD noise standards, and typically below the "Minimal Exposure, Unconditionally Acceptable" level shown in Table 5.17.

Table 5.19. Existing Sound Levels

Location	*Time of Day*	*Measured Leq (dB)*
50 feet from centerline of Kūhiō Highway	7:53 a.m. to 8:53 a.m.	68.7
	4:01 p.m. to 5:01 p.m.	70.8
At Southern end of Kawelo Street	9:51 a.m. to 10:51 a.m.	43.0
	7:24 p.m. to 8:24 p.m.	41.7
At southern end of Kaponohu Road	10:59 a.m. to 11:59 a.m.	46.5
	6:16 p.m. to 7:16 p.m.	47.1
	8:28 p.m. to 9:00 p.m.	45.8
Source: Y. Ebisu & Associates, Table 3 in Noise Report.		

5.6.4 PROBABLE NOISE IMPACTS

5.6.4.1 Construction Noise

Construction noise levels are anticipated to range between 32 to 65 dBA at the closest residences during the entire project construction period. Table 5.20 presents the results of calculations of the predicted noise levels at locations within the closest Anahola residential areas resulting from construction activities at the two closest portions of the Anahola Solar project. The construction activities are expected to be noisier and more continuous than those associated with post construction activities at the KIUC Service Center. The louder construction equipment (pile driver, earth moving equipment, and back-up alarms) are also expected to be audible at all locations on the project site.

Table 5.20. Construction Noise Levels at Noise Sensitive Receptors

Noise Source	*Sound Level at 50 feet (dBA)*	*Predicted Noise Level at Receptor (dBA)*	
		From Work on Northeast Part of Site	*From Work on Center Part of Site*
Vibratory Pile Driver	94.2	59 to 64	57 to 65
Grading / Earthwork	88.9	57 to 61	55 to 62
Front-End Loader/ Backhoe	84.9	53 to 57	51 to 58
Crane	79.5	49 to 52	47 to 53
Dump Truck	88.3	56 to 60	54 to 61
Noisy forklift	76.9	45 to 49	44 to 50
Loud Beeper Back-Up Alarm	91.0	59 to 64	57 to 65
Note: Work on the northeast part of the site is ~880-890 feet from noise-sensitive receptors. Work in the center portion of the site is ~790 to 990 feet from noise-sensitive receptors.			
Source: Y. Ebisu & Associates Noise Report, Tables 7 and 8.			

The average noise level at the closest Anahola residences resulting from construction activities will probably exceed 55 DNL, but be less than 65 DNL during a work day. The implementation of State DOH construction noise permit procedures will require that noisy construction activities do not occur during the nighttime, Sundays, and holidays. These permit procedures, which are routinely applied to noisy construction activities, are intended to minimize adverse noise impacts at residences. Because construction noise is expected to be audible at the closest residences, and may annoy some residents, KIUC's contractor has indicated that it will apply for a construction noise permit.

5.6.4.2 Operations and Maintenance

Solar Array. Once constructed, the photovoltaic panels, mounting racks, pull boxes, and electrical interconnections will make little or no noise. The only noise emission from the photovoltaic equipment and associated electronics would be from the cooling fans inside each of the AE Solaron 500 kW inverters, and a low hum from the transformers located at each equipment pad. Tests of identical inverters at other locations indicated that the inverter produces 65.4 dB(A) at a distance of approximately 10 feet (3 m).[39] This will not be audible off the project site.

Transformers emit a continuous 120 Hz hum with harmonics when connected to 60 Hz circuits. The fundamental frequency is the "hum" that annoys people primarily because of its continuous nature. The sound emissions from the step-up transformers that will serve each of the twelve 1-Megawatt PV modules will vary depending on the exact model selected, but the sound emissions will comply with the NEMA TR-1 Sound Emission Standard for Transformers,[40] which means they will be no more than 58 and 67 dB(A) at 2 meters. This will not be audible off the project site.

Motor vehicles will travel the drive aisles between the photovoltaic panels as part of regular operations and maintenance activities. Given the presence of Kūhiō Highway only a short distance away, the occasional presence of a few vehicles is not significant. Neither will the operation of the type or equipment needed to properly maintain vegetation under and around the PV panels.

Substation. Operation of the control building, transformers, circuit switchers, and other electrical components which make up the substation generally do not generate substantial levels of noise. Some equipment, such as transformers, is sufficiently loud (e.g., up to 68 dBA at 2 meters) to require attenuation. However, the 1,000+-foot distance between these and the nearest noise-sensitive uses and the presence or relatively high levels of masking background noise from highway traffic means that they will not be audible in noise sensitive areas. The type of BESS unit that KIUC has selected does not require the use of noisy air-handling equipment for cooling that some applications use. That, together with its distance from noise-sensitive receptors and the background highway traffic noise means that operational noise from these will not significantly impact surrounding properties or land-uses.

Service Center. Table 5.21 presents the predicted noise levels at noise-sensitive residential areas resulting from various operations at the baseyard.[41] These receptors are ~1,025 to 1,050 feet from the source. Noise sources other than the KIUC Line Trucks, such as delivery tractor/trailer trucks with their noisier forklifts, were included in the tables, since these vehicles may intermittently visit the baseyard. Background ambient noise levels at the receptors during the quieter periods were typically

[39] Tests were conducted by Advanced Energy, Inc. per Acoustic Emissions Standard IEC/EN 61010-1.

[40] NEMA is the National Electrical Manufacturers Association.

[41] The lower range of the predicted noise levels are more likely to occur during the daytime period (due to upward refraction of the sound rays from the sources and/or excess ground attenuation effects), while the higher noise levels are more likely to occur during the nighttime or overcast periods (due to the negligible excess ground attenuation effects). In addition to these sound propagation effects, the background ambient noise levels at the receptor locations are typically lower during the nighttime and early morning periods, so the risks of the baseyard noise sources being audible at the noise sensitive receptor locations are greater during the nighttime and early morning periods than during the normal daytime working periods.

between 35 and 40 dBA, which means that the relatively quiet KIUC Line Trucks should be able to operate on a regular basis during the daytime or nighttime periods with low risk of causing noise complaints at the closest Anahola residential subdivision, as long as their beeper type back-up alarms are replace with broadband noise back-up alarms. Because visits to the KIUC Baseyard by the louder tractor trailer vehicles and loading/unloading equipment should not occur on frequent or regular basis, and when they do would occur during normal business hours, they are not likely to draw complaints. Exceedances of the 55 DNL or 65 DNL noise impact thresholds should not occur at the closest residences with or without the replacement of the Line Truck's back-up alarms. Risks of adverse noise impacts from the proposed KIUC Service Center and baseyard operations are considered to be very low.

Table 5.21. Forecast Noise from Various Baseyard Activities

Noise Source	*Sound Level at 50 feet (dBA)*	*Predicted Noise Level at Receptor*
Steady Noise from Line Truck Idling	64.8	31 to 36 dBA
Average Noise from Operating Line Truck	67.8	36 to 40 dBA
Line Truck Beeper Type Back-Up Alarm	69.0	34 to 40 dBA
Line Truck Broadband Back-Up Alarm	68.6	33 to 39 dBA
Line Truck Air Brake Release	80.4	39 to 45 dBA
Banging Noise During Loading/Unloading	89.5	56 to 61 dBA
Noisy Tractor/Trailer Truck	85.2	52 to 57 dBA
Noisy Forklift	76.9	43 to 47 dBA
Tractor/Trailer Truck Back-Up Alarm	87.5	52 to 58 dBA
Note: Noise-sensitive receptors located 1,028 to 1,056 feet from source.		
Source: Y. Ebisu & Associates Noise Report, Tables 5 and 6.		

Nighttime activities at the proposed baseyard will probably occur due to the deployment of material and personnel during emergency trouble calls. The adverse effect of such activities could be further minimized by using the quietest available equipment for this purpose, and replace the beeper type back-up alarms with broadband noise back-up alarms. The broadband noise back-up alarms (with the same sound level as the beeper alarms of 69 dBA at 50 feet), should perform their required safety purpose but be inaudible at the closest noise sensitive receptors.

Project-Related Highway Noise. Vehicles associated with the proposed project will increase traffic volumes on Kūhiō Highway by at most 20 vehicles per hour. The addition of these to the baseline traffic volumes (900 to 1,100 vehicles per hour) will increase total traffic noise levels by less than 0.1 dB, which will be very difficult to measure. The increases in noise levels attributable to the Anahola Solar Project traffic will not be significant.

5.7 ARCHAEOLOGICAL, HISTORICAL, & CULTURAL RESOURCES

The National Historic Preservation Act (NHPA) Section 106, and the Advisory Council on Historic Preservation's implementing regulations, 36 CFR Part 800 require federal agencies to take into account the effects of a proposed project (the undertaking) on historic properties. In order to determine the "finding of effect", the federal agency must consult with the State Historic Preservation Officer, Indian Tribes and Native Hawaiian Organizations, and other interested parties.

At the state level, Hawai‘i Revised Statutes § 343 and its implementing regulation HAR § 11-200-12 mandate that agencies consider whether a project involves an irrevocable commitment to loss or destruction of any natural or cultural resource in assessing the significance of a project's impacts. Here cultural resources are defined both as resources relevant to ongoing cultural practices as well as historic or pre-historic properties with cultural significance. Chapter 6E, Hawaii Revised Statutes, is the comparable State law governing Historic preservation. It is implemented through a number of Hawai‘i State regulations; these include, but are not limited to, Hawai‘i Administrative Rules (HAR) §13-197, §13-198, and §13-300.

5.7.1 EXISTING CONDITIONS

The Anahola Solar Project is located in the Kamalomalo‘o *ahupua'a*, a narrow strip of land in the Puna district of Kaua‘i. The project site encompasses a 60-acre portion of a much larger 422-acre parcel (TMK: (4) 4-7-004:002), just south of Anahola Village on land owned by the DHHL. Kamalomalo‘o *ahupua'a* includes about 1.5 miles of open coastline, from the outlet of Kamalomalo‘o stream in the south to Lae Līpoa Point at its boundary with the neighboring Anahola *ahupua'a*. This *ahupua'a* consists of 2,366 acres of total area.

In order to assess the presence and nature of any archaeological or historic properties on the project site, T. S. Dye & Colleagues, Archaeologists, Inc. conducted an Archaeological Inventory Survey (AIS) of the project site. Their complete report is included as an appendix to this document (see Appendix A). Because of the extensive grubbing and grading which is necessary to prepare the project sites for the photovoltaic array, substation, service center, and access drive the archaeologists defined the entire 60 acres as the area of potential effect (APE). The AIS consisted of: (*i*) background research on the existing body of available archaeological and historical information pertaining to the project site; (*ii*) excavation of ten test trenches distributed throughout the area with the potential to be affected by the proposed project[42]; and (*iii*) subsequent stratigraphic testing of analysis and identification of selected features.[43]

In addition to the AIS, and pursuant to the requirements of Hawai‘i Revised Statutes § 343, KIUC commissioned Native Kaua‘i, LLC to perform a Cultural Impact Assessment (CIA) in order to collect information regarding the cultural context and ongoing cultural practices in the vicinity of the project site which may be directly or indirectly impacted by the proposed project. The purpose of the CIA is neither to support nor oppose the proposed project, but to produce a document which can be used to identify and protect valuable traditions and practices of Native Hawaiian civilization. The complete CIA is included as Appendix F of this document.

5.7.1.1 Archaeological and Historic Resources

Background information was gathered prior to fieldwork as a means of predicting the types and distribution of historic properties that might be present within the project site. This information is also useful for understanding and evaluating the significance of historic properties. Documents and materials from the State Historic Preservation Division (SHPD) library, the SHPD Geographic Information Systems (GIS) database, the survey office of the State of Hawai‘i's Department of Accounting and General Services, the Hawai‘i State Library, and the library of T. S. Dye & Colleagues, Archaeologists.

[42] Subsurface exploration consisted of backhoe excavation and systematic description of ten test trenches placed throughout the area with the potential to be effected by the proposed project, to determine the presence of subsurface archaeological or historical properties.

[43] All archaeological field recording, sampling, and laboratory methods used in the conduct of the AIS were standard operating procedures used by T. S. Dye & Colleagues, Archaeologists, Inc. designed to report the observational basis of statements made in their AIS report.

Traditional and Early Historic Land Use. According to Wichman's *Kaua'i: Ancient Place-Names and Their Stories* (1998) the name Kamalomalo'o can be translated as "the dry loincloth." It is said to be named thus due to an ancient practice:

> *In olden days, when an ali'i came ashore from a canoe voyage or surfing, his bodyguards threw their spears at him. It was a mark of chiefly strength that he could dodge or catch every spear. After this, he was ceremoniously given a dry malo (a piece of tapa . . . , the principal clothing for men).*

Kamalomalo'o *ahupua'a* is, as noted above, just south of Anahola *ahupua'a*, and is the northernmost *ahupua'a* in the Puna *moku*, or district. Anahola is said to be named (Wichman, 1998), "after a *mo'o*, a lizard *kupua* that appeared on land as a man and in the sea as a merman." Wichman goes on to describe a *heiau* which once existed in Kamalomalo'o *ahupua'a* was described this way:

> *Māhu-nā-pu'u-one, "vapor that rises from the sand dunes," was a heiau where humans were sacrificed. It was built in the late 1600s by Kawelomahamahai'a to celebrate the birth of his twin grandsons who were the owners of the dreaded kapu moe (prostration taboo).*

Handy and Handy's *Native Planters in Old Hawaii: Their Life, Lore, and Environment* (1972) includes the following description of Kamalomalo'o, Anahola, and Keālia.

> *The last ahupua'a on this, the ko'olau (east and northeast) coast, is Anahola. Here is the largest river in the Ko'olau District. There are old abandoned terraces along its banks far upstream. There are old lo'i from two to four miles inland along Anahola River and its tributary Ka'alua Stream, and below their point of juncture there are many lo'i on flats along the river banks as it meanders through its wide gulch. The delta is three-fourths mile wide, and this was all terraced…*
>
> *Two small ahupua'a, Kamalomaloo (Dry Kamalo) and Kealia are rather dry, with small streams and gulches and only a few lo'i areas. Where Keālia and Kapa'a Streams join inland there are wide flats that were terraced. Seaward there were formerly many terraced areas. There are clumps of coconut and mango trees where formerly were kuleana with their lo'i. Inland there were a number of small streams which doubtless once had small lo'i developments.*

Prior to 1840, all land in Hawai'i was owned by the king and his chiefs; the Constitution of the Kingdom stated that while the land belonged to him it was not his personal property but was held in trust for collective management by his government. As foreigners settled in the islands some began to dispute the king's ownership of all lands. This led to the establishment in 1845 of the Board of Commissioners to Quiet Land Titles, known as the Land Commission. By decision of the king and his chiefs, the king was given his own property and the remainder was divided equally among the government, the chiefs, and the tenants as Land Commission Awards (LCA). This was the most important event in the distribution of land in Hawai'i and is known as the Great *Māhele*. Many LCAs were granted during the *Māhele* in the neighboring *ahupua'a* of Anahola, generally clustered around Anahola River and near the coast. There were no claims in Kamalomalo'o.

Historic Land Use. Kaua'i is known as "the Garden Isle" because of its abundant rainfall and the resulting lush vegetation.[44] The runoff provided plentiful water for irrigation, making Kauai an

[44] Wai'ale'ale, which is translated as "rippling water" or "overflowing water", reaches an elevation of 5,080 ft. and has a mean annual rainfall that was at one time estimated to be 476 inches. In recent years, its running 30-year average annual rainfall total has been decreasing almost steadily, from 406 inches in 1997 to just below 384 inches in 2010. For more

attractive and profitable place for sugarcane cultivation. Industrial sugarcane agriculture on Kaua'i began in 1835 with the establishment of the Kōloa plantation. Kōloa Plantation is known as the first sugar plantation in the Kingdom of Hawai'i. In east Kaua'i, Lihue Plantation was founded in 1849 and was only the second sugar plantation in the Kingdom; this plantation brought much of the land in the region into sugarcane cultivation and created the water irrigation system that supported those fields. This ditch system was so effective that "…by 1931, some 79 percent of the 6712 acres of Lihue Plantation's cane land was irrigated by gravity flow and average water production was 82 mgd [millions of gallons per day]" (Wilcox, 1996). A system of railroads helped to transport cane stalks to the mill for processing; a tax map dated November 1936 shows these railroad tracks running through the Anahola Solar Project site (see Appendix A).

The project site is also found on a 1926 field map of Makee Sugar Company, which was founded in 1877 by Captain James Makee and several others, including King Kalākaua, who owned a quarter-interest. Lihue Plantation Co. absorbed the Makee Sugar Co. in 1933.

> *By the time Lihue Plantation acquired Makee, it had 7200 acres in cane with another 2200 acres planted by independent planters, primarily homesteaders. It had a well-developed water collection and delivery system, too, which delivered an average of some 30 mgd [millions of gallons per day] and included Anahola, Kaneha and Kapaa ditches.*

Lihue Plantation Co. eventually became part of Amfac, and Amfac Sugar Kaua'i remained in operation until 2000. At some point in the relatively recent past, the project site fell out of use for commercial sugarcane cultivation.

Previous Archaeological Work. Prior to the work conducted for this project, there have been no known archaeological studies for the project site. The nearest areas which have been the subject of archaeological survey work are in the nearby areas of Kumukumu and Keālia. In 2006, Scientific Consultant Services, Inc. (SCS) conducted an archaeological survey of a 2,008-acre parcel located in Kumukumu and Keālia *ahupua'a*, the two *ahupua'a* south of Kamalomalo'o. The organization and results of that survey are provided in detail in the AIS for this project, included in Appendix A.

The nearest documented human burial to the project site was found at Donkey Beach, which is approximately 1.2 miles southeast of the Anahola Solar Project site. This burial was inadvertently exposed in 1992; the orientation of the bones indicated it was a primary burial. Because the burial was vulnerable to beach erosion, it was excavated and brought to the Office of Hawaiian Affairs (OHA) Kaua'i branch.

In 1999, an archaeological inventory survey was conducted by Perzinsky et al. of a 300-acre parcel in Keālia, which lies just southeast of the Anahola Solar project site. Three sites were identified in this survey, including a complex of plantation-era features (Site 50-30-08-789); a complex of World War II-era features (Site 50-30-08-790), and prehistoric burials at the south end of Donkey Beach which are likely prehistoric- and/or early historic-era native Hawaiian in origin (Site 50-30-08-1899). In general, the majority of sites discovered during previous archaeological work in the region were remnants of the plantation era because use of the area for commercial sugarcane cultivation had such a significant impact on the land. However, while there were no feature remnants that predated the plantation era, the burials potentially do predate plantation agriculture.

Field Survey. The archaeological inventory survey carried out for the Anahola solar project was conducted with backhoe excavation of ten test trenches distributed throughout the project site with systematic documentation of the findings to determine if any subsurface archaeological or historic

---

information, see the National Oceanic and Atmospheric Administration's National Weather Service website: www.weather.gov

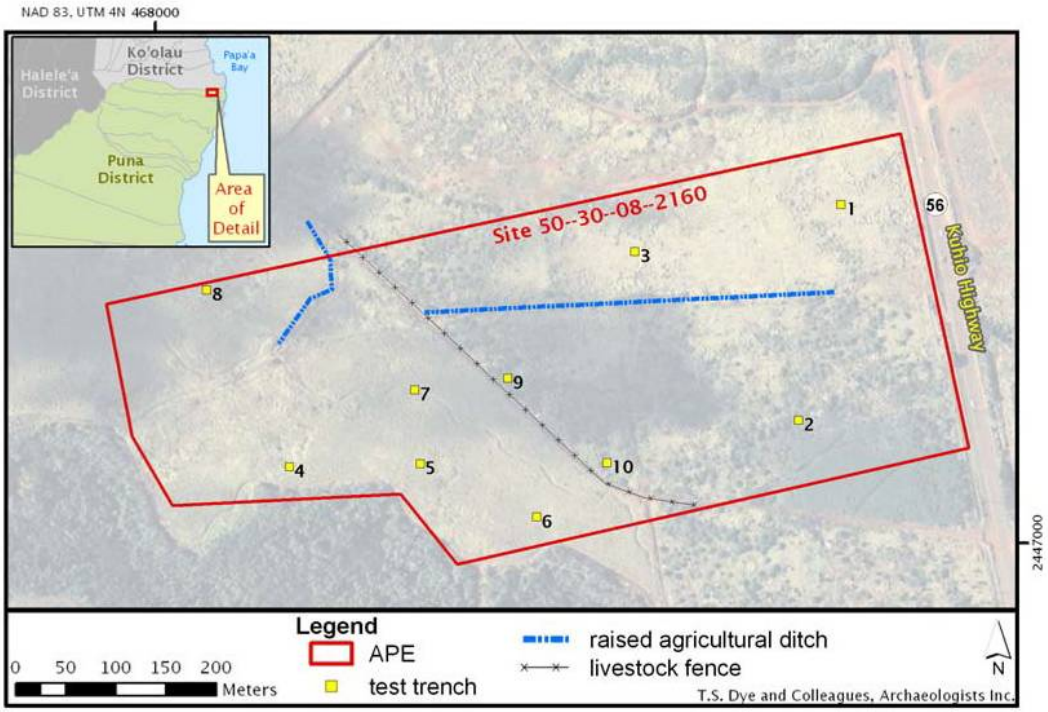
properties were present (see Figure 5.9). In some portions of the site vegetation and other obstacles limited access, but efforts were made to ensure a broad coverage of the entire project site. All trenches were excavated with a backhoe and were between 13 and 22 feet in length, 2 and 4 feet in width, and 4 and 8 feet in depth. The maximum depth of the test trenches was determined by the identification of what soil scientists term the *C Horizon*. The *C Horizon* is the soil strata at which the local bedrock material deteriorates into its mineral components. Excavation to this depth ensures that no buried ground surfaces would be present below the base of excavation.

The ten trenches excavated throughout the project site revealed a profile consistent with natural sediment, including deteriorating bedrock and paleosol, overlain with two layers of agricultural soil This pattern was present throughout the project site. The soil has been significantly reworked during historic sugarcane agriculture. If buried archeological materials were present, they would have been substantially altered or destroyed by plowing for industrial scale agriculture. No buried materials of any kind were observed at any of the test trenches.

The sugarcane fields and the raised agricultural ditches which were built to serve them have been assigned the State Inventory of Historic Site (SIHP) No. 50-30-08-2160, and are believed to be related to historic-era industrial agriculture known to have been conducted on this site between the mid-nineteenth and mid-twentieth centuries.. . The ditches are 5-6 meters wide, 330 and 400 meters long, and constructed of earthen linear mound embankments with discontinuous dry laid basalt cobbles. The ditches contained evidence of modern disturbance through the presence of metal and plastic piping and concrete masonry. Both of the ditch features are visible on current aerial photography. . It is possible that this feature has some relationship to Site No. 50-80-08-789, a complex of plantation-era infrastructure *makai* of Kūhiō Highway, approximately 4,000 feet southeast of the project site. Historic maps of this region also show a section of train tracks intersecting the project site (see Section 5.7.1). No trace of the railroad tracks which once crossed this area were found during field observation.[45] Given the extent of land alteration during the era of sugarcane agriculture in northeastern Kauaʻi, it is likely that all traces of a former rail line would be removed by subsequent field preparation.

[45] Registered Map No. 2282 "Anahola-Kamalomalo, Kauaʻi" dated 1904, depicts the Anahola Solar Project site as containing Fields 13 and 14 of the Makee Sugar Company. This map shows railroad tracks entering the project site from the east and forking, with one track running from the southeast corner of the project site heading northwest, and the other track traversing the southwestern portion of the project site (see Appendix A, Figure 3).

Figure 5.9. Test Trench Locations.



Source: T.S. Dye & Colleagues, Archaeologists Inc.

5.7.1.2 Cultural Resources

Traditional Native Hawaiian practices, and the resources upon which these practices depended, primarily related to subsistence, medicinal, religious, and cultural purposes. Examples of these traditional cultural practices and resources include fishing, gathering seaweed, and collecting plants for the practice of traditional medicine. The purpose of these traditional practices went beyond personal enrichment, allowing Native Hawaiians to meet their responsibility to the community, such as feeding people or healing the sick. While it is the responsibility of Native Hawaiians to conduct these traditional practices, government agencies and private developers also have a responsibility under State law to assess the impacts of their actions, whether direct or indirect, on traditional cultural practices and resources. Per the requirements of Hawai'i Revised Statutes §343, KIUC commissioned Native Kaua'i, LLC to perform a Cultural Impact Assessment (CIA) in order to collect information regarding the cultural context and ongoing cultural practices in the vicinity of the project site which could be directly or indirectly impacted by the proposed project. The complete CIA is included as Appendix F of this document.

In addition to conducting background research and discussing the project's potential impacts in a cultural context, one of the most critical aspects of a CIA is consulting with Native Hawaiian *kūpuna*, Hawaiian cultural organizations, cultural practitioners, and other knowledgeable members of the community who can supply information about traditional Hawaiian sites, resources, and practices on and around the project. Representatives of Native Kaua'i, LLC met with *kūpuna* and *mākua*, elders and parents, of Kamalomalo'o and Anahola *ahupua'a*, seeking out individuals with knowledge, ties, and experience in this region in order to gather information and insight regarding past and present customary practices, traditions, and place names with the potential to be affected by the proposed solar array, substation, and service center.

In total, Native Kauaʻi, LLC interviewed a total of 17 Native Hawaiians in course of preparing their CIA. The majority of interviewees are residents of Anahola, living on Hawaiian Homestead lands; two individuals lived outside of Anahola. Interviewees included elders, parents, educators, community activists, and cultural practitioners, and several fell into two or more of those categories. All are of Native Hawaiian ancestry with personal ties and connection to the Anahola area. In the course of these interviews care was taken to observe a sense of propriety, including patience, humility, and respect for the subjects which reflects Native Hawaiian custom. The interviews were conducted in informal individual and small group settings which were comfortable for the participants. Table 5.22 below identifies the persons who provided interviews for the CIA.

Table 5.22. Persons Interviewed for the CIA

No.	*Name*	*Community Position*	*Place of Residence*
1.	Mr. Valentine "Val" Ako	*Kūpuna*, Cultural Practitioner	Wailua, Kauaʻi
2.	Mr. Frank Cummings	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
3.	Mr. John Pia	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
4.	Mr. John Kaʻohelauliʻi	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
5.	Mr. Kawika Cutcher	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
6.	Mrs. Healani Trembath	*Kūpuna*, Cultural Practitioner	Huleʻia, Kauaʻi
7.	Mrs. Leonora Kelekoma	Homesteader, *Kūpuna*, & Cultural Practitioner	Anahola, Kauaʻi
8.	Ms. Jodi Omo	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
9.	Mr. Chono Fernandez	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
10.	Mrs. Diana Lovell O'Reilly	Homesteader, *Kūpuna*	Anahola, Kauaʻi
11.	Mrs. Carol Manoʻi	*Kūpuna*	Anahola, Kauaʻi
12.	Ms. Esther "Essie" Kaleialoha Williams	Homesteader	Anahola, Kauaʻi
13.	Mr. Llewelyn Woodward	Homesteader, Cultural Practitioner	Anahola, Kauaʻi
14.	Mr. Kamealoha Smith	Educator	Anahola, Kauaʻi
15.	Mr. Leroy Kaʻona	Educator, Homestead ʻOhana	Anahola, Kauaʻi
16.	Mr. Kawika Winter	National Tropical Botancial Garden Limahuli Garden & Preserve	Hāʻena, Kauaʻi
17.	Mr. David "Kawika" Viets	Kauaʻi Native Plant Society	Anahola, Kauaʻi
Note: Mr. Kawika Winter and Mr. Kawika Viets were interviewed because of their knowledge of native plants and their relationship to the traditions of the Anahola region.			
Source: Native Kauaʻi, LLC (2012)			

5.7.2 PROBABLE IMPACTS

5.7.2.1 Effects on Archaeological and Historic Resources

Site No. 50-30-08-2160 was evaluated according to Criterion D; the AIS recommended significant for its information content.[46] The AIS further recommended that all pertinent information related to the report had been recorded on historic maps and within the narrative of the report, and therefore no additional archeological work would need to be completed for the undertaking. RUS submitted provided a detailed description of the proposed action, a copy of the AIS, and the proposed determinations of eligibility and finding of effect in October 2012 to the Hawaiʻi SHPO and the

[46] Hawaiʻi Administrative Rules §13-275-6, Criterion D indicates significance due to a site having yielded, or being likely to yield, information important for research on prehistory or history.

native Hawaiian organizations listed in Table 5.23, which were identified based on the U.S. Department of the Interior Office of Native Hawaiian Relations Native Hawaiian Organization (NHO) Notification List. RUS did not receive any responses to the circulation of the AIS from the NHO's, but did consult further with the Hawai'i SHPO. The SHPO responded to RUS's October 2012 submittal on November 20, 2012, finding the AIS inadequate and offering comments, questions, and suggested additions to the AIS. After engaging in consultation with the SHPO via teleconference in December 2012 and January 2013, the AIS was revised and resubmitted to the SHPO on March 4, 2013. The revised AIS is included as Appendix A. The SHPO responded on March 25, and concurred with a finding of no adverse effect to historic properties. All written correspondence is included in Appendix D.

Table 5.23. Native Hawaiian Organizations Consulted

Ms. Lorraine Rapoza, President, Anahola Hawaiian Homes Association, P.O. Box 646, Anahola, HI 96703
Mr. Soulee LKO Stroud, President, Association of Hawaiian Civic Clubs, P.O. Box 1135, Honolulu, HI 96807
Ms. Blossom Feiteira, President, Association of Hawaiians for Homestead Lands, 1050 Queen Street, Suite 200, Honolulu, Hawai`i 96814
Ms. Robin Danner, President, Council for Native Hawaiian, Advancement, 1050 Queen Street, Suite 200, Honolulu, HI 96814
Ms. Jobie Masagatani, Chair Designate, Department of Hawaiian Homelands, P.O. Box 1879, Honolulu, HI 96805
Mr. Henry Gomes, President, Hawai'i Maoli, P.O. Box 1135, Honolulu, HI 96807
Hokualele Canoe Club, P.O. Box 169, Anahola, HI 96703
Ms. Kaipo Kincaid, Executive Director, Hui Kāko'o 'Āina Ho'opulapula, 767 Kailua Road #212, Kailua, HI 96734
Kanu I Ka Pono New Century Public Charter School, P.O. Box 12, Anahola, Hawai'i, 96703-0012
Mr. Austin Nakoa, Chairman, Native Hawaiian Economic Alliance, 1050 Queen Street, Suite 200, Honolulu, HI 96814
Dr. Kamana'opono M. Crabbe Ph.D., Chief Executive Officer, Office of Hawaiian Affairs, 711 Kapi'olani Boulevard, Suite 500, Honolulu, HI 96813
Mr. Kimo Kaloi, Director, Office of Hawaiian Relations, U.S. Department of the Interior, 1849 C Street, NW (MS 3543), Washington, D.C. 20240
Ms. Liberta Hussey-Albao, President, Queen Deborah Kapule Hawaiian Civic Club, P.O. Box 164, Kapa'a, Kaua'i, HI 96746
Mr. Kamaki Kanahele, Chairman, Sovereign Councils of the Hawaiian, Homelands Assembly, P.O. Box 2881, Waianae, HI 96792
Mr. Melvin Soong, President, The I Mua Group, 422 Iliaina Street, Kailua, HI 96734
Mr. William J. Aila, Jr., SHPO & Chairperson, Department of Land and Natural Resources, State of Hawai'i 1151 Punchbowl Street, Rm. 130, Honolulu, HI 96813

5.7.2.2 Cultural Resources

As noted both above and in the attached CIA, the available evidence indicates that there are no cultural resources or current cultural practices extant on or near the project site. As noted in Section 5.7.1.1, there is one historical property, a remnant irrigation ditch, present on the project site (SIHP Site No. 50-30-08-2160) which has been examined and found not to have any cultural significance.

None of the *kūpuna*, cultural practitioners, botanists, and other informants interviewed in the process of assembling the CIA for the project could identify any cultural properties or practices present on the project site. The lack of such evidence that the affected areas are used for traditional cultural uses, and the fact that the proposed project would not limit members of the Native Hawaiian community from accessing cultural resources which could be present in adjacent areas leads to the conclusion that there would be no adverse impact.

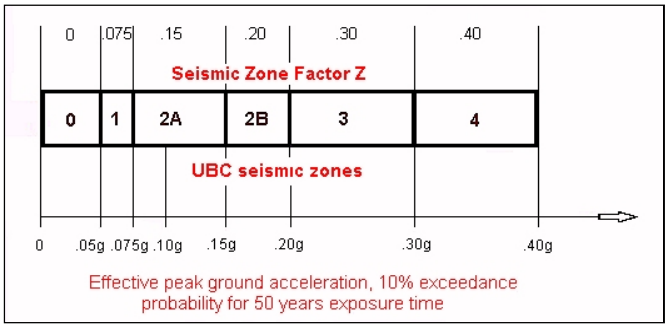
RUS submitted the CIA with the October 2012 correspondence discussed in above to the SHPO and the all of the native Hawaiian organizations listed in Table 5.23. RUS did not receive any comments from the SHPO or NHOs on the content within the CIA. While KIUC believes that the likelihood of new information regarding cultural properties or practices in the area is low, mitigation to address this potential for discovery of undocumented cultural properties includes, but is not limited to: (*i*) the immediate cessation of all work in the area; and (*ii*) notification of the State Historic preservation Division to assess impacts. Once constructed, the proposed facilities would not have the potential to harm cultural properties or practices in any way. Neither will ongoing operations limit or otherwise adversely impact traditional and customary practices.

5.8 NATURAL HAZARDS

5.8.1 SUSCEPTIBILITY TO SEISMIC DAMAGE

Most earthquakes which occur in the State are localized around the island of Hawaii, and most are too small to be detected except by highly sensitive instrument. The most powerful earthquake in Hawaii on record, reported by the U.S. Geological Survey (http://pubs.usgs.gov/gip/hazards/earthquakes.html) was recorded in 1868. This earthquake occurred beneath the Kaʻu district on the southeast flank of Maunaloa, on the island of Hawaiʻi. It had an estimated magnitude of between 7.5 and 8.1 and caused damage across all of Hawaiʻi Island. However, even this powerful earthquake, which was felt on far away Kauaʻi, did not cause any damage there.

Engineers, seismologists, architects, and planners have devised a system of classifying seismic hazards based on the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The diagram below depicts this system of classification:

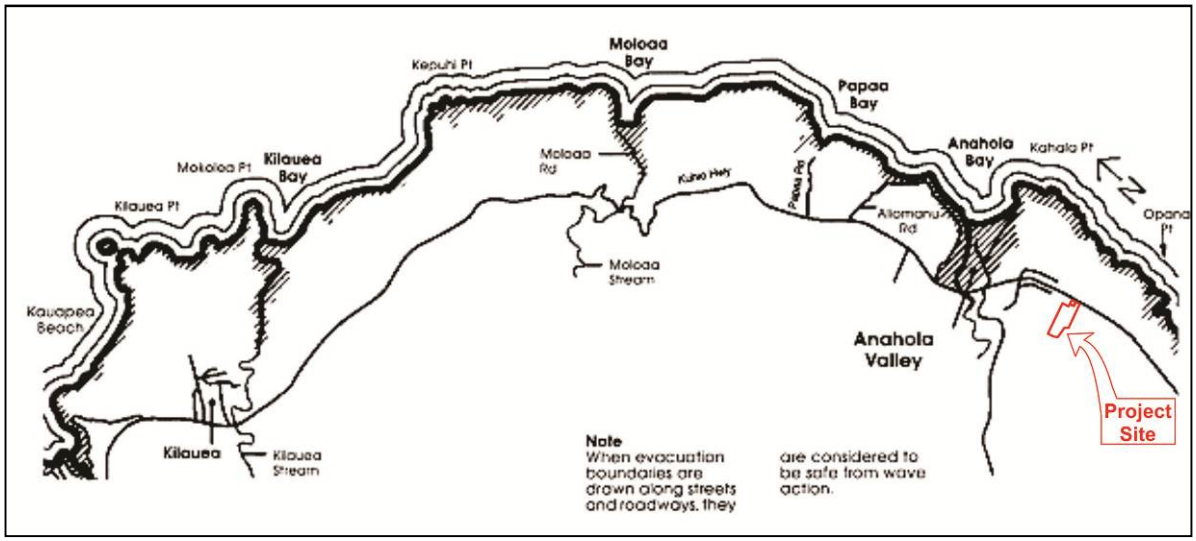


The results are included in the Uniform Building Code (UBC) seismic provisions. The UBC contains six seismic zones, ranging from 0 (no chance of severe ground shaking) to 4 (10 percent chance of severe shaking in a 50-year interval). For the purposes of structural design, the entire island of Kauaʻi is classified as Zone 1, a very low risk of severe ground shaking (USGS 1997). KIUC will construct all structures associated with the proposed solar facility and substation in compliance with the Uniform Building Codes for Zone 1.

5.8.2 VOLCANIC & TSUNAMI HAZARDS

There are no active volcanoes on the island of Kaua‘i and the proposed project site is not in a region that the U.S. Geological Survey (1997b) has designated as subject to volcanic hazards. According to the Civil Defense Tsunami Evacuation Map for this portion of the County of Kaua‘i (see Figure 5.10), the tsunami evacuation zone is well *makai* of Kūhiō Highway, whereas the entire project site is *mauka* of the highway. Thus, no portion of the project is within the tsunami evacuation zone and would not be susceptible to inundation in the event of a tsunami.

Figure 5.10 Tsunami Evacuation Map 2: Kauapea Beach to Anahola Bay



Source: Civil Defense Tsunami Evacuation Zone maps for the County of Kauai (http://tsunami.pdc.org/hazards/tsunami/kauai/Kauai02.gif)

5.8.3 SUSCEPTIBILITY TO HURRICANE DAMAGE

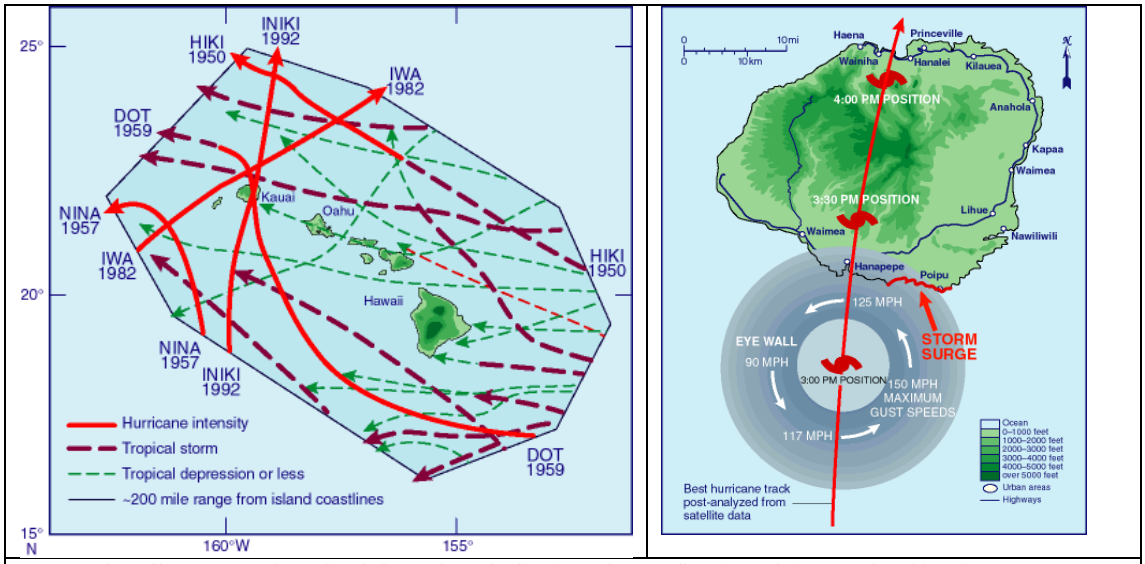
Two different factors must be considered in evaluating a facility’s susceptibility to hurricane damage. The first is the likely track and magnitude of the storm themselves. The second is the robustness of the facility. Both are discussed below.

Hurricane season in the Hawaiian Islands begins in June and lasts through November. During the last 50 years, many hurricanes and tropical storms have come close to the Hawaiian Islands), but only three hurricanes have had direct impact. In all three cases, Kaua‘i was the hardest hit (see Figure 5.11 and Table 5.24. The two most recent hurricanes, ‘Iwa which struck the island on November 23, 1982 and ‘Iniki which hit a decade later on September 11, 1992, have been by far the most devastating. Electrical power was knocked out island-wide, and it was many months before Kauai Electric (KIUC’s predecessor electrical utility) was able to restore full service to North Shore communities.

Hurricane ‘Iniki, which struck in September of 1992, was by far the most destructive storm to strike Hawai‘i in recorded history, with widespread wind and water damage exceeding $2.2 billion. In August of 1959, losses in Hurricane Dot were about $6 million. In November of 1982, Hurricane ‘Iwa caused over $250 million in damages, and in 1992 Hurricane ‘Iniki caused damages totaling $1.9 billion, by far the most expensive natural disaster to affect the State of Hawai‘i. For both the 1982 and 1992 hurricanes, the majority of the damage was suffered on the island of Kaua‘i.

In considering the effect of hurricane forces on the photovoltaic modules and mounts, two potential sources of failure were considered: applied pressure loads generate by extremely high winds, and impact from foreign objects which may become airborne in a hurricane environment. The distinction is important because they represent very different potential sources of failure.

Figure 5.11 Tracks of Major Hurricanes Affecting the State of Hawai'i (1950-2012)



Source: http://www.soest.hawaii.edu/MET/Faculty/businger/ poster/hurricane/Fig2_tracks.gif and Fig4_kauai_track.gif

Table 5.24 Major Hurricanes Affecting the State of Hawai'i: 1950-2010

Name	*Date*	*Maximum Recorded Winds Ashore (mph)*		*Category*	*Deaths*
		Sustained	*Peak Gusts*		
Hiki	Aug. 15-17, 1950	68	NA	1	1
Nina	Dec. 1-2, 1957	NA	92	1	1
Dot	Aug. 6, 1959	81	103	2	-
'Iwa	Nov. 23, 1982	65	117	3	1
'Iniki	Sept. 11, 1992	92	143	4	8

*Note: Category is based on the Saffir-Simpson Hurricane Scale:
Category 1 – Wind speed of 74-95 mph, minimal damage.
Category 2 – Wind speed of 96-110 mph, moderate damage.
Category 3 – Wind speed of 111-130 mph, extensive damage.
Category 4 – Wind speed of 131-155 mph, extreme damage.
Category 5 – Wind speed of >155 mph, catastrophic damage.

Source: *State of Hawaii Data Book 2010*

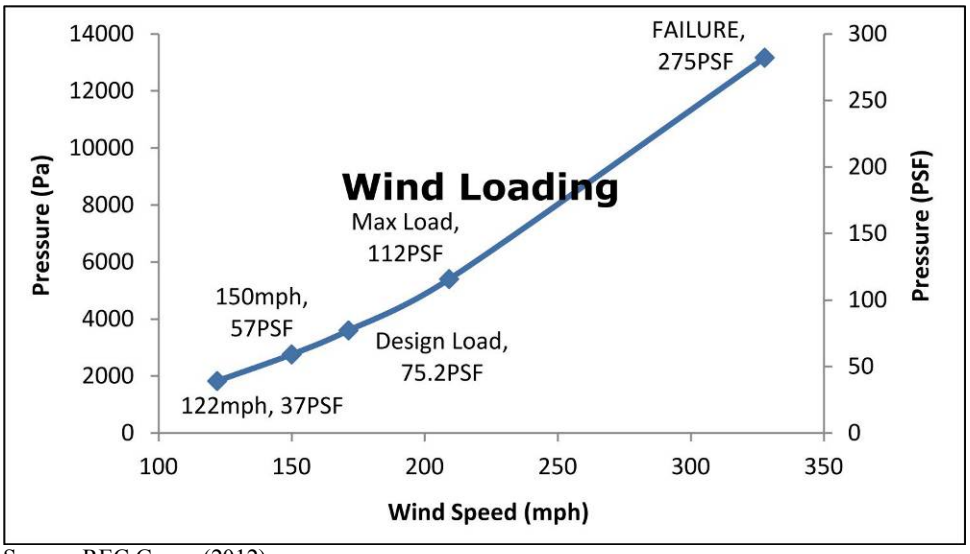
Impact Damage. An object striking a photovoltaic module is a concentrated load whereas high winds apply a distributed pressure (load). The modules to be used for the solar array are guaranteed against

impacts up to 122 miles per hour. Above this speed, it becomes unrealistic to expect that the module glass will survive impacts from flying objects at speeds far above this rating.

Wind Load Damage. With respect to wind loads:

- The module manufacturer, REC Group, has tested the module to significantly higher pressure load than the 37 lbs./ft.^{2} which corresponds to the 122 mph rating.
- As seen in the graph reproduced in Figure 5.12, the ultimate load a module may support before failure is 275 pounds per square foot.

Figure 5.12 REC Group Module Wind Speed Test Results



Source: REC Group (2012)

- Based on the American Society of Civil Engineers (ASCE) Section 7 standards for building wind loading, a wind speed of 150 mph could generate an applied pressure of 57 pounds per square foot on the module. This is well below both the design and maximum loads listed by the manufacturer.
- In addition, both the mounting racks and the driven piles which support the photovoltaic modules will be designed to support the 105 mph wind speed required by Kaua‘i County Code. While they will eventually fail when wind speeds greatly exceed that limit, it will not be a catastrophic failure. Instead, the structural elements will distort, but hold fast.

In view of these findings, it appears likely that while an extremely powerful hurricane (Category 4 and higher on the Saffir-Simpson Hurricane Scale) could damage the solar array, it is unlikely to uproot the equipment and allow it to become airborne. Hence, it does not represent a measurable threat to adjacent uses.

5.9 SCENIC & AESTHETIC RESOURCES

This section discusses the effect that construction and operation of the proposed facilities would have on visual resources. It begins with a summary of the methodology that was used in the assessment. That discussion includes a listing of the project components that would actually be visible. This is followed by a description of existing conditions. The section concludes with a discussion of the effect that the project would have on views from key vantage points with and without landscape screening.

5.9.1 VISUAL IMPACT ASSESSMENT METHODOLOGY

The extent to which project-related visual change would be perceived as "adverse" depends upon many factors, including (but not necessarily limited to) the location of the viewer and the activity which the viewer is involved in at the time. For example, individuals passing the facilities while on a daytime scenic drive along Kūhiō Highway will not have the same expectations or experience as individuals doing the same thing during a nighttime commute trip. Similarly, an Anahola resident looking toward the arrays daily from the living room of their nearby home will have a different attitude toward/experience with the facilities than will an individual who catches a glimpse of the panels from a distant hillside.

In order to determine which viewpoints deserved detailed attention, we undertook the following tasks:

- *Gathered information*. Site visits, analysis of photographs, examination of Google Maps and ESRI® aerial and satellite photography, and community outreach meetings were all used to gather information about the existing visual environment, land use plans and controls, and the potential impacts of the project. This process helped determine areas from which the site is visible, who the potential viewers might be, and the nature of these existing views.
- *Created a Geographic Information System (GIS) database.* A library of geographic information was collected for the analysis, including USGS 1:24,000 base maps, aerial/satellite images, and other geographic and land use data. This information came from public and private sources such as the State of Hawai'i, the County of Kaua'i, and the project contractors.
- *Assembled a computer model of the terrain.* Once the GIS system was populated with information regarding the project and the surrounding environment, planners created a three-dimensional electronic model using topographic information downloaded from the USGS National Elevation Dataset (URL: http://seamless.usgs.gov/website/seamless/ viewer.html).
- *Added a height value to major pieces of equipment and structures identified on the site plan*. Planners incorporated each project components with the potential for substantial visual effect was incorporated in the model. Also incorporated was the height of the average observer, 6.5 feet, somewhat higher than the average person stands to allow for persons in higher vehicles.
- *Mapped areas from which one or more project components could be seen if there is no screening*. This was accomplished using ArcView® Spatial Analysis Extension software together with the terrain model and information on the project components described above.[47] The software then creates a digital raster with each pixel representing 10,000 square feet of area.[48]
- *Graphically depicted and tabulating the model results*. The ESRI® software produced maps showing areas from which the proposed project could not be seen, could be partially seen, or would be fully visible.
- *Site Visit and Photography*. Having identified critical vantage points and viewer-populations, the final step in forming the visual impact analysis involved visiting the project site and the surrounding viewpoints, determining areas of visibility, and building a baseline of photographs documenting existing views of the project.

Because of their small size, low-lying nature, or underground installation, some of the proposed structures and equipment (e.g., electrical pads, underground conduits, and access roads) would be

[47] The facility could also be visible from some locations offshore or above Kaua'i, (i.e., from boats or aircraft). These were not mapped because the locations would not be static.

[48] The process was also used to determine the extent to which the visibility of project components could be reduced if a visual screen (presumably vegetation) was created around the edges of the project site. Two different screening heights were simulated: (*i*) 8 feet—the approximate height of the perimeter security fence, approximating a shrubbery screen; and (*ii*) 15 feet which approximates the height of rapidly established trees.

barely visible or not-visible from most public vantage points. Due to their greater height, bulk, or lateral extent, other components will be more visible. The analysis in Section 5.9.3 is limited to the following project components.

Photovoltaic Array. Each individual module is very modest in size; when fastened to its mounting structure it stands approximately 9 feet off the ground at its highest point (see Figure 2.3 and Figure 2.5). However, together the twelve 1-MW groupings (each of which has 4,900 PV panels) will contain a total of 59,000 modules and cover approximately 30 acres, and this massing means that if it were not partially screened, it could have substantial visual weight. Two inverters and twelve transformers will be mounted on a poured concrete pad that adjoins each one-MW block. The metal cabinets containing the electrical equipment will be painted a muted green (or earth-toned) shade which reduces reflectivity, but the electrical equipment and dedicated concrete pads will still be visible from some vantage points.

Substation. The substation has approximately 300 feet of frontage along Kūhiō Highway. As this portion of Kūhiō Highway is heavily travelled (approximately 12,500 vehicles per day at the time of the most recent traffic count) the substation will be visible to many passers-by.[49] In addition to its proximity to the highway, the substation will have overhead wires linking it to the existing 12 kV and 69 kV power along the highway. These wires will be supported by an A-frame riser approximately 45 feet in height. Other structures within the substation (e.g., H-frames, transformers, a BESS, and prefabricated control building), will range from 15 to 25 feet in height; the substation will also be enclosed by a security fence. Unless screened with landscape plantings, the substation would have a distinctly industrial character and will be in the foreground for the majority of persons passing along the highway.

Service Center. The Service Center site has approximately 510 feet of frontage along Kūhiō Highway and is the project component that is closest to the existing homes in Anahola. While it consists of single-story structures, the need for the service bays on the *mauka* side of the main structure to accommodate bucket trucks require that portion of the building to be approximately 27 feet high. This is taller than any of the other structures in the area except for the second floor that has been added to one of the single-family homes in Anahola immediately to the north. Without landscape screening, this component of the project could stand out.

5.9.2 EXISTING CONDITIONS

The northeast portion of the island of Kaua‘i is renowned for its scenic beauty. In recognition of this, the Kaua‘i County General Plan designates some portions of Kūhiō Highway that pass through the area, including the portion of the highway that runs along the eastern boundary of the project site, as a Scenic Roadway Corridor.[50]

The general visual character of the project site has been heavily modified from what existed prior to the start of intensive human habitation and use. The vegetation is dominated by guinea grass with varying amounts of Christmas berry and, in some areas, dense patches of lantana with Java plum trees dotting the site. The site is crossed by unpaved roads (mostly former field and haul roads from the sugar plantation era) and rudimentary paths.

[49] This comes from the most recent available traffic count, conducted at Station B73005601278 on Kūhiō Highway between ‘Ioane Road and Hokualele Road, on November 30, 2010.

[50] The Kauai County General Plan designates Scenic Roadway Corridors to conserve open space, scenic features, and views within and along Kauai’s most heavily traveled routes. The intent of this policy is to establish basic principles for roadway design and land use within these scenic corridors, and to provide a basis for County action to establish programs and regulations to implement them. Scenic Roadway Corridors are intended to provide design guidance but are not to restrict the principal land uses of urban areas.

Because of the size of the property and the undulating nature of the terrain, only portions of the 60-acre site are visible from any single ground-level vantage point. By far the greatest numbers of people near the site are traveling in vehicles on Kūhiō Highway, and roadside vegetation in the foreground obscures much of the project site from that vantage point. For viewers looking south from Anahola Village, the view is of the northern edge of the site, where the guinea grass and Christmas berry in the foreground prevent clear views of the substation site. The photographs reproduced in Figure 5.13 through Figure 5.15 depict views of the project site from Kūhiō Highway. Figure 5.16 depicts the project site as seen from existing residences in Anahola Village immediate north of the project site. Additional information on existing views is presented as part of the impact discussion in Section 5.9.3.

Figure 5.13. Views Near the Intersection of Kūhiō Highway and ʻIoane Road

<table>
<tr><td>  </td><td> 
</td></tr>
<tr><td>View toward the project site from alongside Anahola Market Place ~75 feet south of the intersection of Kūhiō Highway and ʻIoane Road.</td><td>View toward the project site from the entrance to the parking lot of the AHHA Resource Center.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>View towards the project site from the outlet of ʻIoane Road onto Kūhiō Highway, AHHA buildings in the foreground.</td><td>View towards project site from the mauka edge of the Anahola Marketplace parking area.</td></tr>
<tr><td colspan="2">Source: All photos by Planning Solutions, Inc. (May 15, 2012).</td></tr>
</table>

Figure 5.14 Views Toward the Project Site from Kūhiō Highway Travelling North

View towards project site, travelling north along Kūhiō Highway, ~675 feet south of the southernmost edge of the property.

View towards project site from an elevated portion of Kūhiō Highway ~1 mile south of the project site. Travelling north, this is the last rise prior to the project site, which is not visible from this location.

View travelling north along Kūhiō Highway from the intersection with Kamole Road towards the project site. The project site is not visible from this location.

View towards the project site (~2.5 miles away) from Mailihuna Road, just mauka of Kūhiō Highway, below Kapa'a High School athletic field. The project site is not visible from this viewpoint.

Source: All photos by Planning Solutions, Inc. (May 15, 2012).

Figure 5.15 Views Toward Property from Kūhiō Highway Adjacent to the Project Site

View across Kūhiō Highway towards the southeastern corner of the project site.

View from makai edge of Kūhiō Highway towards the project site, directly across from proposed substation location.

View across Kūhiō Highway towards the proposed Service Center site.

View from Kūhiō Highway across the proposed Service Center site, ~300 feet from northeastern corner of the project site.

Source: All photos by Planning Solutions, Inc. (May 15, 2012).

Figure 5.16 contains photos of the site from the homes and businesses of Anahola Village, including Anahola Homesteads. Because site visits and photography confirm that there are no clear views of the project site from Anahola Village north of ʻIoane Road, the discussion focuses on the southernmost portion of Anahola in the vicinity of ʻIoane Road and closest to the project site.

Figure 5.16 Views Toward Project Site from Anahola Village

View towards the eastern portion of the project site from the southern edge of Anahola Village.

View towards project site from 'Ioane Road at intersection with Kapūnohu Street.

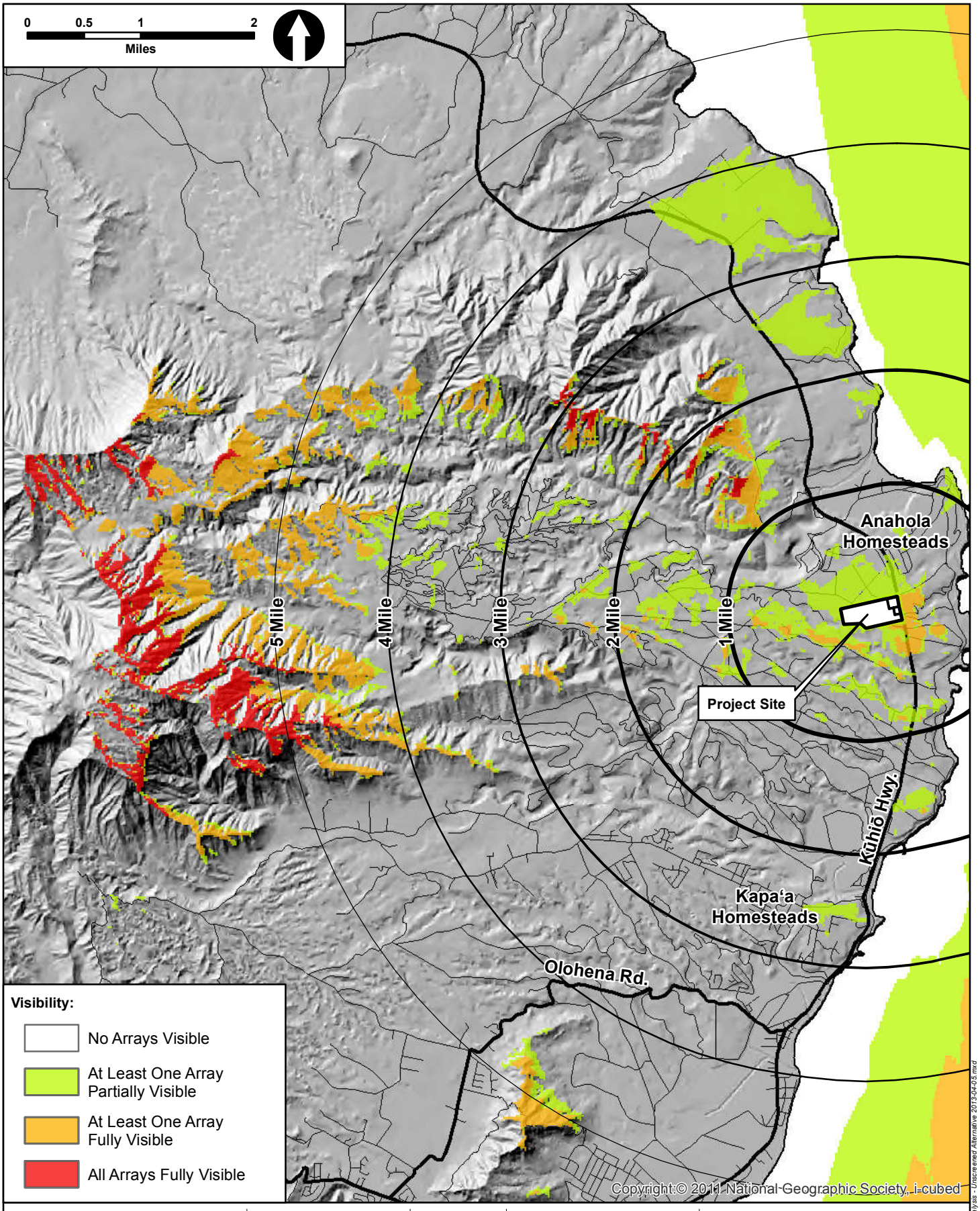
View towards project site from intersection of 'Ioane Road and Kawelo Street.

View towards project site from Kapūnohu Street.

Source: All photos by Planning Solutions, Inc. (May 15, 2012).

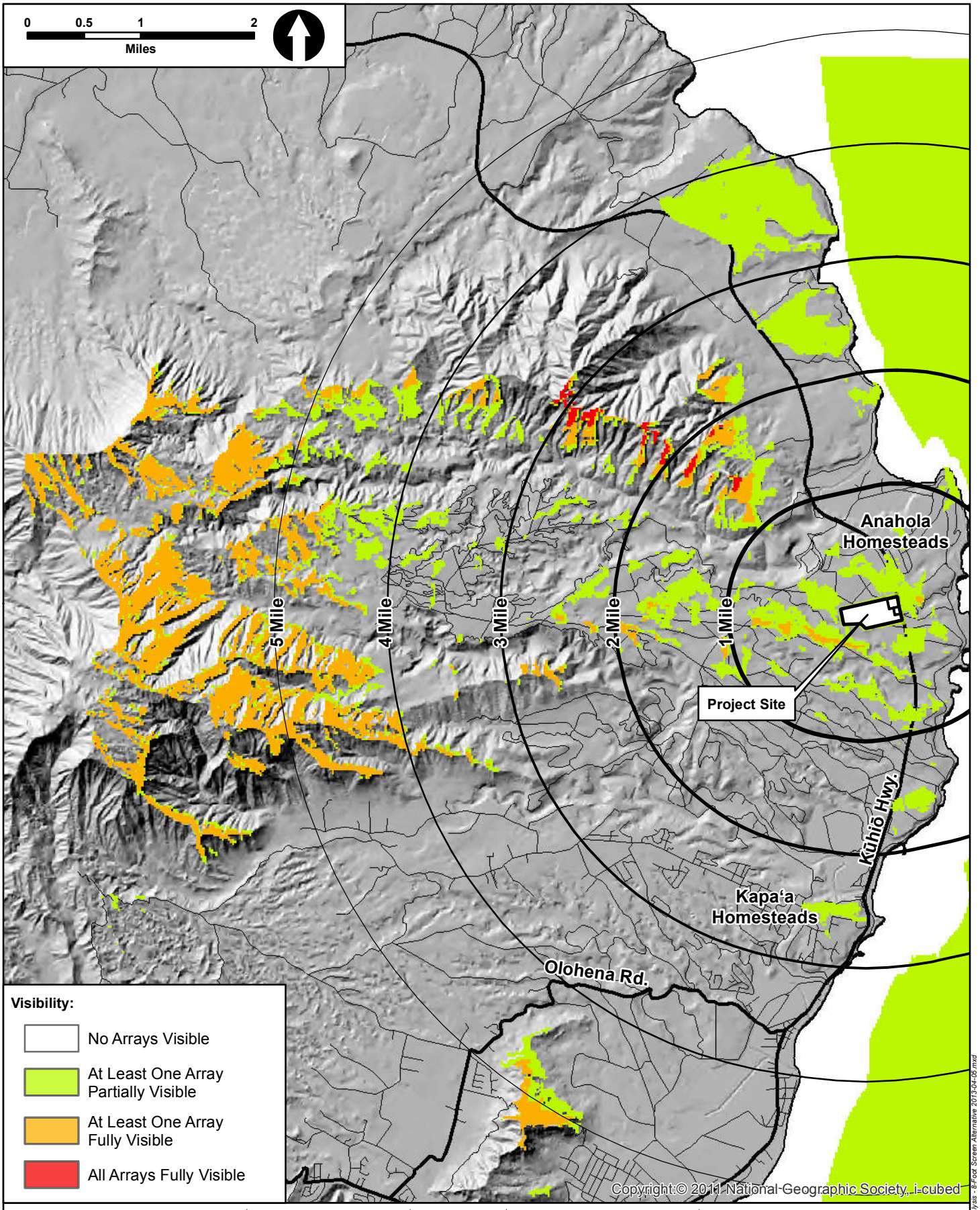
5.9.3 PROBABLE VISUAL IMPACTS

The computerized viewshed analysis described in Section 5.9.1 identified areas from which portions of the proposed facilities might be visible under several different circumstances. Figure 5.17 shows the areas from which an unscreened facility might be seen. Figure 5.18 and Figure 5.19 show the visibility of a facility with an 8-foot and 15-foot screen, respectively. Figure 5.20 summarizes the difference between the 8-foot and 15-foot screening alternatives. Together, the graphics provide insights into the extent to which visual screens might be effective in reducing their visibility.



Prepared For:	Prepared By:	Source:	Project:	Figure 5.17:
Kaua'i Island Utility Cooperative	PLANNING SOLUTIONS	PSI	Anahola Solar Project	**Viewshed Analysis: Unscreened Alternative**

Figure 5-17 Viewshed Analysis - Unscreened Alternative 2013-04-05.mxd



Prepared For: Kaua'i Island Utility Cooperative

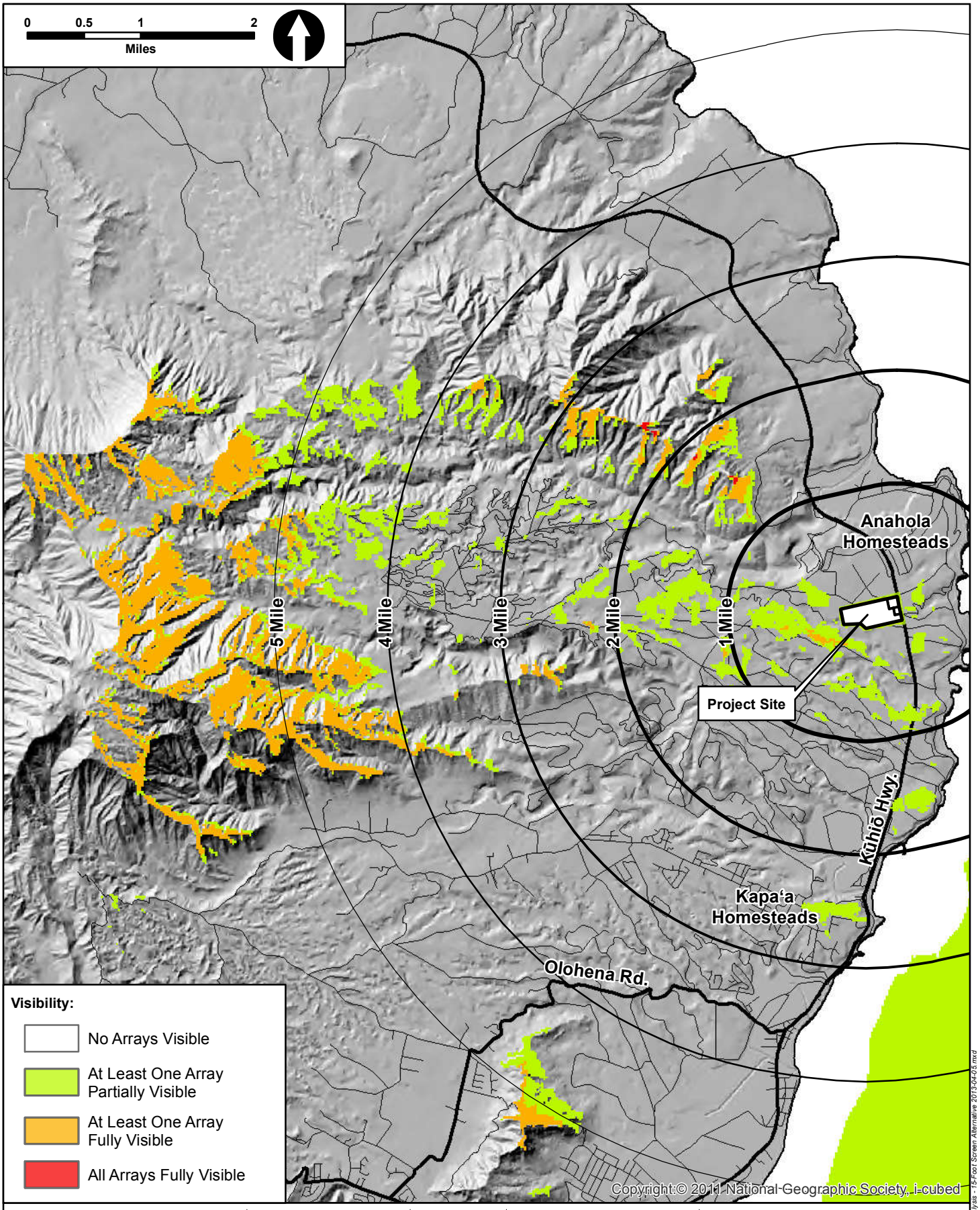
Prepared By: Planning Solutions

Source: PSI

Project: Anahola Solar Project

Figure 5.18: Viewshed Analysis: With 8-Foot Screen

Figure 5-18 Viewshed Analysis - 8-Foot Screen Alternative 2013-04-05.mxd



Prepared For: Kaua'i Island Utility Cooperative

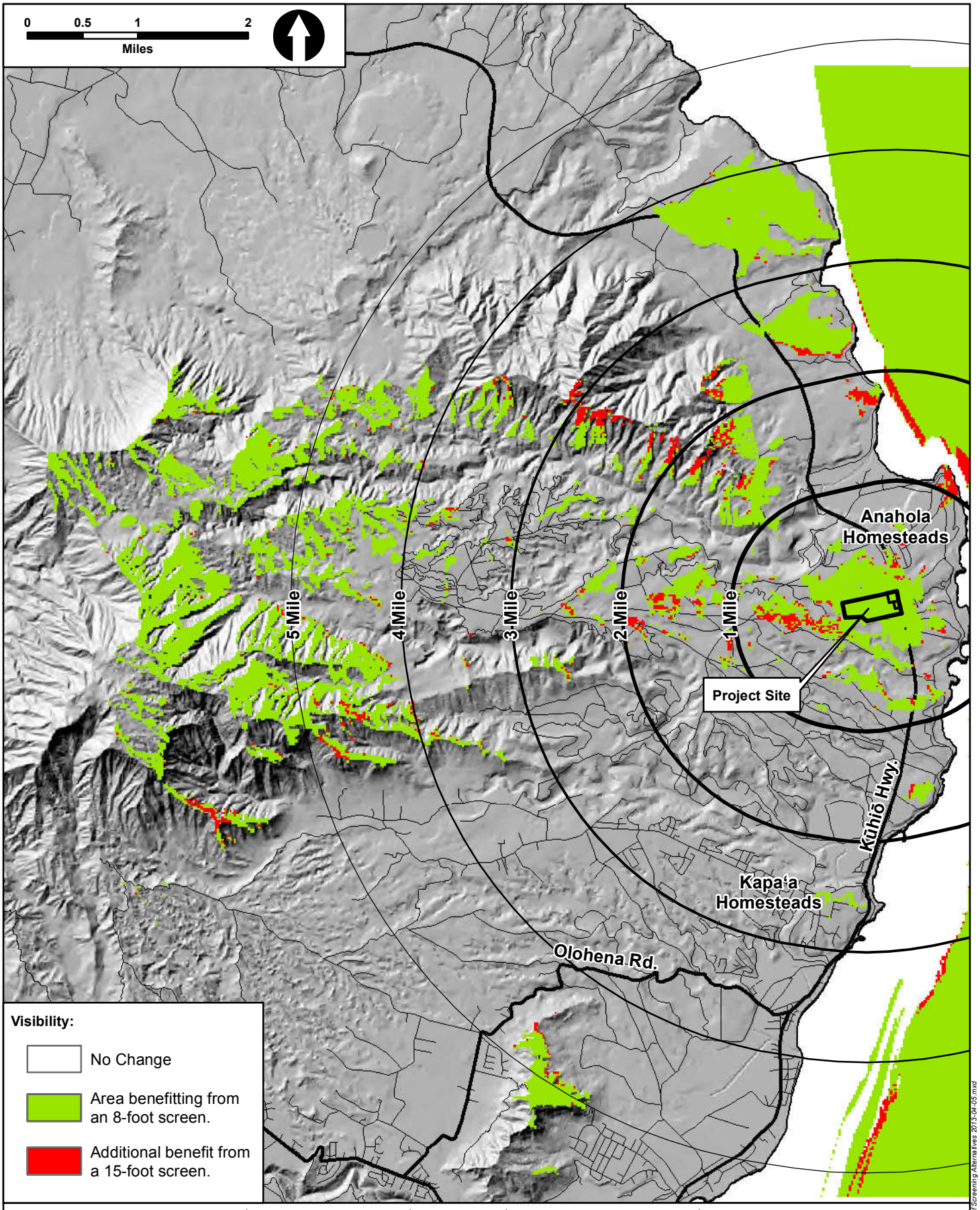
Prepared By: Planning Solutions

Source: PSI

Project: Anahola Solar Project

Figure 5.19:
Viewshed Analysis: With 15-Foot Screen

Figure 5-19 Viewshed Analysis - 15-Foot Screen Alternative 2013-04-03.mxd



Prepared For:	Prepared By:	Source:	Project:	Figure 5.20:
Kauaʻi Island Utility Cooperative	PLANNING SOLUTIONS	PSI	Anahola Solar Project	**Comparison of Screening Alternatives**

Figure 5-20 Comparison of Screening Alternatives 2013-04-05.mxd

KIUC planners and staff presented the maps and other information concerning the appearance of the project at a meeting with representatives of the Anahola Hawaiian Homestead Association. The purpose of the meeting, which was held at the AHHA Community Resource Center in Anahola, was to discuss community concerns regarding the appearance and visual impact of the project components, planned future land-use in the areas around the project, and other relevant information. Following that discussion, a planner visited many of the areas which appeared to have the potential for visual impacts, documented existing views from them, and assessed site visibility constraints that were not apparent from the computer analysis. The following subsections discuss the potential visual impacts with reference to specific viewpoints on the island.

The site visits showed that the computer simulations often exaggerated the level of visibility. Because of their reliance on digital elevation data, the simulations do not account for all aspects of topography; neither do the account for vegetation which can obscure line-of-sight. Many of the areas from which the simulations suggested the project site might be visible did not, when visited, prove to provide a view of any portion of it. In many cases it was trees and other vegetation (which the topographic model did not account for) which obstructed the line-of-sight. In other instances, the data used in the topographic model was too coarse to account for minor variations in ground elevation that significantly affected the visibility.

The remainder of this section discusses potential effects from the three viewpoints deemed to be both representative and important: (*i*) vehicles north of the project site that are southbound on Kūhiō Highway; (*ii*) vehicles south of the project site northbound on Kūhiō Highway; and (*iii*) views from vehicles driving past (i.e., adjacent to) the project site.

5.9.3.1 Effect on View Looking Southward toward the Project Site

Presently, as drivers and passengers travel south along Kūhiō Highway from the direction of Moloa‘a (and northern Kaua‘i in general), the project site first becomes visible in the vicinity of ‘Ioane Road in Anahola Village. From this viewpoint, the homes and businesses of Anahola, including the Anahola Marketplace and the AHHA Community Resource Center, are in the foreground with the project site visible in the background on the *mauka* side of the highway.

While viewshed analysis had suggested that the project site would be visible further north, photographs document that prior to that the structures and vegetation in the foreground obscure all views of the site from Kūhiō Highway north of ‘Ioane Road. Viewed from alongside Kūhiō Highway (see Figure 5.15), the site appears to be totally overgrown; the guinea grass, Christmas berry, and Java plum in the closer portions of the project site block views across the area and make site boundaries indeterminate. In general, the site is too overgrown to allow individual features to be distinguished, although there is a mound alongside the eastern edge of the project site which can be ascertained. The utility poles and lines running along Kūhiō Highway dominate the foreground. From certain angles, Mount Wai‘ale‘ale and Mount Kalalea are visible in the distant background across the site.

Once the project is constructed, drivers travelling this route will see, in addition to the existing Anahola Marketplace, KIUC’s new Anahola Service Center in the foreground, with some portion of the substation behind it along the highway corridor.[51] Where now the view is of guinea grass and other invasive plants, in the future it will be of trees, shrubs, and other native plants that are part of KIUC’s proposed landscaping. This proposed vegetative screen will soften the visual presence of the new service center, with its access drive and customer parking area along the highway. It would do

[51] All three Anahola solar project components (i.e., the service center, the substation, and the photovoltaic array) will be surrounded by security fencing. The base case assume that this will be traditional open mesh and will neither block views of the facilities behind or be obscured by landscape vegetation that is installed as part of the proposed Anahola Solar Project.

the same for the substation. The landscaping and structures that would be constructed on the service center and the substation areas and along the portion of the solar array site fronting the highway south of the substation will obscure direct views of the relatively lower solar arrays that lie behind them from this vantage point.

Installation of an 8-foot tall screen would substantially reduce the area from which the PV arrays could be seen. The areas that would benefit most from this are in Anahola. Raising the height of the visual barrier provides little additional benefit.

5.9.3.2 Effect on Views Looking Northward toward the Project Site

Because there is little development in the area south of the project site, the key vantage point in that area is Kūhiō Highway, which carries many thousands of people every day. The location of the project on a gentle rise between two natural drainage channels suggested that drivers travelling northward along Kūhiō Highway begin to catch glimpses of the project site in the vicinity of Mailihuna Road and further north, near Kumukumu, Kamole Road, and elsewhere. A follow-up visit to the area showed that the site is not visible to drivers travelling north on the highway until approximately 800 feet before the southeastern corner of the 60-acre project site, as their vehicles travel up the gentle slope south of the site. Prior to that point, the grade and existing vegetation block clear views of the site.

As drivers travel up the gentle slope toward the project site, the first views of the proposed facilities will be of the photovoltaic array in the foreground, the substation in the middle-distance, and the access road and Service Center in the background. The current view of the Anahola Marketplace will be obscured by the larger visual presence of the service center. Landscape screening installed as part of the substation and service center components of the proposed project can provide an effective visual screen for those facilities. It is not possible to achieve the same degree of screening by installing landscaping around the much more extensive solar arrays.

Based on the information now available, KIUC does not believe that such screens will be needed. However, should experience with the actual development indicate that the view of project facilities from certain vantage points is too obtrusive, KIUC will develop and implement plans for enhancing the visual screens in such areas.

5.9.3.3 Effect on Views from Kūhiō Highway Adjacent to the Project Site

Regardless of whether persons looking at the project site from this viewpoint are travelling southbound or northbound on Kūhiō Highway, the views of the project site are lateral. As shown in Figure 5.15, the views are of the nearest guinea grass, Christmas berry, and other vegetation which grows unmanaged in the foreground. From the eye level of people in cars, buses, and trucks traveling on Kūhiō Highway (~8 feet above ground level or less), the remainder of the project site is not visible behind this vegetative screen. In the very near foreground, the poles and utility lines which run along the neatly trimmed highway right-of-way are clearly visible, with Mount Wai‘ale‘ale and Kalalea in the distance. The overall appearance of this former agricultural land is rural and unimproved.

Construction of the proposed facilities will substantially alter the views from this portion of the highway. Landscape vegetation composed largely of native shrubs and trees will stand in front of an 8-foot-high security fence. Depending upon their density (which will vary from place to place, these will either hide or soften the appearance of the facilities that stand behind.

While extensive, the solar arrays and related facilities are low. Hence, the screening will be most complete for those. The solar panels themselves are south-facing at a low angle (approximately 20 degrees from horizontal); consequently, to the extent that they can be seen at all, the view of them will be sidelong. In the limited areas where the line-of-sight is not blocked by vegetation, the racks upon which the panels are mounted will be visible under the nearer installations, as will some of the

pad-mounted electrical equipment which serves the closer arrays. Because the land slopes very gently, many of the panels in the background will be at least partially blocked by the closer modules.

There will be a break in the landscaping between the service center and the substation where the new access driveway is located, and one or more acceleration/deceleration lanes in the highway corridor itself will also announce the presence of the facility. The substation on the southern side of the access road will be visible principally to occupants of southbound vehicles. Certain factors will work to make this substation one of the more visually intrusive elements of the project; these include the industrial visual character of the electrical equipment, the higher profile of the metal structures, the need to keep screening vegetation away from the electrical connections, and its presence in the foreground along the highway.

The Service Center complex will be most visible from northbound vehicles as they approach the access road/highway intersection. The appearance of the service center building and the surrounding parking and baseyard will be softened, but not completely hidden, by the presence of landscaping running along the highway corridor outside of the security fence. The size of the service center building means that it will tend to draw the gaze toward it; it also means that the structure and associated landscaping will tend to hide much of the solar panel complex that lies behind it.

5.10 PUBLIC INFRASTRUCTURE

5.10.1 WATER SUPPLY

5.10.1.1 Existing Conditions

There is no potable water supply available to the project site at the present time. However, the County of Kaua'i Department of Water (DOW)[52] operates the Anahola Water System which services the homes on DHHL Anahola land just to the north of the project site. The Anahola water system includes three wells (Anahola Well A [90-A], and Anahola Well B and Anahola Well C). All of the water is chlorinated and pumped into the distribution system or stored in two tanks, one with a capacity of 500,000 gallons and other with a capacity of 150,000 gallons. As indicated by the results of results of tests conducted in 2011 that are reproduced in Table 5.25, the quality of the water from the three wells is very good and requires no treatment except for disinfection.[53]

5.10.1.2 Probable Effects

Because they are unmanned, neither the PV arrays nor the substation require potable water; crews will bring their own drinking water to the site when they need it. The Service Center, on the other hand, will be the base of operations for between 15 and 20 KIUC staff members, and members of the public will visit it as well. Most of these visits will be for the purpose of dealing with the small customer service staff that KIUC expects to base there. However, KIUC's policy of making the meeting room available to community organizations when it is not needed for the cooperative's business means that small groups of community members will use the facility as well.

[52] DOW is a semi-autonomous agency responsible for the management, control, and operation of the island's municipal water system.

[53] DOW tests the water for many potential chemical regulated contaminants, each with a maximum contaminant level (MCL) and a maximum contaminant level goal; and unregulated contaminants, which don't have maximum contaminant levels. Included among the contaminants for which it tests are coliform bacteria and heavy metals (lead and copper).

Table 5.25. Potable Water Test Results: Anahola Water System – 2011.

Substance	*Highest Level Allowed (MCL)*	*EPA MCLG*	*Highest Level Detected*	*Detection Range*	*Date*	*Violation*	*Source of Contaminant*
Inorganic Contaminants							
Chromium (ppb)	100	100	6	-	2011	No	Erosion of natural deposits
Nitrate (ppm)	10	10	0.4	-	2011	No	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Organic Contaminants							
Haloacetic Acids (HAA)	60	NA	1.1	-	2010	No	By-product of drinking water chlorination
Lead and Copper Rule Compliance							
Substance	Action Level	MCLG	Highest Level Detected	# of Sites Sampled	# of Sites Found Above the AL Source of Contaminant		
Lead (ppb)	15	0	11	10	0		Corrosion of household plumbing systems
Copper (ppm)	1.3	1.3	0.08	10	0		Corrosion of household plumbing systems

Source: Water Quality Report Covering the period of January 1, 2011 to December 31, 2011. Kaua'i Department of Water Anahola Water System.

KIUC's civil engineers estimate that potable water use at the baseyard and service center will average approximately 1,200 gallons per day. In consultation with the Kaua'i Department of Water Supply, they have determined that this water should come from the three wells that serve the existing Anahola system. Accomplishing this will require the installation of approximately 3,000 feet of 12-inch diameter line. The pipeline extension would begin at the intersection of Kalalea Road and Kūhiō Highway and run within the highway right-of-way as far as the northern boundary of the parcel that KIUC is proposing to lease. From there, KIUC would install one or more smaller pipes to serve the various uses within the proposed facility. The new line has a greater capacity than is needed for KIUC's project alone, but would provide sufficient additional capacity to serve the future development that the Department of Hawaiian Home Lands has planned for its property in the area.

The Department of Water has indicated to KIUC that the existing well has sufficient excess capacity to accommodate the projected Service Center water use. With the pipeline extension that KIUC would provide, the system will be adequate to meet the project's needs.

5.10.2 SANITARY WASTEWATER COLLECTION AND DISPOSAL

5.10.2.1 Existing Conditions

There is no sanitary sewer system in this part of the island. Instead, wastewater is treated by each owner using individual wastewater treatment systems. At the present time, the County of Kaua'i Wastewater Management Division does not envision extending service to Anahola.[54]

5.10.2.2 Probable Impacts.

Neither the PV array nor the substation will generate any sanitary wastewater. Civil engineers estimate that persons at the proposed base yard and service center will generate an average of 400 gallons of sanitary wastewater per day. In order to dispose of the sanitary wastewater that would be generated by people at the baseyard and service center, KIUC will construct on onsite individual wastewater treatment and disposal system (see Figure 2.11). It envisions that the treatment will be provided by septic system filter and that the treated effluent will be disposed of in an adjacent leach field just north of the service center. The system would be designed, constructed, and operated in accordance with the provisions off Hawai'i Administrative Rules §11-62.

§11-62-31.1 establishes general requirements for individual wastewater systems. It provides that individual wastewater systems may be used as a temporary on-site means of wastewater disposal for non-residential uses in lieu of wastewater treatment works when: (*i*) there are 10,000 square feet of usable land area for each individual wastewater system; (*ii*) the total wastewater flow is not more than 15,000 gallons per day; (*iii*) the lot is at least 10,000 square feet; and (*iv*) the total wastewater flow into each individual wastewater system does not exceed one thousand gallons per day. KIUC is able to comply with all of these provisions.

5.10.3 ELECTRICITY AND TELECOMMUNICATIONS

5.10.3.1 Existing Conditions

KIUC power lines extend along the *makai* side of the service center site, and by the time these facilities are under construction the new substation will be in service. Telecommunications lines are also located within the highway right-of-way fronting the project site.

5.10.3.2 Probable Effects

There is more than sufficient available electrical generating capacity in KIUC's system to accommodate the loads that the proposed facilities would impose even if they were all new loads (i.e., were not loads that were already on the system). In this instance, nearly all of the energy-consuming activities that would take place at the Anahola service center and baseyard are already connected to KIUC's transmission and distribution grid and are, therefore, drawing power from the generating system. Hence, the proposed project primarily entails the relocation of existing loads rather than the imposition of entirely new ones. In view of the fact that the electrical fixtures that are installed at the new site are likely to be more energy-efficient than the older ones that are presently in use, it is even possible that the baseyard and service center may consume less power than had the activities remained at their present locations elsewhere on the island.

Telecommunications service to the service center will require only a few circuits. The existing lines that pass the site have adequate excess capacity to provide the needed service.

[54] See the Final *Wastewater Rate Study and Long-Term Financial Analysis Report* prepared for the County by R.W. Beck in September 2010.

5.10.4 EMERGENCY SERVICES AND SCHOOLS

5.10.4.1 Existing Conditions

The project site is served by the Hanalei and new Keālia Fire Stations, and the Hanalei and Līhu'e Police Stations, operated by the Kaua'i County Fire Department and the Kauai County Police Department, respectively. The area is served by the Anahola campus of Kamehameha Preschool, Kanuikapono Public Charter School of Kauai, Kapa'a Elementary School, Kapa'a Middle School, and Kapa'a High School. There is no hospital in Anahola; the nearest medical facilities are the Kaua'i Medical Clinic in Kīlauea and Wilcox Memorial Hospital in Līhu'e.

5.10.4.2 Probable Impacts to Police, Emergency Medical Services, and Schools

The entire PV array, substation, and service center will be enclosed with a security fence, with the exception of the public access portion of the service. The security fencing minimizes the risk of unauthorized entries or theft of materials from within the facility. The only personnel allowed within the substation are trained electrical workers (KIUC personnel and contractors) experienced working around electrical equipment.

None of the proposed facilities will place any additional demands on the existing police, emergency medical services, or on any of the public or private schools in the area. The only anticipated impact of the proposed project is to improve the reliability of electrical service to the region's public infrastructure. Prior to commencement of construction activities, the Police Department, Emergency Medical Services, and the Kaua'i Fire Department (KFD) will be notified of the construction schedule and apprised of emergency vehicle access routes to use during the construction process. The contractor will be required to provide ample clearance for emergency vehicles at all times. The proposed project does not involve any activities that would permanently alter the need for, availability, or ability to provide, emergency services.

5.10.4.3 Probable Impacts to Emergency Fire Services

For reasons summarized below, the proposed project will not significantly impede or burden emergency firefighting services in the Anahola area. Each of the project elements are treated separately below.

Substation. All of the facilities are distributed within the substation on non-flammable material (principally gravel). Most of the equipment is non-flammable, and only a few pieces of equipment (e.g., the BESS units) contain material that can burn. The BESS units are modular and are separated from one another sufficiently to keep a fire in one from spreading to another; moreover, each container is equipped with its own dedicated fire suppression system. In addition, the BESS units will be equipped with a self-contained fire suppression system using Novec™ 1230 fluid vapor. This fire suppression system is designed to prevent situations such as the August 2, 2012 fire which destroyed a BESS at a wind farm in Kahuku, on O'ahu. No landscaping will be placed within the fence line, further reducing the risk of fire.

PV Array. The *NFPA 1 Fire Code Handbook* §11.12.3 provides fire prevention guidance for ground-mounted photovoltaic system installations. The handbook requires a cleared area 10-feet wide around the PV array, and a non-combustible base installed under and around the photovoltaic installations. KIUC has met with the Kaua'i Fire Department and shared its plans for the facility with them. Its design for the PV array will be consistent with the requirements of KFD and the Uniform Fire Code.

The PV equipment is largely free of flammable material. Some such materials are present within the PV array area are in very small quantities, but frequent inspections, site security, and vegetation management are intended to keep the risk of fire at a minimum.

Service Center. The service center and attached baseyard will be constructed largely of non-combustible materials and conform to all requirements of the Uniform Fire Code. In order to assure

the safety of individuals and operations at the service center, the building will be equipped with an integral sprinkler system in the five truck bays, fire alarms, and fire extinguishers. The latter will be located at regular intervals throughout the building, including all office areas and the internal truck bays. The water for the sprinkler system will be provided by the new pipeline extension (see Section 5.10.1) which will connect this facility to the existing Anahola Water System operated by the DOW.

5.10.5 SOLID WASTE MANAGEMENT

5.10.5.1 Existing Conditions

The Kauaʻi County Department of Public Works Solid Waste Division (SWD) is responsible for the collection and disposal of residential and Subtitle "D" commercial solid waste at the Kekaha Phase II Land Fill which is the primary solid waste disposal site on the island[55]. The nearest Refuse Transfer Station is in Līhuʻe, adjacent to the airport; the nearest green waste diversion site is in Hanalei, and the nearest recycling redemption center is in Kapaʻa. According to Kauaʻi County's *Integrated Solid Waste Management Plan* (R.W. Beck, September, 2009), the Kekaha Landfill was projected to reach capacity in January, 2009 (approximately) unless an expansion was completed. Consequently, the Kekaha Landfill Phase II Lateral Expansion was constructed with an additional 1.55 million cubic yards of capacity. This Phase II Lateral Expansion will continue to accept solid waste through 2013.

5.10.5.2 Probable Impacts

Construction of the proposed project will not generate significant demolition waste as there are currently no structures on the project site which will be cleared away as part of the construction process. The proposed project will not produce significant solid waste once it is operational, with the exception of green waste from vegetation control activities. Were the project to be decommissioned, most of the solar array could be reused or recycled as postconsumer product.

During both the construction and the operational phases of the project, the principal source of solid waste (as noted above) is green waste produced grubbing and maintaining the land around and under the solar arrays. Green waste produced from these activities will be transferred by the contractor to Moloaʻa Heart & Soul Organics, a County of Kauaʻi permitted composting center located at 6220 Koʻolau Road, Kīlauea, Kauaʻi. Any metal construction waste will be recycled at Puhi Metals Recycling Center, located at 3951 Puhi Road in Līhuʻe. Cardboard packing materials used for shipping of photovoltaic modules, racks, and electrical equipment will be transported by the contractor to Garden Isle Disposal, also located in Līhuʻe at 2666 Niumalu Road. These materials will either be transported to their destinations by the contractor or by an approved sub-contractor such as Garden Isle Disposal.

5.11 HAZARDOUS MATERIALS

5.11.1 EXISTING CONDITIONS

As part of its planning for the Anahola Solar Project, KIUC commissioned HAZTECH Environmental Services, Inc. (HAZTECH) to conduct a Phase I Environmental Site Assessment of the property in accordance with ASTM E1527-05, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*.[56] The purpose of the investigation was

[55] Subtitle D of the Resource Conservation and Recovery Act (RCRA) addresses non-hazardous solid wastes, including certain hazardous wastes which are exempted from the Subtitle C regulations such as: hazardous wastes from households and from conditionally exempt small quantity generators. Subtitle D also includes garbage (milk containers, coffee grounds), non-recycled household appliances, the residue from incinerated automobile tires, refuse such as metal scrap, wall board and empty containers, and sludge from industrial and municipal waste water and water treatment plants and from pollution control facilities.

[56] Phase 1 Site Assessments do not include any sampling activities or analysis of suspect soil or other materials.

to determine the likelihood that hazardous materials are present on the property and, if so, whether the quantities and types of materials present are such that they require remediation.

As part of its assessment work, HAZTECH:

Physically inspected the property for visual evidence of prospective environmental concerns including existing or potential soil and groundwater contamination, as substantiated by soil, asphalt, concrete staining or discoloration, stressed vegetation; hydraulic equipment that may contain polychlorinated biphenyls (PCBs); indications of waste dumping or burial, pits, ponds, or lagoons; containers of hazardous substances or petroleum products; and underground and aboveground storage tanks.

Examined historical aerial photos, historical topographic maps, and Sanborne maps for evidence of prior land use that could have led to recognized environmental conditions.

Evaluated information available on general geology and topography of the subject property, local groundwater conditions and proximity to ecologically sensitive receptors, such as streams, that might be impacted by recognized environmental conditions and environmental issues.

HAZTECH confirmed that the property is currently being used as pastoral lands for horses and that the fences that are evident around and throughout portions of the property are a function of that use. The investigation also determined that the gully that is present and runs from West to East through the property is in the location of a historical cane road. It noted that the surrounding areas consist of undeveloped, residential, and pastoral properties. Based on its visual observations and a check of the available environmental databases, it concluded that there were no signs of recognized environmental conditions. Its search of the database records, indicated that no sites of interest have been reported within a 1 mile radius of the site. However, 14 "orphan sites" (sites without accurate mapping details) have been identified by the radius report. These sites identified in one or more of the concerned databases are believed to be within the search radius but conflicting information has excluded them from this report.

HAZTECH's assessment for the property revealed the following:

As would be expected in former agricultural fields such as these, various types of solid waste are scattered throughout the property.

This waste includes scrap metal debris, car parts, an abandoned boat, a car battery, household appliances, PVC pipes, an empty 5-gallon plastic bucket, and a number of rusted, empty, steel 55-gallon drums. These findings are a recognized environmental condition because the chemicals in the abandoned waste could adversely impact the property.

Based on its analysis, HAZTECH recommended topsoil removal to depths of 6 to 12 inches followed by verification sampling for contaminants at the locations where these were found. Based on the interviews it conducted during its study, HAZTECH concluded that fertilizers, pesticides, and herbicides were likely to have been used at the site historically and identified this as a recognized environmental concern due to the possibility of soil contamination from these chemicals. It did not recommend any specific remedial measures for this.

5.11.2 PROBABLE IMPACTS

5.11.2.1 Solar Array

All equipment to be installed as part of the photovoltaic array and associated electronics are dry-type, solid state equipment and will not pose a threat of hazardous waste with three notable exceptions: (*i*) the methyl-alcohol/water mixture used as coolant within the AE Solaron 500 kW inverters; (*ii*) the mineral-oil filled transformers installed at each equipment pad; and (*iii*) the diesel fuel used by the vibratory pile driver and other construction vehicles.

The inverter cooling system uses a 5-gallon closed-loop cooling system; the coolant in the inverters and the mineral oil in the transformers could only be spilled if physical damage occurred to the units. The diesel used by the combustion-engine construction equipment will be stored in a closed tank on the same platform as the fuel pump or a fuel truck. As with the other two sources of hazardous materials noted above, only physical damage to the tank or pump could result in a release of diesel. The storage, maintenance, and fuel of vehicles will be in compliance with all NPDES regulations and best management practices.

At completed installations of photovoltaic systems for power generation, the potential for chemical releases appears to be small since chemicals are present in sealed PV modules. Releases from these are likely to occur only due to fires or other unusual accidents, which are extremely rare. Importantly, cadmium which could be a potential concern with thin-film technologies is not present in the cells that are proposed at Anahola. Other chemicals that have inhalation toxicity factors are present only during the manufacturing process. Leaching of metals from the installed modules is not likely to be a concern, as documented in a study by Steinberger (1998).

Manufacture of PV Modules and Other Equipment. To a very great extent, two of the three major components of the proposed project are what might be termed "installation projects". In other words, the bulk of the work associated with their implementation has to do with the manufacture of equipment and only a smaller proportion is related to the work that would be done on the project site. Because of the disproportionate amount of off-site activity that the proposed project would support, KIUC briefly examined the kinds of impacts that this would entail. The evaluation was not meant as a substitute for the environmental review that would occur at the point(s) of manufacture. Rather it was intended as a cross-check to ensure that KIUC-funded activities would not unintentionally lead to significant adverse consequences elsewhere.

Polycrystalline Silicon. The panels that will be installed for the Anahola PV project are composed of polycrystalline silicon. This material is composed of many smaller silicon grains of varied crystallographic orientation. It can be synthesized easily by allowing liquid silicon to cool using a seed crystal of the desired crystal structure. The abundance, stability, and low toxicity of silicon, combined with the low cost of polysilicon relative to single crystals makes this variety of material attractive for photovoltaic production (Platzer, Michaela D., June 13, 2012). Manufacture of a crystalline silicon system involves several stages:

Polysilicon Manufacturing. Polysilicon, based on sand, is used to make the semiconductors used in PV panels. Silicon dioxide consisting of either quartzite gravel or crushed quartz is placed into an electric arc furnace and a carbon arc is then applied to release the oxygen. The products are carbon dioxide and 99-percent pure molten silicon. This is then purified even further using physical processes (generally referred to as the "floating zone" technique).

Wafer Manufacturing. Manufacturers use traditional semiconductor manufacturing equipment, to shape polysilicon into ingots and then slice the ingots into thin wafers. They then cut, clean, and coat the wafers according to the specifications of the system manufacturers.

Cell Manufacturing. Solar cells are the basic building blocks of a PV system. They are made by cutting wafers into the desired dimensions and shapes and then attaching very thin copper leads so the cell can be linked to other cells. Metals such as palladium/silver, nickel, or copper are vacuum-evaporated through a photoresist, silkscreened, or merely deposited on the exposed portion of cells that have been partially covered with wax. After the contacts are in place, thin strips (most often tin-coated copper) are placed between cells.

Module Manufacturing. Modules, which normally weigh 34 to 62 pounds, are created by mounting 60 to 72 cells on a plastic backing within a frame, usually made of aluminum. The module is covered by solar glass to protect against the elements and to maximize the efficiency with which the unit coverts sunlight into power. Pure silicon is relatively shiny (it can reflect can reflect up to

35 percent of the sunlight), so an anti-reflective coating is put on the silicon wafer; most commonly titanium dioxide and silicon oxide.

Materials Used in the Production of Polycrystalline Silicon Solar Cells. The production of photovoltaic devices involves the use of a variety of chemicals and materials. The amounts and types of chemicals used will vary depending upon the type of cell being produced. There is also some variability among the different photovoltaic companies with respect to the chemicals used for manufacturing the same type of photovoltaic cells. Table 5.26 provides a general list of chemicals and materials used in the production of Polycrystalline Silicon Cells solar cells. It was obtained from a 2004 report published by the Public Interest Energy Research Program (PIER) titled *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells*. While the report provides an excellent discussion of the topic, it is based on information that is now nearly a decade old, which is a long time in an industry that is evolving as rapidly as PV wafer manufacturing. Hence, the materials used in the manufacture of the cells used in the Anahola project may differ from this.

Table 5.26 Chemicals and Materials Used in the Production of Polycrystalline Silicon Cells

Aluminum	Phosphine
Ammonia	Phosphorus trichloride
Arsine	Silicon
Boron trichloride	Silicon dioxide
Copper catalyst	Silane
Diborane	Silicon trioxide
Ethyl acetate	Silicon tetrachloride
Ethyl vinyl acetate	Silver
Hydrochloric acid	Sodium hydroxide
Hydrogen	Stannic chloride
Hydrogen fluoride	Sulfuric acid
Hydrogen peroxide	Tantalum pentoxide
Ion amine catalyst	Titanium
Isopropyl alcohol	Titanium dioxide
Nitric acid	Trichlorosilane
Nitrogen	
Source: EPRI and California Energy Commission. (August 2004). *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells*.	

A variety of acids or corrosive liquids (e.g., hydrochloric acid, sulfuric acid, nitric acid, and hydrogen fluoride) are used in fairly large quantities during the manufacturing process, primarily for the cleaning of wafers or to remove impurities from raw semiconductor materials.[57] Solvents including 1,1,1-trichloroethane and acetone are also used in large quantities in the various cleaning steps conducted during the production processes. Etching compounds such as sodium hydroxide can also be used in relatively large quantities. A number of these chemicals are classified as hazardous by the Federal Department of Transportation.

[57] The amount of a given chemical used will vary depending upon numerous factors including the type of cell being produced, the amount of material processing required, and the amount of wafer cleaning required. The manufacturing processes are constantly evolving and changing, and this makes it impossible to provide a definitive list.

Toxicity of Materials Used in the Manufacture of PV Modules. Based on a review of the chemical information reported in the U.S. EPA's Toxics Release Inventory System (TRIS) database for six photovoltaic companies producing solar cells, EPRI and California Energy Commission. (August 2004) reported that it appeared that most of the chemicals used by the U.S. manufacturing companies it studied are not released in reportable quantities. Similar information is not available for PV modules manufactured in China, which is the source of the panels being used for the Anahola project.

Human Health Risk Associated with Manufacture of PV Modules. Tetratech's comprehensive analysis of the possible effects of PV manufacturing included an extensive discussion of potential human health risks. While noting that the potential for human exposure to these materials can occur during the manufacturing process, from the leaching of cracked or broken modules, or from the combustion of modules, the greatest risks are related to manufacturing, rather than installation, of these devices.

Accidental Release of Toxic Gases. Short-term exposures to highly toxic substances used in the photovoltaic industry could occur as a result of the accidental release of toxic gases (e.g., silane, arsine, phosphine, hydrogen sulfide, and hydrogen selenide). These can present health risks to both workers and the general public. Such releases are likely to be contained within the manufacturing plant, placing plant workers at the highest risk for exposure. However, persons living in the vicinity of the plant may be at risk from a catastrophic release of toxic gases (e.g., a large explosion at the manufacturing facility). No catastrophic releases of toxic gases from photovoltaic manufacturing facilities are known to have occurred, and the likelihood of such a catastrophic release is believed to be extremely small.

Long-Term Exposure. The exposure to low levels of toxic materials used by the photovoltaic industry over long periods of time may present potential health risks to both workers and the general public. In production facilities, workers may be directly exposed to hazardous compounds through the air they breathe, from ingestion by hand to mouth contact, or from absorption through the skin; the general public may be exposed to low levels of chemicals through indirect pathways such as the contamination of public drinking water from the improper disposal or treatment of plant effluent (Fthenakis and Moskowitz, 2000).

End-of-Life Issues. The U.S. regulatory framework for solar PV end-of-life is based on the federal Resource Conservation and Recovery Act (RCRA) and state policies like California's HWCL.[58] If PV components are determined to be hazardous waste, RCRA could be used to regulate their handling, recycling, reuse, storage, treatment, and disposal. Decommissioned solar panels are currently considered hazardous waste if they do not meet the U.S. Environmental Protection Agency's (EPA) Toxicity Characteristic Leaching Procedure (TCLP) standards and, therefore, have the potential to leach into the groundwater near waste disposal sites. The TCLP test is required for all new solar panels that enter the U.S. market.[59]

[58] The European Union has notably stricter standards regarding hazardous wastes of this sort, and a number of environmental organizations and American trade groups believe that these provide superior end-of-life protection and should be adopted. E.U.'s RoHS (Restriction of Certain Hazardous Substances), for example, requires that electronics sold on the E.U. market not contain lead, mercury, cadmium, chromium, polybrominated biphenyls (PBBs), or brominated diphenylethers (PBDEs). Based on the known toxicity of many PV materials and the unstudied toxicity of many others, some recommend that the U.S. follow the E.U.'s lead in restricting sales of solar panels that contain materials shown to pose a danger to human health or the environment. Similarly, they recommend that the U.S. should follow the E.U.'s example and apply the so-called "precautionary principle," restricting sales of products containing materials that have not been proven to be safe.

[59] California's Hazardous Waste Control Law and regulations in several other states provide even stricter hazardous waste designations than the federal government, but the panels that are being used at Anahola have not been rated for that purpose.

5.11.2.2 Substation

Very small amount of hazardous materials are present in equipment within the substation. The design of the proposed facilities provides proper storage for these, and KIUC will operate it in accordance with all applicable regulations and guidelines. Consequently, no adverse effects are anticipated.

5.11.2.3 Service Center

In support of the activities planned for the service center, KIUC will store moderate quantities of hydraulic fluid, transformer oil, motor oil, creosote from utility poles, cleansers, solvents, and diesel fuel on site. All of these materials will be properly contained in accordance with applicable regulations and best practices. No adverse impacts are anticipated.

5.12 TRANSPORTATION FACILITIES

5.12.1 EXISTING CONDITIONS

5.12.1.1 Airports and Harbors

Līhu'e Airport. Līhu'e Airport, the only public use airport on the island of Kaua'i, is located approximately 12 miles south of the project site. It is owned and operated by the State of Hawai'i Department of Transportation. Situated approximately 150 feet above sea level, the airport has two asphalt-surfaced runways 3/21 and 17/35; both are 6,500 feet long. In 2005, there were slightly more than 100,000 operations and 28 based aircraft at the airport. In 2010, over 2,415,000 passengers and 14,386 tons of air cargo passed through the airport. The proposed project is not in or near a runway approach or clear zone; neither is it sufficiently close to any designated flight paths for reflections from it to adversely affect aircraft in flight.

Princeville Airport. Princeville Airport is a private facility located approximately 11 miles west-northwest of Anahola. Its single runway (5/23) is located at an elevation of 344 feet above mean sea level, is 3,560 feet long and has an asphalt surface. The airport is owned and operated by the Princeville Corporation. The proposed project is not in or near a Princeville Airport runway approach or clear zone; neither is it anywhere near flight paths associated with that airport.

The State DOT Harbors Division owns and operates Nāwiliwili Harbor. It is a manmade port, which includes three piers providing over 1,800 ft. of berthing space and handles all of the island's waterborne commerce. Construction materials for the proposed project would arrive through the harbor and then be trucked to the project site.

5.12.1.2 Roadways: Kūhiō Highway

Road access to the Anahola Solar Project site is via Kūhiō Highway (Hawai'i Route 56). Route 56 is a 28-mile route stretching from Hawai'i Route 50 at the junction of Rice Street in Līhu'e to Ha'ena on the north shore of the island. The road itself is a major thoroughfare for travel to and from the eastern and northern parts of the island and is the principal means of access to communities in the project vicinity. The portion of the highway near the project site is a two-way, two lane roadway with a pavement width of 24 feet; 6-foot shoulders are present on both sides. Sight-distance in both directions is more than 1,000 feet. The posted speed limit is 45 miles per hour.

Several smaller roadways intersect Kūhiō Highway near the project site. To the north along Kūhiō Highway, the nearest intersection is at 'Ioane Road approximately 1,000 feet away. To the south the nearest intersection is at Makanani Street, approximately one mile away. There are multiple unnamed agricultural roads which also have ingress-egress points closer to the project site. In addition, the Anahola Hawaiian Homes Association (AHHA) community center and marketplace is located off an unnamed driveway on the mauka side of the highway, approximately 1,000 feet north of the project site.

Kūhiō Highway in the vicinity of the project site is a Class 2 rural minor arterial roadway.[60] The appropriate design level of service for minor rural arterials highways varies with level and rolling terrain is LOS "B" (see Table 5.27 for level of service definitions). The primary measures for service quality for two-lane Class 2 facilities such as Kūhiō Highway is the percent time-spent-following and average travel speed.

Table 5.28 summarizes peak-hour and total daily traffic volumes on Kūhiō Highway from the State Department of Transportation traffic count station B73005601278 located on Kūhiō Highway between ʻIoane Road and Hokualele Road, a short distance north of the project site. Based on these counts, the Department estimates average daily two-directional traffic of approximately 13,000 vehicles. Afternoon traffic volume is substantially higher than that in the morning, and the directionality of the trips differs considerably between the two periods as well.

As can be seen in Figure 5.21 below, two-way traffic volume increases sharply from overnight lows near zero to over 700 vehicles per hour by 8:00 A.M. It remains between 800 and 900 vehicles per hour through the remainder of the morning and early afternoon, before climbing to its peak of approximately 1,000 vehicles per hour between 3:00 and 5:00 P.M. The peak-hour factor is relatively low, with approximately 6 percent of the 24-hour volume occurring during the morning peak hour and 8 percent occurring during the busiest 60-minute period in the afternoon. The Level of Service (LOS) during the morning peak-hour is generally at the lower end of the "C" range; it is in the lower-middle part of the "C" range during the afternoon peak-hour.

Unlike many segments of the highway closer to Līhuʻe (where the traffic flow in the morning is predominantly towards that town), the directional splits near Anahola are usually quite even, with slightly fewer vehicles traveling northbound than are headed southbound (percentages on the four days in the table were 53%, 55%, 47%, and 51%. In the afternoon (when the volumes were higher than in the morning), the directionality was much greater, with southbound, i.e., Kapaʻa-bound, traffic accounting for about 60% of the two-way total.

[60] Island of Kauaʻi - Inset 4 – Kapaʻa-Wailua, Traffic Analysis Zones (TAZ) – DRAFT, Statewide and Regional Long-Range Land Transportation Plans for the Islands of Maui/Molokaʻi/Lanaʻi, Hawaiʻi and Kauaʻi.

Table 5.27 HCM 2-Lane Highway LOS Classification

Level of Service	*Description*
A	Motorists are able to travel at their desired speed. Without strict enforcement, this highest quality would result in average speeds of 55 mph or more on two-lane highways in Class 1. The passing frequency required to maintain these speeds has not reached a demanding level, so that passing demand is well below passing capacity, and platoons of three or more vehicles are rare. Drivers are delayed no more than 35 percent of their travel time by slower-moving vehicles. A maximum flow rate of 490 pc/h total in both directions may be achieved with base conditions. On **Class II highways**, speeds may fall below 55 mph, but motorists will not be delayed in platoons for more than 40 percent of their travel time.
B	Traffic flow is speeds of 50 mph or slightly higher on level terrain Class 1 highways. The demand for passing to maintain desired speeds becomes significant and approximates the passing capacity at the lower boundary of LOS B. Drivers are delayed in platoons for up to 50 percent of the time. Service flow rates of 780 pc/h total in both directions may be achieved with base conditions. On **Class II highways**, speeds may fall below 50 mph, but motorists will not be delayed in platoons for more than 55 percent of their travel time.
C	Flow increases, resulting in noticeable increases in platoon formation, platoon size and frequency of passing impediments. The average speed still exceeds 45 mph on level terrain Class 1 highways, even though unrestricted passing demand exceeds passing capacity. At higher volumes the chaining of platoons and significant reductions in passing capacity occur. Although traffic flow is stable, it is susceptible to congestion due to turning traffic and slow-moving vehicles. Percent time-spent-following may reach 65 percent of the time. Service flow rates of 1,190 pc/h total in both directions may be achieved with base conditions. On **Class II highways**, speeds may fall below 45 mph, but motorists will not be delayed in platoons for more than 70 percent of their travel time.
D	LOS D represents unstable flow. The two opposing traffic streams begin to operate separately at higher volume levels, as passing becomes extremely difficult. Passing demand is high, but passing capacity approaches zero. Mean platoon sizes of 5 to 10 vehicles are common, although speeds of 40 mph still can be maintained under base conditions on Class 1 highways. The proportions of no-passing zones along the roadway section usually has little influence on passing. Turning vehicles and roadside distractions cause major shock waves in the traffic stream. Motorists are delayed in platoons for nearly 80 percent of their travel time. Maximum service flow rates of 1,830 pc/h total in both directions may be achieved with base conditions. On **Class II highways**, speeds may fall below 40 mph, but in no cases will motorists be delayed in platoons for more than 85 percent of their travel time.
E	Traffic flow conditions have a percent time-spent-following greater than 80 percent on Class 1 highways and greater than 85 percent on **Class II**. Even under base conditions, speeds may drop below 40 mph. Average travel speeds on highways with less than base conditions will be slower, even down to 25 mph on sustained upgrades. Passing is virtually impossible and platooning becomes intense as slower vehicles or other interruptions are encountered. The highest volume attainable under LOS E defines the capacity of the highway, generally 3,200 pc/h in both directions. Operating conditions at capacity are unstable and difficult to predict. Traffic operations seldom reach near capacity on rural highways, primarily because lack of demand.
F	Represents heavily congested flow with traffic demand exceeding capacity. Volumes are lower than capacity and speeds are highly variable.
Source: *2000 Highway Capacity Manual*	

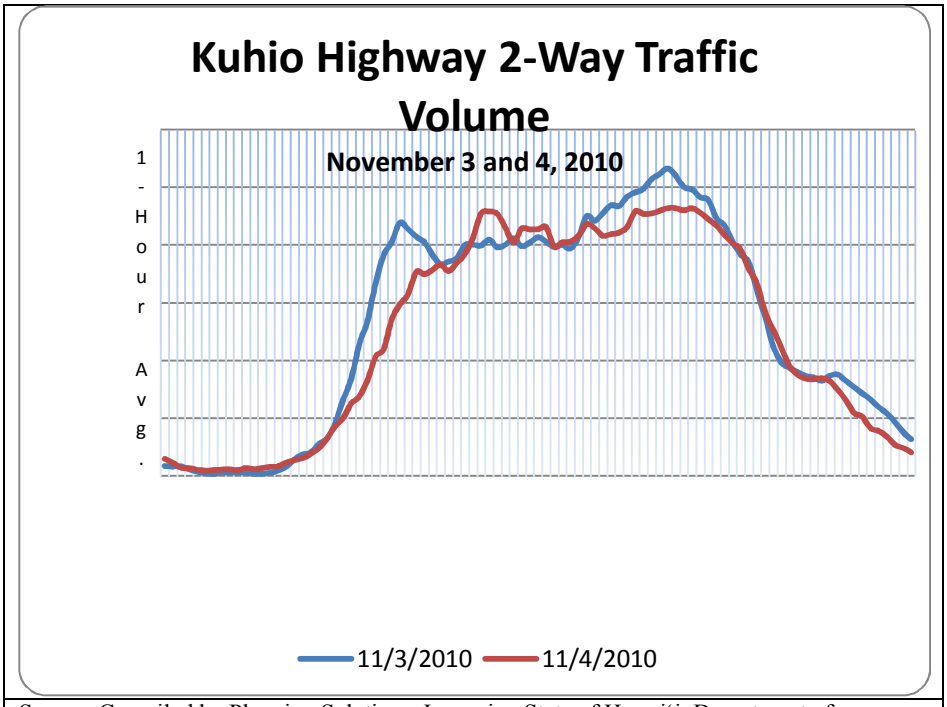
Table 5.28 Traffic Volume on Kūhiō Highway between ʻIoane Road and Hokualele Road

Date	*AM Peak Hour (vph)*					*PM Peak Hour (vph)*					*24-Hour Volume for Both Directions*
	Time	*North-bound*	*South-bound*	*Total*	*LOS*	*Time*	*North-bound*	*South-bound*	*Total*	*LOS*	
07/08/2010	6:00-7:00	458	161	619	**B**	3:00-4:00	407	636	1043	**C**	13,917
	7:15-8:15	439	395	834	**C**	3:45-4:45	475	663	1,138	**C**	
07/09/2010	6:00-7:00	347	227	574	**B**	3:00-4:00	485	673	1158	**C**	14,151
	7:15-8:15	451	376	827	**C**	3:30-4:30	501	673	1,174	**C**	
11/03/2010	6:00-7:00	356	410	766	**B**	3:00-4:00	387	642	1,029	**C**	12,482
	7:15-8:15	415	464	879	**C**	3:30-4:30	397	670	1,067	**C**	
11/04/2010	6:00-7:00	212	229	441	**A**	3:00-4:00	348	562	910	**C**	11,574
	7:45-8:45	364	344	708	**C**	3:30-4:30	361	568	929	**C**	

Note: Survey conducted on at Site ID: B73005601278 on Kūhiō Highway between Ioane Road and Hokualele Road. LOS estimate based on the following *2000 Highway Capacity Manual* criteria for service flow rates (with base conditions) in each direction: A = up to 780 passenger car equivalents/hr; B = up to 780 passenger car equivalents/hr; C = 1,190 passenger car equivalents/hr; and D = 1,830 passenger car equivalents/hr.

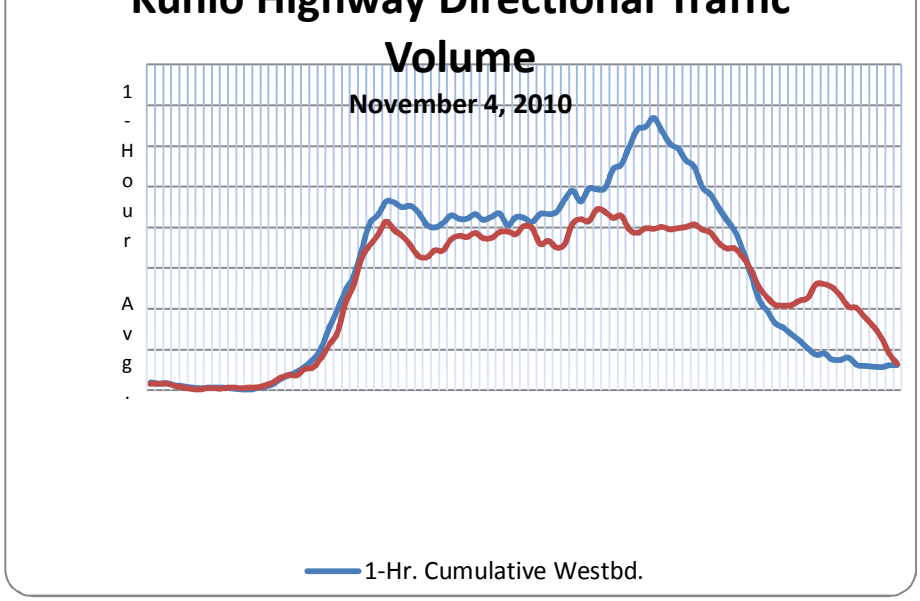
Source: State of Hawai‘i, Department of Transportation, Highways Division, Highways Planning Survey Section.

Figure 5.21 Two-Way Traffic Volumes on Kūhiō Highway



Source: Compiled by Planning Solutions, Inc. using State of Hawai‘i, Department of Transportation traffic counts from Site ID B73005601278 on Kūhiō Highway between Ioane Road and Hokualele Street.

Figure 5.22 Kūhiō Highway Directional Split



Source: Compiled by Planning Solutions, Inc. using State of Hawai'i, Department of Transportation traffic counts from Site ID B73005601278 on Kūhiō Highway between Ioane Road and Hokualele Street.

5.12.2 PROBABLE IMPACTS

Our assessment of the potential effects that construction and operation of the proposed facilities would have on area roadways began with estimates of the vehicle-trips that would be generated by each component of the project. This was done using construction employment estimates provided by REC Solar (the PV contractor) and by KIUC (which has considerable experience with previous substation construction projects and which has information on trips from its existing baseyard at Kapa'a). The same sources estimated other construction traffic that would result from the delivery of equipment and material. In the case of the solar array, the principal consideration was the delivery of the approximately 59,000 solar panels that are at the heart of the project. In the case of the substation, the volume of material that needed to be delivered was of less consequence than the size of a few pieces of equipment.

The proposed Anahola Solar project would affect traffic volumes on area roadways, and in particular, on Kūhiō Highway. Quantitative estimates of the change are presented below. Because the effect would vary substantially between the construction and operational phases, they are discussed separately.

5.12.2.1 Construction Phase Vehicle-Trip Generation

Construction-Worker Employment. Project-related construction will require workers to commute to and from their jobs on the project site, thereby adding to traffic along Kūhiō Highway. Construction employment will vary over the course of the work, rising and falling depending upon the specific type

of activity that is occurring. Table 5.29 shows estimated construction employment on the average day during the busiest month of construction.[61]

Table 5.29 Estimated Construction Work Force

Project Component	***Construction Employment*** *(Average Day During Peak Month)*		
	Residing to North	***Residing to South***	***Total***
Solar Array	25	55	**80**
Substation	5	10	**15**
PV/Substation Total	***30***	***65***	***95***
Service Center Total	***10***	***30***	***40***

Note: "Totals" assume that the busiest work day on the solar array and the substation will coincide. This is a "conservative" assumption (i.e., one that tends to overestimate the actual number) because they are not likely to occur at the same time. Work on the service center and baseyard facilities will not begin until after the other two components of the project are completed. Hence, the two phases will not have a cumulative effect.
The directional splits assume that approximately 25 percent of the work force will reside/come from the north and 75 percent will reside/come from the south.

Source: Compiled by Planning Solutions, Inc. using estimates from REC Solar and KIUC.

While it is unlikely that the peak month of construction activity for the two components (PV array and substation) will coincide, we have made the "conservative" assumption (i.e., the assumption that leads to the highest project-related traffic) that they will, leading to an estimated peak construction work force of 95 persons.

Construction Worker Vehicle-Trips and Vehicle-Trip Routing. The extent to which car-pooling will occur (which affects the number of persons per vehicle) and the place where construction workers reside (and, therefore, the place from which they will arrive-from/depart-to) will differ from phase to phase. The following are among the factors that influence these travel patterns:

Car-pooling (ride-sharing) is more common among construction workers who live well away from the project site, particularly those who are from off-island and/or work for subcontractors based elsewhere on the island, than it is for those who live nearby.

The changing balance between different trades over the course of the construction work will affect the location where workers reside while working on the project. The base work force (i.e., those who work on the project over most of its duration) will be most likely to reside in and around Anahola, and, therefore, to travel to and from the site from the north. The peak period work force will include more workers with specialty trades, and these are more likely to reside in their own homes or in rental units to the south.

[61] It is possible that the number of workers present may be slightly higher on a few days, but the overage would be small and would apply to no more than a few days during the month.

A portion of the peak-period work force is likely to include specialty trades who find it easier to commute to the island on a daily basin and who will, therefore, commute from and to the south (Līhu'e Airport).

In estimating the directionality of the worker commuter trips, we considered that REC has made a strong commitment to the Anahola community to recruit from the local work force to the greatest extent practicable. Accordingly, we have estimated that a substantial proportion of the individuals working on the project for longer periods of time are likely to reside in Anahola and other communities to the north and west of the project site. The remainder will drive to and from points south of the project site, such as Līhu'e and Kapa'a. When work at its very busiest, it is likely to be because in addition to the regular work force there are substantial numbers of specialists on the site, and most of them wound necessarily come from outside of the area.

In order to convert construction employment into vehicle-trips, it was necessary to estimate the average number of workers per vehicle. Vehicle occupancy is influenced by the same kinds of factors as directionality. Workers living relatively near the project site (particularly in the Anahola community) are less likely to car-pool than workers who are commuting from farther away. As that proportion changes in accordance with the kinds of work that is ongoing, vehicle occupancy changes as well. Based on input from individuals familiar with construction work on Kaua'i, Planning Solutions, Inc. estimated average vehicle occupancies during the peak month would be 1.1 workers per vehicle for trips to and from the north and 1.2 persons per vehicle for trips to and from the south.

Planning Solutions, Inc., combined these estimates of construction employee numbers, locations, and average vehicle-occupancies employee trip-timing estimates provided by REC Solar and KIUC to arrive at the construction worker vehicle-trip estimates shown in Table 5.30.

Table 5.30 Summary of Construction-Worker Vehicle-Trips

Period	*Time of Day*	*Solar Array*				*Substation*			
		In (from)		*Out (to)*		*In (from)*		*Out (to)*	
		N	*S*	*N*	*S*	*N*	*S*	*N*	*S*
Busiest Day	*6:00am to 7:00am*	23	67	0	0	4	9	0	0
	7:00am to 3:00pm	10	40	10	40	3	10	3	10
	3:30pm to 4:30pm	0	0	27	67	0	0	4	9
	4:30pm to 6:00am	3	7	3	7	1	3	1	3
	24-Hour Total	36	114	40	114	8	22	8	22
Average Day/ Busiest Month	*6:00am to 7:00am*	22	47	0	0	4	9	0	0
	7:00am to 3:00pm	8	32			3	10	3	10
	3:30pm to 4:30pm	0	0	26	56	0	0	4	9
	4:30pm to 6:00am	2	6	2	6	1	3	1	3
	24-hour Total	32	85	28	62	8	22	8	22

Notes: Estimates are for worker-trips only. Material and equipment delivery vehicle-trips are estimates separately.

Source: Compiled by Planning Solutions, Inc. using estimates by REC Solar and KIUC.

Equipment and Material Delivery Trips. Construction of the proposed project components will involve the importation of several relatively large pieces of diesel-powered equipment such as trucks,

bulldozers, and earthmovers. Many smaller pieces of equipment will be needed as well. This equipment will all have to be brought in from elsewhere on the island. In addition, construction activities will involve the transport of construction materials to the site, including photovoltaic modules, mounting racks, pull boxes and other electrical equipment, including transformers and electrical poles. Moderate quantities of gravel and other fill material will also be brought in from off-site. No large concrete pours are needed for the project, and it does not entail the import or export of significant quantities of earth or other bulk materials (i.e., excess cut or fill or select material). Hence, by far the most significant type of equipment and material delivery trips are expected to be related to the PV Panels. Altogether, approximately 59,000 panels will be used, and these will be trucked to the site as needed in standard 40-foot shipping containers.[62]

Based on preliminary construction plans, REC Solar anticipates approximately 250 truck deliveries will be made to the site and that these will be spread over several months. It estimates that during the peak construction months (months 3 through 6) there will be an average of 2 to 4 such materials deliveries per day, and has pledged to limit the number to no more than 8 per day. These will occur between 8:00 am and 3:00 pm and do not, therefore, overlap with the construction-worker trips.

Oversized Loads. A few deliveries (such as the steel structures for the substation) may require oversized loads. Transporting the largest items (e.g., steel structures for the substation) may produce oversized loads which require special police escort. If this occurs, its contractor will move the materials at off-peak hours, most likely in the early morning hours, when other traffic is minimal. The timing, together with the police escort, will minimize any slowdowns that might otherwise affect other motorists.

Clearing and Demolition Waste. There are no structures on the site which will need to be demolished prior to commencement of construction. Grubbing of the area to be used for both the solar array and, to a lesser extent, the substation will produce a significant amount of green waste, but this would be kept on-site.[63]

Fill Material. Small amounts of select fill (e.g., gravel) may need to be imported. In general, however, cut and fill is expected to be balanced within the project site, avoiding the need for substantial offsite material hauling.

5.12.2.2 Construction Phase Vehicle-Trip Generation

PV Array and Substation. Construction of the PV arrays and substation will not require any temporary lane closures or other actions that would affect the roadway system's ability to accommodate normal traffic flow.[64] Hence, the only mechanism through which those components of the proposed project could adversely affect the level of service on area roadways is through the temporary increase in traffic that the proposed project would cause.

The cumulative totals shown in Table 5.31 reflect the busiest levels of project-related construction traffic.[65] Table 5.31 shows the effect that project-related traffic would on the number of vehicles

[62] Because of their value, REC Solar anticipates that they will be stored off-site in a bonded warehouse until shortly before they are used, then trucked to the site.

[63] As discussed in Section 5.11, small amounts of potentially hazardous material left by previous activities remains on the site. It is possible that some of this material will need to be removed from the site and disposed of. The volume of this material is small and will lead to no more than a few truck trips.

[64] A possible exception to this would occur if the contractor determines that this is needed during the delivery of a few oversize pieces of equipment and/or KIUC deems a lane closure necessary for safety reasons during a few hours on the day that the overhead power line connecting the substation to the existing 69 kV and 12.47 kV power lines within the Kūhiō Highway right-of-way is needed for safety reasons.

[65] Readers should note that the morning peak 60-minute period on the highway at this location actually occurs between 7:15 am and 8:15 am. This is slightly later than the peak project traffic, but the difference is small and to avoid unnecessary complications, we have assumed that the project peak and existing highway peak are the same.

during the peak-hour of the highway (which in this case is nearly the same as the period during which the proposed project would generate the greatest number of vehicle-trips). It indicates that construction traffic would increase peak-hour totals by a little less than 9 percent in the morning and a little more than 7 percent in the afternoon. However, because the trips will be split between areas north and south of the project site, the actual effect on the volume at any one location would be substantially less.

Table 5.31 Impact of Peak Construction-Period Traffic on Highway Volume

Time Period	*Existing Kūhiō Hwy. (vehicle-trips per hour)*			*Anahola Solar Project Construction Totals*			*Project as % of Total*
	North-bound	*South-bound*	*Total*	*In-bound*	*Out-bound*	*Total*	
Morning: Highway Peak-Hour (7:15 a.m.-8:15 a.m.)	415	464	879	77	0	77	8.76%
Afternoon: Highway Peak-Hour (3:30-4:30 p.m.)	397	670	1,067	0	77	77	7.22%
Source: Anahola Solar Project estimates by Planning Solutions, Inc.							

The contractor will be required to prepare and obtain State Department of Transportation approval of a detailed traffic control plan prior to beginning work. KIUC anticipates that the plan will include provisions (e.g., the use flag men, designated arrival/departure routes that do not require vehicles entering and leaving the construction site to cross in front of opposing traffic, etc.) to minimize potential delays. Nonetheless, a small decrease in the level of service can be anticipated during the peak commute hours. Project-related construction traffic is sufficiently low during the middle part of the day (i.e., 8:00 a.m. to 3:00 p.m.) that no noticeable degradation in the level-of-service will occur.

Service Center. The Service Center will require a construction work force no more than a third the size of that needed to construct the solar array/substation components of the project. It will, therefore, generate proportionately fewer worker vehicle commute trips. The level of construction-vehicle travel on the highway during the middle part of the day will be much lower as well. In view of this, construction-vehicle traffic from this component of the project does not have the potential to measurably reduce the level of service on Kūhiō Highway.

At the same time, the Kūhiō Highway intersection that will be required to accommodate the service center and baseyard will require work within the existing highway right-of way that is certain to entail temporary lane closures during the middle of the day and the other temporary changes to the roadway that will have the potential to adversely affect traffic flow. While KIUC will develop and implement a traffic control plan designed to minimize the adverse effects of such work, delays will be recurrent over the 6 to 9 month period that it will take to complete the highway improvements.

5.12.2.3 Operational Phase Trip-Generation

Normal operations and regular maintenance (e.g., washing of the photovoltaic modules, trimming vegetation, applying herbicides, etc.) of the proposed project does not involve activities with the potential to significantly affect transportation facilities. No significant impacts to offsite traffic volumes are predicted during the operational phase. Occasional maintenance trucks would access the site, but this would represent no more than two vehicle-trips per day during typical business hours. Thus, none of the proposed project activities are expected to generate significant additional trip volume on public roads.

The service center and baseyard activities will generate relatively low numbers of vehicle trips, almost certainly no more than 20 vehicle-trips per hour. Given the small number and the intersection improvements that KIUC will make as part of the project, these do not have the potential to adversely affect the level off service. It should be noted that the activities that KIUC proposes to shift to the new service center and base yard are already occurring elsewhere on the island. This means that in many cases there will be a corresponding decrease in the number of vehicles traveling on other segments of the island roadway. As the areas where the reductions will occur are generally more heavily travelled (and congested) than are those in the vicinity of the proposed project, the net benefit on the level of service is likely to be positive when all areas are considered.

5.13 SOCIOECONOMIC FACTORS AND ENVIRONMENTAL JUSTICE

5.13.1 EXISTING CONDITIONS

As of the 2010 Census, the project site is located within the new Anahola Census Tract 9400, which encompasses 55.17 square miles. The resident population of this area was 3,715, representing about 5.5 percent of the island's population of 67,091. According to the 2010 American Community Survey, median household income in Kauai County was somewhat lower than the State average, at $55,723 compared with $63,741.[66] Unemployment within the civilian labor force was 4 percent, 4 percent lower than the countywide average of 8.5 percent.[67]

Executive Order (EO) 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires federal agencies to consider impacts that may arise from human health or environmental effects of a project on either minority or low-income populations. The EO states that, "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health of environmental effects of its programs, policies, and activities on minority populations and low-income populations." A Presidential Memorandum accompanying the EO directed agencies to incorporate environmental justice concerns into their NEPA processes and practices.

Environmental justice issues are identified by determining whether minority or low-income populations are present in the project site. If so, disproportionate effects on these populations should be considered. The Council of Environmental Quality (CEQ) guidance states that minority populations should be identified when the percentage of minority residents in the affected area exceeds 50 percent or is meaningfully greater than the percentage of minority residents in the general population (CEQ, 1997). If the percentage of minority residents of the population in the project site census tract exceeds the county level by more than 10 percent, it is considered to be "meaningfully greater" for the purpose of analysis. The CEQ guidance also states that the low-income populations should be identified based on poverty thresholds as reported by the U.S. Census Bureau. If the poverty rate for the population of the project site census tract exceeds the county poverty rate by more than 10 percent, it is considered to be an area of environmental justice concern for the purposes of analysis. Table 5.32 summarizes the relevant comparative data between Tract 9400 and the County of Kaua'i for an assessment of environmental justice.

[66] American Community Survey 5-Year Estimates Hawaii Geographic Area Profiles, Census Tracts Neighbor Islands.

[67] U.S. Bureau of Labor Statistics for 2011, not seasonally adjusted.

Table 5.32 Comparative Data for Environmental Justice Analysis

Comparative Data for Environmental Justice Analysis		
Race	***Census Tract 9400 (Anahola)***	***Kaua'i County***
	Percentage	***Percentage***
White	29.9	33.0
Black	0.3	0.4
Native American & Alaskan	0.5	0.4
Asian	9.4	31.3
Native Hawaiian & Pacific Islanders	26.1	9.0
Mixed	33.3	24.9
Other	0.5	0.9
TOTAL MINORITY	70.1	67.0
White	29.9	33.0
TOTAL	100	100
Percentage of Population With Income Below Poverty Level		
Anahola	***Kaua'i County***	
13.1	13.2	
Source: U.S. Census Bureau, 2007-2011 American Community Survey		

The Kawaihau Planning District extends from Wailua in the south to Moloa'a in the north, and encompasses the communities of Wailua, Kapa'a, and Anahola, as well as the entire project site. The *Kauai General Plan* (2000) 6.2.4.2(a)(1) states policy for regional growth and public facilities in the Kawaihau Planning District: "Locate new growth in and around the Waipouli-Kapa'a urban center and on DHHL lands in Anahola." It further states that, under the guidance of the Department of Hawaiian Homelands long-range master plan, Anahola will continue to be developed with additional homes, farm homesteads, and ancillary infrastructure.

DHHL's *Anahola, Kamalomalo'o, Moloa'a Regional Plan* (June 2010), which is the most recent of its many plans for the area, notes that DHHL owns 4,228 acres in Anahola and Kamalomalo'o extending from the shoreline mauka to the Keālia. It notes that Anahola is the largest Hawaiian homestead community on Kaua'i, but that most of the land remains undeveloped and unused by homesteaders. It provides the following summary of leases as of 2009: (*i*) 529 residential leases on 165 acres; (*ii*) 47 agricultural leases on 241 acres; and (*iii*) 154 acres of pasture and commercial uses short term leases.

In 1987, DHHL commissioned a comprehensive land use development plan which analyzed all DHHL lands in Anahola and made corresponding land use recommendations. The 1987 Anahola/Kamalomalo'o plan envisioned the area as a contemporary *ahupua'a* and provided for a mixture of land uses: cultural, homestead, agriculture, pastoral, income-generating and public services. In 2004, DHHL produced the Kaua'i Island Plan, which increased the residential land use areas, reflecting DHHL's emphasis on residential awards and therefore ensuring that Anahola would continue to be the largest residential homestead area on the island of Kaua'i.

DHHL's plan also call for commercial facilities, reserve areas, and other services to be located along the highway, south of the main residential area of Anahola. The plan anticipates continued growth to

the residential population of the east coast of the island, but at a slower rate than in the 1970-2000 period. The general intent of the re-designations is to increase residential and employment opportunities in the area, to provide lands for that urban residential growth, and to provide adequate infrastructure to meet this expanding residential base in the Waipouli-Kapa'a urban corridor. A critical part of DHHL's plan is the Ho'omaluō Energy Policy intended to enable the native Hawaiian and other citizens of the state to work together towards a self-sufficient and sustainable energy supply. The project's consistency with this policy is discussed at length in Section 6.2.2.

5.13.2 PROBABLE IMPACTS

As can be seen in Table 5.32, the total minority population in Census Tract 9400 is not meaningfully higher than the County as a whole; readers should note that the total minority population of both the County and the Anahola Census Tract exceeds 50 percent. However, the percentage of residents in Census Tract 9400 (70 percent) is nearly the same as the County average (67 percent). As such it does not represent a meaningful concentration of poverty or a source of environmental concern, particularly given the close cooperation the community has given to the proposed project.

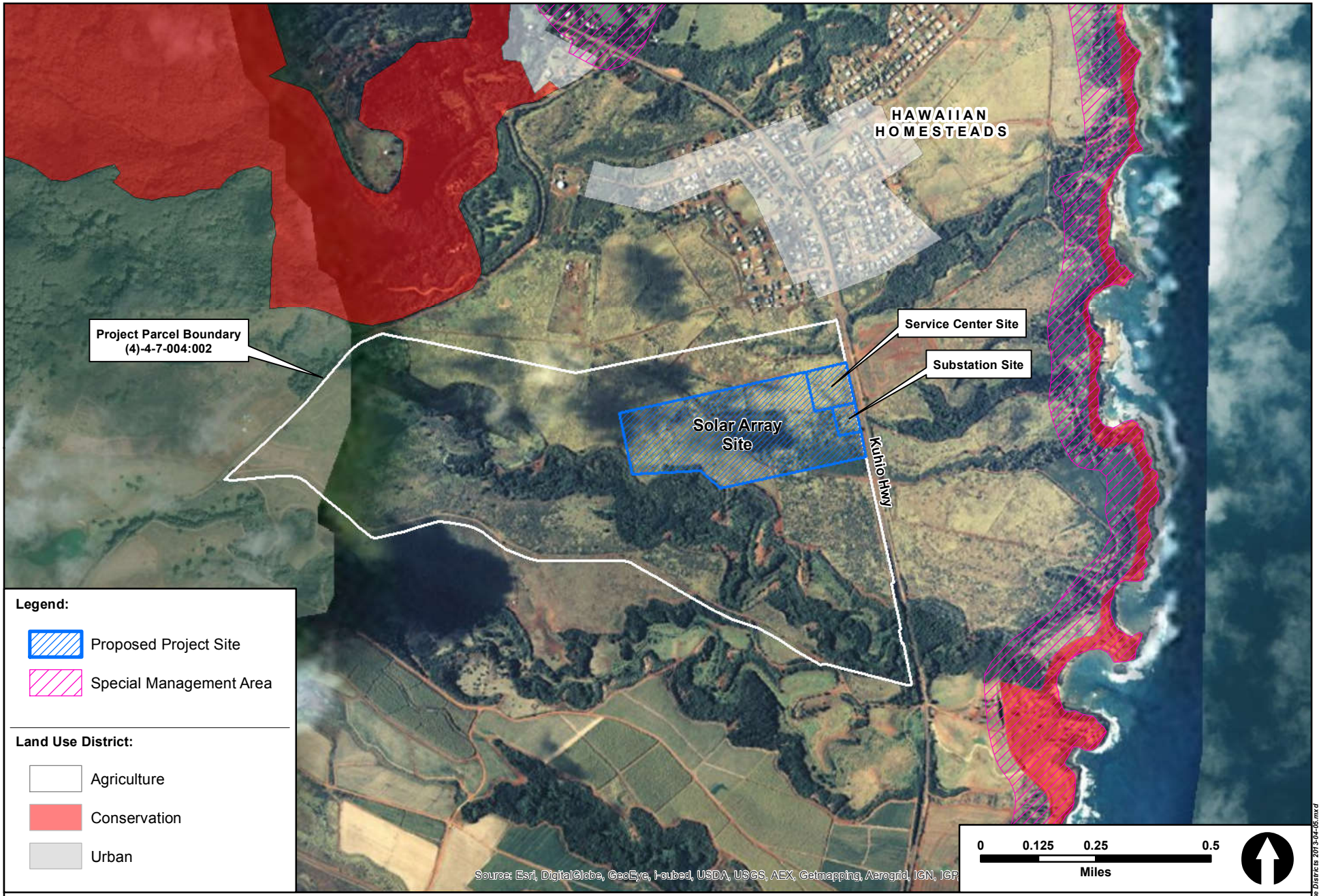
The project site is directly adjacent to the Kūhiō Highway right-of-way. The entire project site is located in the State "Agriculture" district, and the County of Kaua'i "Agriculture" zoning districts. While the proposed Anahola Solar Project would be located on DHHL which is not subject to State and County land use regulations, the proposed project is an allowable use under these designations conforming to their purpose and intent. Figure 1.4 contains photographs of existing conditions on the project site. Figure 5.23 shows state land use districts in the project site. Figure 5.24 depicts the county zoning near the project site.

According to the *Kaua'i Economic Development Plan* 2005-2015, the visitor industry generates about one-third of Kaua'i's real income in a typical year.[68] The plan recognizes that the visitor industry is a mature industry and is a critical component of Kaua'i's economic future. The areas within the Kawaihau Planning District communities and roadways were originally laid out for agricultural homesteads during the Territorial Government, with limited interconnections. The policies on regional growth are intended to support growth within the Kapa'a-Wailua area and on the DHHL lands at Anahola (Kaua'i General Plan 2000).

Table 5.33 Parcels Neighboring the Anahola Solar Project

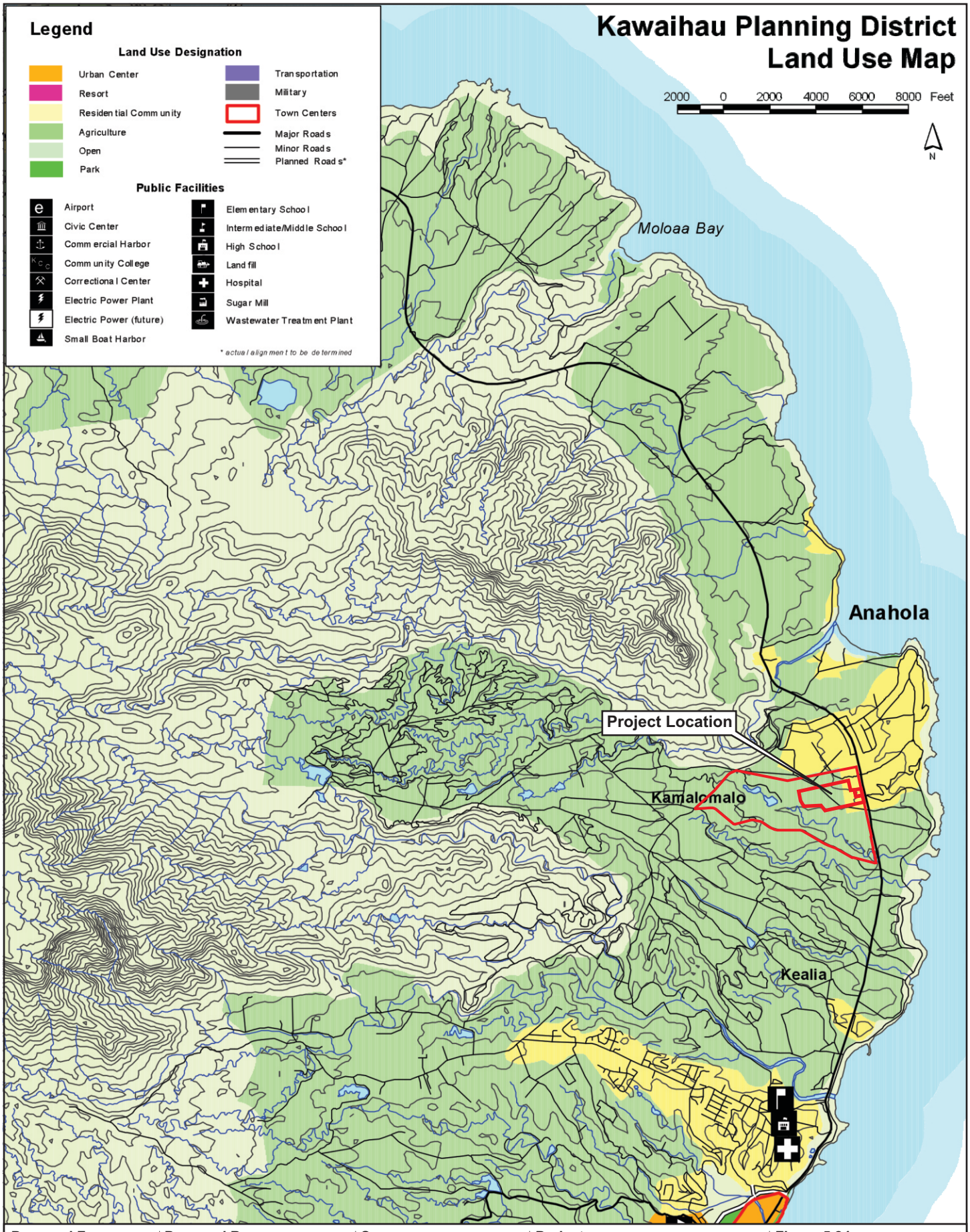
Parcel TMK No.	*Listed Owner*	*Tax Acres*
(4)4-7-004:001	Cornerstone Hawaii	1066.096
(4)4-7-002:003	Cornerstone Hawaii	1679.883
(4)4-7-002:004	Department of Hawaiian Homelands	994.12
(4)4-7-004:007	Department of Hawaiian Homelands	227.438
(4)4-8-003:004	Department of Hawaiian Homelands	35.72
(4)4-8-003:006	Department of Hawaiian Homelands	360.204
(4)4-7-004:999	State of Hawai'i	0
(4)4-8-003:999	State of Hawai'i	0
Note: The TMK numbers ending in 999 are part of the Highway Right of Way and are not subject to taxation.		
Source: State of Hawaii GIS (2011)		

[68] University of Hawai'i, Economic Research Organization, *Kaua'i Economic Outlook*, prepared for the County of Kaua'i, June 14, 2004.



Prepared For:	Prepared By:	Source:	Project:	Figure 5.23:
Kaua'i Island Utility Cooperative	PLANNING SOLUTIONS	-State of Hawai'i GIS -County of Kaua'i GIS ESRI	KIUC Anahola Solar Project	**Land Use Districts & Special Management Area**

Figure 5-23 State Land Use Districts 2013-04-05.mxd



Prepared For:	Prepared By:	Source:	Project:	Figure 5.24:
KIUC	PLANNING SOLUTIONS	Kauai County General Plan November 2000	KIUC Anahola Solar Project	Kawaihau Planning District Land Use Map

Figure 5-24 Kawaihau Planning District Map 2013-04-05.cdr

KIUC believes that the proposed project is compatible with, and in the interest of, the planned for and intended use of the area. Aside from the temporary construction employment it would generate, and the expenditures which it would create, the project would create infrastructure which will accommodate the future growth and economic activity in the area. The project is intended to accommodate customers who already reside in the northeast and North Shore communities of the island who currently must travel to Kāpa‘a to meet with KIUC planners. By improving customer access and increasing the reliability of electricity in the area, this project will have a positive impact on the socio-economic environment. No persons will be displaced by the proposed project.

5.14 RECREATION & SHORELINE ACCESS

5.14.1 EXISTING CONDITIONS

The County of Kaua‘i operates 15 parks encompassing 211 acres of land in the Kawaihau Planning District, which includes Anahola. These include athletic fields, playgrounds, beach parks, and playing courts. There are two parks within a mile of the proposed project: Anahola Hawaiian Homes Park approximately 1,650 feet away, and Anahola Beach Park, one mile away, both in a northerly direction. Anahola Hawaiian Homes Park has a community pavilion, playing courts, and a playing field. Anahola Beach Park accommodates typical beach activities including, but not limited to, picnicking, camping, swimming, surfing, and fishing.

5.14.2 PROBABLE IMPACTS

The existing parks in the area are separated from the project site by significant distances, intervening roadways, and terrain. While the new facilities—screened by vegetation—could be visible from the highway, none of them would be seen from the parks in the area. None of the new facilities or the work required to construct them would obstruct access to area beaches or shoreline. Construction and operation of the proposed facilities will not generate noise or air emissions that have the potential to adversely affect the existing recreational experience in the area. Neither will it generate sufficient vehicular traffic or changes in water quality that could degrade available recreational experiences. Consequently, no recreational or shoreline access impacts are anticipated.

5.15 SUMMARY OF MITIGATION MEASURES

Table 5.34 summarizes the mitigation measures introduced in this chapter.

Table 5.34 Summary of Mitigation Measures

Section	Committed Mitigation Measures
5.1 – Topography, Geology & Soils	None
5.2 – Hydrology	Maintain existing patterns and avoid increase in storm water runoff. Implement Best Management Practices (BMP) in NPDES Permit.
5.3 – Climate/Micro-Climate	None
5.4 – Air Quality	Implement construction minimization measures as called for in Section 5.4.2.1
5.5 – Biota	Implement vegetation management plan contained in Appendix C. Refrain from trimming woody vegetation in excess of 15 feet height between June 1 and September 15.
5.6 – Noise	Equip trucks using service center with broadband noise back-up alarms
5.7 – Archaeological, Historical, & Cultural Resources	If undocumented cultural properties are encountered, KIUC will, at a minimum: (i) immediately cease all work in the area; and (ii) notify the State Historic preservation Division to assess impacts. As appropriate, further mitigation measures would be proposed and coordinated with SHPD.
5.8 – Natural Hazards	Design to appropriate standards as discussed in Section 5.8.
5.9 – Scenic & Aesthetic Resources	Erect and maintain landscape screens as proposed.
5.10 – Public Infrastructure	Install water and telecommunications connections as proposed.
5.11 – Hazardous Materials	Implement recommendations in HAZTECH Phase 1 report.
5.12 – Transportation Facilities	Construct highway intersection improvements before occupying service center.
5.13 – Socioeconomic/ Environmental Justice	None.
5.14 – Recreation and Shoreline Access	None. -

THIS PAGE WAS INTENTIONALLY LEFT BLANK

6. CONSISTENCY WITH EXISTING POLICIES, CONTROLS, AND LAND USE PLANS

In accordance with the requirements of HAR §11-200-17 (h), this chapter discusses the relationship of the proposed Anahola Solar Project to land use plans, policies, and controls for the area. KIUC has evaluated the solar array, substation, and service center for consistency with these regulations. It has also identified the extent to which the proposed project would conform or conflict with objectives and specific terms of approved or proposed land use plans, policies, and controls.

The discussion is organized first by jurisdiction (county, state, or federal) and then by specific ordinance, regulations, or law. This is followed by a listing of the required permits or approvals. An important consideration is that the proposed project is planned to be located in Anahola, Kaua'i on approximately 60 acres of land owned by the Department of Hawaiian Home Lands (DHHL). DHHL will lease the land to the Homestead Community Development Corporation (HCDC), a Hawaiian non-profit corporation. HCDC will in turn sublease the land to KRS One, a subsidiary of KIUC. Because of the unique situation on DHHL lands, not all land use classifications and county zoning regulations—from which DHHL lands are exempt—are applicable. However, KIUC believes that, despite DHHL's exemption, the proposed project is consistent with the rules and regulations which would typically apply.

6.1 COUNTY OF KAUA'I

6.1.1 KAUAI COUNTY GENERAL PLAN

6.1.1.1 Relevant Provisions

The *Kaua'i County General Plan* is the primary document covering long-range and comprehensive development, land use, and allocation of land and water uses within the County of Kaua'i. It serves as the enabling legislation establishing the framework, parameters, constraints, and guidelines for the County's Development Plans, Comprehensive Zoning Ordinance (CZO), infrastructure master plans, and capital improvement programs. The General Plan also establishes the geographic areas of the county to be utilized or developed for various purposes, such as agriculture, open space, communities, and resorts. Other ordinances and regulations (e.g., the CZO) regulate specific uses within these areas. As discussed below, the proposed project is consistent with the provisions of the *Kaua'i County General Plan*. The purpose of the plan is reproduced below in italics:

> *1.2 Purpose of the General Plan*
>
> *The General Plan fulfills the legal mandates of State law and the Charter of the County of Kauai. More importantly, it provides guidance for land use regulations, the location and character of new development and facilities and planning for County and State facilities.*

In that plan, the objective of land use policy related to growth is described as follows:

> *5.1.2 Policy for Future Growth*
>
> *(a) Allow for incremental growth of Towns, contiguous to existing development. Concentrate primary shopping facilities within the Town Center. Support infill development.*
>
> *(b) Provide for build-out of existing Residential Communities, to include areas zoned R-1 or higher. Allow small, neighborhood-oriented commercial sites in Residential Communities.*

(c) In the outlying West Side and North Shore districts, plan for additional residential use to meet regional demands for housing.

The proposed Anahola Solar Project is within the Kawaihau Planning District identified on approved county plans and is intended to meet its growing need for reliable, renewable electrical service. The proposed project's physical design is consistent with existing uses, although it represents an intensification of the utility's presence along Kūhiō Highway, and in the area in general. Attention is given in the plan to balancing urban development in the area with the unique rural character and scenic views which residents of the area value:

6.2 Kawaihau

The Kawaihau district extends from the Wailua River north to Moloa'a, including the Kapa'a-Wailua basin, Keālia and Anahola. The Kapa'a-Wailua basin is home to a large portion of Kaua'i's population. An urban corridor extends along Kūhiō Highway from Haleilio Road in Wailua to Kawaihau Road, at the northern edge of Kapa'a Town.

6.2.1 Community Assets

During the 1988-99 General Plan Update process, Kawaihau residents and business people attending community meetings listed the assets of their communities. The entire list was long and diverse and is available in the GP Update Working Papers. Following is a selection of assets related to the Kawaihau District, particularly the physical environment:

- *Rural scenery, open space, and agricultural lands.*
- *Scenic mountain views.*
- *Recreational opportunities—beaches, ocean, mountains.*
- *Walking paths and bridges.*
- *Plantation town heritage.*
- *Working Town environment.*

It was with concern for this grassroots desire to preserve visual resources, the natural environment, and the opportunities which it affords that the land use policies were mapped out and areas set aside for regional growth:

6.2.4.2 Policy

(a) Regional Growth and Public Facilities

(1) Locate new growth in and around the Waipouli-Kapa'a urban center and on DHHL lands in Anahola.

(c) Support agricultural, residential, and limited commercial development of the Hawaiian Home Lands at Anahola, with the recommendation that projects be sited to avoid the appearance of strip development along the highway and that the highway frontage be enhanced with landscaping.

The proposed project will be constructed on DHHL lands in Anahola, as supported by the *Kaua'i County General Plan*. In addition, the *Kaua'i County General Plan* promotes a move away from dependence on fossil fuels for energy production and towards clean, renewable energy production:

7.7 Energy

> *In the long term, energy generation and use on Kauai will be affected by the cost of imported fuels, technological innovations in energy generation, and deregulation of energy utilities. The cost of imported fuel will drive innovation and encourage energy self-sufficiency. Future development of fuel cell technology and cost-effective photovoltaic generation may enable households and businesses to generate much of their own electrical energy. This in turn may reduce the need for distribution systems. It may also enable broad use of net metering, by which individual establishments can sell energy back to the utility.*
>
> *Purchase of fuel constitutes a substantial flow of money out of the local economy. Replacement of imported fuel with renewable energy produced on Kauai would provide jobs and retain money to circulate and strengthen the island's economy. Opportunities include generating energy from solid waste or from biomass crops; producing liquid fuels from biomass crops; and developing solar and wind generation facilities, either large- or small-scale. Developing additional hydro-electric power should be considered.*

6.1.1.2 Conformance with the Plan

The proposed Anahola Solar Project is in conformance with the *Kaua'i County General Plan*. The plan sets out regional policies that encourage the orderly development of resources and infrastructure for all members of the community. The proposed project meets all applicable design standards. It is also consistent with the stated policy objectives for the Kawaihau Planning District, which specifically calls for development on DHHL lands in Anahola in support of measured residential and commercial growth. The proposed project is allowable under the existing state and county zoning and development regulations. Construction and operation of this project would not produce substantial air or noise emissions which would disturb existing or planned uses on adjacent properties.

6.1.2 COUNTY OF KAUA'I LAND USE ORDINANCE

Pursuant to HRS §205-2, the County of Kaua'i establishes the permitted uses for zoning districts in the Comprehensive Zoning Ordinances (CZO). The purpose of the CZO is to regulate land use in a manner that will encourage orderly development in accordance with adopted land use policies. It does this by establishing zoning districts and specifying the kinds of development and development standards that must be adhered to within each zoning district.

The Anahola Solar Project is located in the County Agriculture District. The proposed facilities are consistent with the applicable height limitations, setback requirements, and other design standards of this zoning district (CZO §8-7.6). As discussed in Chapter 3, the construction of the proposed project is not expected to significantly impact surrounding properties with more sensitive zoning and land uses. If this project were not exempted, it would require a Class IV Use Permit. If such a permit were being sought, it appears as though this project would satisfy all of the conditions and restrictions contained in the applicable section of the CZO (e.g., lot size, setbacks, and height limits).

6.2 STATE OF HAWAI'I

6.2.1 HAWAI'I STATE PLAN

The *Hawai'i State Plan* is intended to guide the long-range development of the State by:

- Identifying goals, objectives, and policies for the State and its residents;
- Establishing a basis for determining priorities and allocating resources; and

- Providing a unifying vision to enable coordination between the various counties' plans, programs, policies, projects and regulatory activities to assist them in developing their county plans, programs, and projects and the State's long-range development objectives.

The *Hawai'i State Plan* is a policy document. It depends upon implementing laws and regulations to achieve its goals. The sections of the *State Plan* that are most relevant to the proposed project are Sections 226-18(a) and (b), which establish objectives and policies for energy facility systems. These sections are reproduced in italics below, and the proposed project's consistency with them is discussed.

§226-18 Objectives and policies for facility systems—energy/telecommunications.

(a) Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:

(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;

(2) Increased energy self sufficiency.

(b) To further achieve the energy objectives, it shall be the policy of the State to:

(1) *Support research and development as well as promote the use of renewable energy resources.*

Discussion: The proposed project would contribute to the efficiency of KIUC operations while maintaining or improving environmental quality and maintaining costs to KIUC customers at a reasonable level. It would also decrease KIUC's dependence on imported fuel to meet the growing energy needs of the Kaua'i community by promoting the use of a renewable energy resource. Therefore the project is consistent with this provision of the *Hawai'i State Plan*.

6.2.2 DEPARTMENT OF HAWAIIAN HOME LANDS

6.2.2.1 Relevant Position

DHHL has developed the Ho'omaluō Energy Policy intended to enable the native Hawaiian and other citizens of the state to work together towards a self-sufficient and sustainable energy supply. In July, 2009, DHHL entered into an energy partnership with Kaua'i Island Utility Cooperative to work towards these ends. As formalized in the *Anahola Regional Plan* (2010) the partnership agreed to the following (DHHL, 2010):

- *Pursuing opportunities that support economic self-sufficiency and contribute to Hawaii's Clean Energy Initiative through leasing lands owned by DHHL for renewable energy projects;*
- *Incorporating renewable energy technologies into existing homesteads;*
- *Conducting outreach programs to educate and encourage the public to live a "green" lifestyle;*
- *The DHHL-KIUC Energy Partnership agrees to collaborate to achieve critical energy objectives;*
- *Assist homesteaders in their efforts to affordably incorporate energy efficiency into their own homes;*
- *Showcase the Homestead Energy Program and the retrofitting of energy saving devices in existing homesteads, including but not limited to solar water heating systems and compact fluorescent light (CFL) fixtures;*

- *Helping advance the commercialization of developing green technology by identifying appropriate opportunities for demonstration of such technology in the Department's projects;*

In pursuit of these objectives, the Hoʻomaluō Energy Policy was crafted with five critical objectives. Objective 2 is as follows:

> ***Koʻo*[69]*:*** *Facilitate the use of diverse renewable energy resources.*
>
> *Activities:*
>
> - *Identify properties in DHHL's land inventory that have potential for renewable energy projects.*
> - *Pursue the leasing of those lands that are identified as suitable for renewable energy projects. (First priority should be given to entities that would provide "firm" renewable energy power such as garbage-to-energy (mass-burn), geothermal, pump storage, hydropower, solar-thermal and second priority to "as-available" renewable energy power such as wind, solar-photovoltaic, and wave.)*
> - *Encourage existing and future general lessees and licensees of DHHL's properties to design and build their facilities so that they are energy and resource efficient.*
> - *Seek partnerships for the development of renewable energy resources. In this connection, build relationships that could assist DHHL on non-energy related issues.*
> - *Evaluate DHHL's available authorities/powers that could expedite renewable energy projects for the State of Hawai'i.*
> - *Seek innovative processes to provide reliable electricity, by assisting electric utilities (in a world where energy is an essential but very limited resource) to reduce Hawaii's dependency on fossil fuels.*

DHHL views KIUC's Anahola Solar Project as an important opportunity to work towards these and other objectives of its Kaua'i Island Plan, Anahola Regional Plan 2010, and the Hoʻomaluō Energy Policy, as evidenced by its cooperation with KIUC in subleasing its land through the Homestead Community Development Corporation.

6.2.2.2 Conformance with the Policy

The proposed Anahola Solar Project conforms to the stated objectives of the Anahola Regional Plan 2010, the DHHL-KIUC Energy Partnership, and DHHL's Hoʻomaluō Energy Policy. The Anahola Regional Plan 2010 presents the energy partnership with KIUC as a key component of its goal of sustainable development in the area. The Hoʻomaluō Energy Policy specifically identifies photovoltaic facilities sited on DHHL lands as a priority objective. By utilizing DHHL lands and authority to promote self-sufficient and sustainable energy production for the benefit of the native Hawaiian and broader island community the Anahola Solar Project would be compatible with DHHL goals and policy. In addition to supporting its energy policy, the proposed project would also, generate funds to support other DHHL objectives through the revenues generated by its sublease to KRS One.

[69] In the Hawaiian language *koʻo* has the meaning of supporting, bracing, propping, or helping. Here it has the meaning of DHHL actively working to help the implementation of clean, renewable energy projects.

6.2.3 PUBLIC UTILITIES COMMISSION

The State of Hawai'i, Department of Regulatory Agencies under Title VII – Public Utilities Commission has propagated General Order No. 7 Standards for Electric Utility Service in the State of Hawai'i. Under Section 7.5 Interruptions of Service it states:

> *Each utility shall make reasonable efforts to avoid interruptions of service…*

Currently, the North Shore of Kaua'i is an area where power outages have been an ongoing issue. One of the principle objectives of the proposed project, as noted in, is to improve system reliability to customers on the North Shore by breaking the Kapa'a-Princeville transmission corridor into two segments and by providing additional voltage support. Thus, the Anahola Solar Project is intended to meet KIUC's mandate to provide uninterrupted power to its clientele.

6.2.4 CHAPTER 205, HAWAI'I REVISED STATUTES - LAND USE LAW

Chapter 205, Hawai'i Revised Statutes (HRS), establishes the State Land Use Commission (SLUC) and gives this body the authority to designate all lands in the state as Urban, Rural, Agricultural, or Conservation District lands. The Counties make all land use decisions within the Urban Districts in accordance with their respective County general plans, development plans, and zoning ordinances. The counties also regulate land use in the state Rural and Agricultural Districts, but within the limits imposed by Chapter 205.

The Anahola Solar Project is in the State Agricultural District. Hawai'i Revised Statutes §205-2 defines allowable activities within the Agricultural District, in part, as follows:

> *(d)(6) Solar energy facilities; provided that this paragraph shall apply only to land with soil classified by the land study bureau's detailed land classification as overall (master) productivity rating class D or E;*

In addition, HRS §205-4.5 Permissible uses within the agricultural districts, states:

> *(a) Within the agricultural district, all lands with soil classified by the land study bureau's detailed land classification as overall (master) productivity rating class A or B shall be restricted to the following permitted uses:*
>
> *(7) Public, private, and quasi-public utility lines and roadways, transformer stations, communications equipment buildings, solid waste transfer stations, major water storage tanks, and appurtenant small buildings such as booster pump stations, but not including offices or yards for equipment, material, vehicle storage, repair or maintenance, treatment plants, corporation yards, or other small structures;*

The land which has been identified as the preferred alternative in this document has been classified by the Land Study Bureau as being class "B"; thus the proposed project is not an allowable use of land in the Agricultural District without a Special Use Permit, under typical circumstances.

Because the project is larger than 15 acres, this permit would have to be approved by the State of Hawai'i Land Use Commission, as opposed to the County of Kaua'i. However, because this project involves use of lands owned entirely by the Department of Hawaiian Home Lands, and because DHHL lands are not subject to the State's land use classifications and county zoning designations, this requirement would not apply.[70]

[70] Hawaii Attorney General Opinion No. 72-21: "Under this bill certain specific lands are withdrawn from [the public land commissioner's] jurisdiction and from the jurisdiction of every commission except the special one to have charge of these specific lands described in the bill, and those lands are exclusively by the terms of this bill under the control of this commission." The commission which is referred to is the Hawaiian Homes Commission.

The total land area that would be disturbed by the new construction involved in this project is approximately 60 acres. Consequently, this project will require coverage under the State of Hawai'i NPDES General Permit program (HAR §11-55, Appendix C).

6.2.5 COASTAL ZONE MANAGEMENT (CZM) PROGRAM

The objectives of the Hawai'i Coastal Zone Management (CZM) Program are set forth in the Hawai'i Revised Statutes, Chapter 205A. The program is intended to promote the protection and maintenance of valuable coastal resources. All lands in Hawai'i are classified as valuable coastal resources. The State Office of Planning administers Hawai'i's CZM program. A general discussion of the project's consistency with the objectives and policies of Hawai'i's CZM Program follows.

6.2.5.1 Recreational Resources

Objective: *Provide coastal recreational opportunities accessible to the public.*

Policies:

1. *Improve coordination and funding of coastal recreational planning and management; and*
2. *Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:*
    a. *Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
    b. *Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;*
    c. *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
    d. *Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
    e. *Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*
    f. *Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*
    g. *Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*
    h. *Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.*

Discussion: The proposed project would have no effects on coastal recreational resources. Once constructed, the proposed facilities would not be visible from Anahola Beach Park or other nearby coastal recreational resources, and construction of the proposed facilities would not disrupt ongoing use of the park or access to the shoreline.

6.2.5.2 Historic Resources

Objective: *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.*

Policies:

1. *Identify and analyze significant archaeological resources;*
2. *Maximize information retention through preservation of remains and artifacts or salvage operations; and*
3. *Support state goals for protection, restoration, interpretation, and display of historic resources.*

Discussion: The proposed work will occur in areas that have already been extensively disturbed. Section 5.7 describes the known locations of historic properties and discusses the steps that KIUC would take to preserve any resources inadvertently discovered during construction. SHPD will be sent a copy of this EA for review and their comments, if any, will be reproduced in the *Final EA*.

6.2.5.3 Scenic and Open Space Resources

Objective: *Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.*

Policies:

1. *Identify valued scenic resources in the coastal zone management area;*
2. *Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;*
3. *Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and*
4. *Encourage those developments that are not coastal dependent to locate in inland areas.*

Discussion: Coastal open space would not be affected by the proposed project. None of the proposed construction would substantially alter natural landforms and much of the proposed structures would be sited well away from any public view of the shoreline. While the project would represent a new visual presence along a scenic highway corridor, the facilities would be generally low-lying and screened by vegetation consistent with other construction along this route.

6.2.5.4 Coastal Ecosystems

Objective: *Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*

Policies:

1. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
2. *Improve the technical basis for natural resource management;*
3. *Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*

4. *Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and*
5. *Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Discussion: The proposed project will not affect coastal ecosystems or any other water body, as described in Section 5.2.2.

6.2.5.5 Economic Uses

Objective: *Provide public or private facilities and improvements important to the State's economy in suitable locations.*

Policies:

1. *Concentrate coastal dependent development in appropriate areas;*
2. *Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and*
3. *Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:*
    a. *Use of presently designated locations is not feasible;*
    b. *Adverse environmental effects are minimized; and*
    c. *The development is important to the State's economy.*

Discussion: The proposed project would not lead to any changes in the concentration or location of coastal developments. The work would be constructed entirely within an area designated for development, and would not change the character or normal use of surrounding areas.

6.2.5.6 Coastal Hazards

Objective: *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

Policies:

1. *Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;*
2. *Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;*
3. *Ensure that developments comply with requirements of the Federal Flood Insurance Program; and*
4. *Prevent coastal flooding from inland projects.*

Discussion: Section 5.8 confirms that the project site is outside a designated Special Flood Hazard Area and is not within the County Tsunami Evacuation Zone (see Figure 5.10).

6.2.5.7 Managing Development

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources and hazards.*

Policies:

1. *Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;*
2. *Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and*
3. *Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.*

Discussion: KIUC has initiated contact and continues to work cooperatively with all government agencies with oversight responsibilities to facilitate efficient processing of permits and informed decision making by the responsible parties.

6.2.5.8 Public Participation

Objective: *Stimulate public awareness, education, and participation in coastal management.*

Policies:

1. *Promote public involvement in coastal zone management processes;*
2. *Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and*
3. *Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.*

Discussion: The public will have an opportunity to review and comment on the EA, pursuant to the requirements of Hawai‘i Administrative Rules §11-200.

6.2.5.9 Beach Protection

Objective: *Protect beaches for public use and recreation.*

Policies:

1. *Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;*
2. *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*
3. *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

Discussion: The project poses no risks to beaches. No structures are planned seaward of the shoreline, and no interactions with littoral processes would be involved.

6.2.5.10 Marine Resources

Objective: *Promote the protection, use, and development of marine and coastal resources to assure their sustainability.*

Policies:

1. *Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*
2. *Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*
3. *Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*
4. *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*
5. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

Discussion: The proposed project does not have the potential to affect marine resources.

6.3 FEDERAL REGULATIONS, STATUTES, AND EXECUTIVE ORDERS

The following sub-sections address the proposed project's relationship to federal regulations, statutes, and executive orders as required by RUS for electric projects requiring an environmental assessment.

6.3.1 NATIONAL HISTORIC PRESERVATION ACT (16 U.S.C. § 470)

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by ACHP. RUS, in consultation with both the State of Hawai'i Historic Preservation Division (SHPD) of the Department of Land and Natural Resources and Native Hawaiian organizations has determined that the project will have no effect on historic properties, and the impact assessment conducted for the project detected no evidence that the site is used or valued for cultural purposes. Consequently, the proposed project is in compliance with these regulations.

6.3.2 CLEAN AIR ACT (42 U.S.C. § 7401)

The Clean Air Act requires the Environmental Protection Agency (EPA) to develop and enforce regulations to protect the public from airborne contaminants known to be hazardous to human health by regulating emissions. As discussed in Section 5.4.2.1, any emissions of fugitive dust during construction of the project are expected to be temporary and relatively minor. It is anticipated that diesel-powered construction equipment will be used to construct the proposed facilities. Emissions from the diesel will slightly degrade air quality for the relatively short period of time they are in operation. However, all applicable emission and ambient air quality standards will continue to be met. The contractors will employ Best Management Practices (BMPs) to control fugitive dust emissions during the construction phase. Normal operation of the Anahola Solar Project will not produce any on-site air emissions, will not alter air flow in the vicinity, and will have no other measureable effect on the area's micro-climate.

Substitution of photovoltaic energy production for the use of a portion of the fossil fuels needed to meet the growing demand for electricity on Kaua'i will reduce emissions of regulated pollutants over

time. Hence, not only does the proposed project comply with the provisions of the Clean Air Act, it will have a beneficial effect on air quality.

6.3.3 CLEAN WATER ACT

The Clean Water Act (Federal Water Pollution Control Act, 33 USC 1251, et seq.) is the principal law governing pollution control and water quality of the nation's waterways. As discussed above, there are no water bodies near the project site that could be affected. This project does not require KIUC to seek approvals under the Clean Water Act. It will, however, obtain an NPDES Construction permit from the State of Hawai'i Department of Health.

6.3.4 COASTAL BARRIER IMPROVEMENT ACT (42 U.S.C. 4028)

The Coastal Barrier Improvement Act requires that no new flood insurance coverage may be provided for any new construction or substantial improvements of structures located on any coastal barrier within the John H. Chafee Coastal Barrier Resources System established by Section 3503 of Title 16. Coastal Barrier Resources Act (CBRA), Public Law 97-348 (96 Stat. 1653; 16 U.S.C. 3501 et seq.), enacted October 18, 1982, designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System (System). Areas so designated were made ineligible for direct or indirect Federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. This Act does not apply to the State of Hawai'i at this time, therefore the proposed project will not affect any areas protected by this Act.

6.3.5 COASTAL BARRIER RESOURCES ACT (16 U.S.C. § 3501)

Coastal Barrier Resources Act (CBRA), Public Law 97-348 (96 Stat. 1653; 16 U.S.C. 3501 et seq.), enacted October 18, 1982, designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System (System). Areas so designated were made ineligible for direct or indirect Federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. This Act does not apply to the State of Hawai'i at this time, therefore the proposed project will not affect any areas protected by this Act.

6.3.6 COASTAL ZONE MANAGEMENT ACT (16 U.S.C. § 1456(C) (1))

Enacted as Chapter 205A, HRS, the Hawai'i Coastal Zone Management (CZM) Program was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972. The CZM area encompasses the entire state, including all marine waters seaward to the extent of the state's police power and management authority, as well as the 12-mile U.S. territorial sea and all archipelagic waters. Section 6.2.5 above discusses the consistency of the projects with the CZMP's ten policy objectives.

6.3.7 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, & LIABILITY ACT (42 U.S.C. 9601)

The Comprehensive Environmental Response, Compensation, and Liability Act – also known as CERCLA or Superfund -- provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through CERCLA, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup. As detailed in Section 5.11, there are no known hazardous materials remaining on the site from previous uses of the area. No hazardous materials will be used in the construction or operation of the proposed project and therefore is in compliance with this Act.

6.3.8 COUNCIL ON ENVIRONMENTAL QUALITY REGULATIONS (40 CFR PARTS 1500-1508)

The National Environmental Policy Act (NEPA) is the basic national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. Two sets of regulations govern EPA's implementation of NEPA; The Council on Environmental Quality (CEQ) regulations and EPA's NEPA implementing regulations. This EA has been prepared in accordance with the requirements of these federal environmental impact assessment regulations, as discussed in Section 1.3. As part of the assessment process, RUS has consulted with other government agencies, private organizations, and the public in the preparation of this document and has concluded that the proposed project will not have a significant effect on the quality of the human environment.

6.3.9 ENDANGERED SPECIES ACT (16 U.S.C. 1531 ET SEQ.)

The Endangered Species Act (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984 and 1988) provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the U.S. or elsewhere. The Act mandates that federal agencies seek to conserve endangered and threatened species and use their authorities in furtherance of the Act's purposes. It provides for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species, and contains exceptions and exemptions.

Existing biota on and near the project site is discussed in Section 5.5.1. The discussion documents the fact that there are no known rare or endangered species on or immediately adjacent to the project site that would be adversely affected by the project. RUS, in consultation with the USFWS, has made the determination that the proposed project is not likely to adversely affect any threatened, endangered, or candidate species.

6.3.10 FARMLAND PROTECTION POLICY ACT (7 U.S.C. § 4201 ET SEQ.)

The U.S. Congress adopted the Farmland Protection Policy Act (FPPA) (Public Law 97-98) on December 22, 1981). The U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) has national leadership for administering the FPPA. The effective date of the FPPA rule (part 658 of Title 7 of the Code of Federal Regulations) is August 6, 1984.

The stated purposes of the FPPA are to:

- Minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.
- Assure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private programs and policies to protect farmland.

"Farmland", as used in the FPPA, includes prime farmland, unique farmland, and land of statewide or local importance. "Farmland" subject to FPPA requirements does not have to be currently used for cropland. Because the Anahola Solar Project will use federal funds for the conversion of prime agricultural lands, pursuant to the requirements of the Farm Policy Protection Act (FPPA), KIUC consulted with the Natural Resources Conservation Service (NRCS) on behalf of RUS, filing two USDA Form AD-1006 Farmland Conversion Impact Ratings (one for the solar array and the Anahola Substation and one for the Service Center) (see Appendix D). Based on the impact ratings, RUS and NRCS concluded that this project was wholly consistent with the FPPA.

6.3.11 MARINE PROTECTION, RESEARCH, & SANCTUARIES ACT (33 U.S.C. 1401)

The purpose of this act, as stated in Section 2(b) is as follows:

> *The Congress declares that it is the policy of the United States to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities.*

Construction and operational activities associated with the proposed project will not entail any dumping of materials into ocean waters. As indicated in Section 5.10.5, all solid waste from the proposed project will be disposed of at approved off-site locations. The contractor will comply with all best management practices as necessary during the construction phase to prevent fugitive contaminants and soil from leaving the project site with storm water runoff (see Section 5.2.2). Consequently, the Anahola Solar Project is consistent with the provisions of the Marine Protection, Research, & Sanctuaries Act.

6.3.12 NATIONAL ENVIRONMENTAL POLICY ACT (42 U.S.C. 4321-4346)

The National Environmental Policy Act (NEPA) establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment and provides a process for implementing these goals within the federal agencies. The Act also establishes the Council on Environmental Quality (CEQ). The purpose of the Act is as follows:

> *"To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality."*

It is KIUC's intent to implement all appropriate measures in order to avoid or eliminate any significant impacts to the environment. As described in this report, the Anahola Solar Project is expected to have little or no effect on the surrounding environment. In fact, the proposed project will have a beneficial impact to the stimulation of the health and welfare of those who live on Kaua'i as the project will use a clean renewable resource to generate energy. Reducing the island's combustion of fossil fuel will decrease a substantial volume of pollutants into the atmosphere.

6.3.13 NATIONAL TRAILS SYSTEM ACT (16 U.S.C. 1241)

The purpose of this act, as stated in Section 2(a) of its preamble is as follows:

> *Considerations for determining establishment of trails in order to provide for the ever increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open air, outdoor areas and historic resources of the Nation, trails should be established (i) primarily, near the urban areas of the Nation, and (ii) secondarily, within scenic areas and along historic travel routes of the Nation, which are often more remotely located.*

There are no known recreational, scenic or historic trails in or around the proposed project site. Therefore the proposed project will not affect any areas protected by this Act.

6.3.14 NATIVE AMERICAN GRAVES & REPATRIATION ACT (25 U.S.C. 3001)

The Native American Graves Protection and Repatriation Act (NAGPRA) was enacted on November 16, 1990, to address the rights of lineal descendants, Indian tribes, and Native Hawaiian organizations to Native American cultural items, including human remains, funerary objects, sacred objects, and objects of cultural patrimony. As indicated in Section 5.7, it is highly unlikely any archaeological and/or cultural remains will be encountered as the project site has been highly disturbed due to past agricultural use. In the unlikely event that undocumented remains are discovered, the contractor will: (1) cease work immediately; (2) protect the inadvertent discovery from additional disturbance; and (3)

notify the SHPD immediately. As appropriate, additional mitigative measures will be proposed and coordinated with SHPD. Consequently, the Anahola Solar Project is consistent with the provisions of this Act.

6.3.15 NOISE CONTROL ACT (42 U.S.C. 7901)

The purpose of this act, as stated in Section 2(b) of its preamble is as follows:

> *The Congress declares that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare. To that end, it is the purpose of this Act to establish a means for effective coordination of Federal research and activities in noise control, to authorize the establishment of Federal noise emission standards for products distributed in commerce, and to provide information to the public respecting the noise emission and noise reduction characteristics of such products.*

As described in Section 5.6.4 all construction activities will comply with all applicable federal and state noise controls. Operation of the proposed project is not expected to alter noise levels over the present conditions. Consequently, the Anahola Solar Project is consistent with the provisions of the Noise Control Act.

6.3.16 RESOURCE CONSERVATION & RECOVERY ACT (42 U.S.C. 3251)

The Resource Conservation and Recovery Act gives EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. As described in Section 5.11 no hazardous materials will be used in the construction of the proposed facilities nor would any be produced as a result of its operation. Consequently, the proposed project is consistent with the provisions of the Act.

6.3.17 SAFE DRINKING WATER ACT (42 U.S.C. § 300(F))

The Safe Drinking Water Act (SDWA) is the principal federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. The Safe Drinking Water Act requires that all public water systems meet stringent water quality standards. These standards cover a long list of potential chemical, radiological and biological contaminants. The standards distinguish between surface water and groundwater sources, with the testing and monitoring requirements for surface water and GWUDI sources being far greater than those for groundwater sources.

As discussed in this report, the proposed Anahola Solar Project and any associated work will not impact the surface water and groundwater sources. None of the proposed work will require or lead directly to sustained withdrawals from any aquifer and would not affect any sole source aquifer as none exist in Kaua'i. Therefore, the proposed project is in compliance with the Safe Drinking Water Act.

6.3.18 TOXIC SUBSTANCES CONTROL ACT (15 U.S.C. 2601)

The purpose of this act, as stated in Section 1-3 of its preamble is as follows:

> *It is the policy of the United States that-*
>
> *(1) adequate data should be developed with respect to the effect of chemical substances and mixtures on health and the environment and that the development of such data should be the responsibility of those who manufacture and those who process such chemical substances and mixtures;*

(2) adequate authority should exist to regulate chemical substances and mixtures which present an unreasonable risk of injury to health or the environment, and to take action with respect to chemical substances and mixtures which are imminent hazards; and

(3) authority over chemical substances and mixtures should be exercised in such a manner as not to impede unduly or create unnecessary economic barriers to technological innovation while fulfilling the primary purpose of this chapter to assure that such innovation and commerce in such chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment.

As described in Section 5.11 no hazardous materials will be used in the construction of the proposed facilities nor would any be produced as a result of operations. Consequently, the proposed project is consistent with the provisions of the Toxic Substances Control Act.

6.3.19 WILD AND SCENIC RIVERS ACT (16 U.S.C. §1271)

The purpose of this act, as stated in Section (b) of its preamble is as follows:

It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.

There are no designated Wild and Scenic Rivers in the State of Hawai‘i at this time. Consequently, the proposed project is consistent with the provisions of the Wild and Scenic Rivers Act.

6.3.20 WILDERNESS ACT (16 U.S.C. 1131)

The purpose of this act, as stated in Section 2(a) of its preamble is as follows:

In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness. For this purpose there is hereby established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas", and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness; and no Federal lands shall be designated as "wilderness areas" except as provided for in this Act or by a subsequent Act.

There are no designated “wilderness areas” in or around Anahola. Consequently, the proposed project is consistent with the provisions of the Wilderness Act.

6.3.21 EXECUTIVE ORDER 11593, PROTECTION AND ENHANCEMENT OF THE CULTURAL ENVIRONMENT (3 CFR 1971 COMP., PG. 154)

Executive Order 11593 was issued by President Nixon on May 13, 1971, directing federal agencies to inventory their cultural resources and establish policies and procedures to ensure the protection, restoration, and maintenance of federally owned sites, structures, and objects of historical, architectural, or archaeological significance. The Anahola Solar Project is not being constructed on federally owned land and there are no known archaeological, historical, and/or cultural resources found in or around the project site as noted in the Section 5.7. As a result, the proposed project is in compliance with this Executive Order.

6.3.22 EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT (3 CFR 1977 COMP., PG. 117)

As described in Section 5.2.1, the Anahola Solar Project lies within Flood Zone X, Zone X is defined as the flood insurance rate zone that corresponds to: (*i*) areas outside the 500-year floodplain; (*ii*) areas within the 500-year floodplain where the water depth resulting from the 100-year flood is less than 1 foot; (*iii*) areas where the contributing drainage area is less than 1 square mile; and (*iv*) areas protected from the 100-year flood by levees. Because of the low probability of flooding, no base flood elevations or depths have been defined within the zone. The proposed improvements comply with the standards of the National Flood Insurance Program. Neither the new structures, nor those structures being relocated would exacerbate existing flood hazards in the area.

6.3.23 EXECUTIVE ORDER 11990, PROTECTION OF WETLANDS (3 CFR 1977 COMP., PG. 121)

There are no wetlands on or near the site. Neither are there food resources on the site that are important to wildlife that use wetlands elsewhere on the island. Copies of the *Draft EA* are being sent to the administrator of the Pacific Island Eco-Region, U.S. Fish & Wildlife Service, and to the State Department of Land and Natural Resources Department of Aquatic Resources to ensure adequate consideration of this topic in the environmental review for this project.

6.3.24 EXECUTIVE ORDER 12898, ENVIRONMENTAL JUSTICE (3 CFR 1994 COMP., PG. 859)

Environmental Justice is defined by the EPA as "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies."

As discussed in Section 5.13, a given census tract can be considered a community of environmental justice concern if: (i) the minority population is greater than 50 percent of the total population; (ii) if the minority population is 10 percent (or more) greater than the surrounding county; or (iii) the number of persons with income below the poverty level is 10 percent higher than the surrounding county. While the Census Tract 9400, where the proposed project would be located, does not possess a meaningfully higher proportion of minority or impoverished residents than the county as a whole, it does have a minority population greater than 50 percent. However, the objective of the proposed Anahola Solar Project is to help reduce Kaua'i's dependence on fossil fuels by producing a renewable energy source which will in turn reduce emissions of pollutants over time. KIUC has at length engaged the community discussing their needs and concerns with regard to the project and how it will benefit both their community, and the island, on both an economical and environmental level. Consequently, the Anahola Solar Project is in compliance with Executive Order 12898.

6.3.25 HIGHLY ERODIBLE LAND & WETLAND CONSERVATION (7 CFR PART 12)

The purpose of this provision is to set forth the terms and conditions under which a person who produces an agricultural commodity on highly erodible land or designates such land for conservation use, plants an agricultural commodity on a converted wetland, or converts a wetland shall be determined to be ineligible for certain benefits provided by the USDA and its agents. The parcel on which the proposed project site is located is not classified as highly erodible land or as a wetland. As indicated in Section 5.1.2, the Anahola Solar Project will have very little effect on local topography. Consequently, the provision does not apply to the proposed project.

6.3.26 USDA'S ENHANCEMENT, PROTECTION, & MANAGEMENT OF THE CULTURAL ENVIRONMENT (7 CFR PART 3100)

The purpose of this regulation, as stated in Section 3100.43 (a) and (d) is as follows:

> *(a) The nonrenewable cultural environment of our country constitutes a valuable and treasured portion of the national heritage of the American people. The Department of Agriculture is committed to the management—identification, protection, preservation, interpretation, evaluation and nomination—of our prehistoric and historic cultural resources for the benefit of all people of this and future generations.*
>
> *(d) The Department is committed to consideration of the needs of American Indians, Eskimo, Aleut, and Native Hawaiians in the practice of their traditional religions.*

There are no archaeological or cultural resources in the areas on or near the proposed Anahola Solar Project. The project site does not contain any cultural resources that pertain to any Native Hawaiian cultural practices. Consequently, the proposed project is consistent with the requirements of this regulation.

6.4 REQUIRED PERMITS AND APPROVALS

The permits and approvals required for the proposed projects include:

- NEPA Environmental Assessment;
- Chapter 343 Environmental Assessment;
- National Pollutant Discharge Elimination System – Notice of Intent [Construction] (NPDES-NOI[C]);
- Noise permit;
- Construction on a State Highway Permit;
- Certificate of Public Convenience and Necessity;
- Grading Permit;[71]
- Building Permit (Service Center only);
- Driveway Approach and Road Permits;
- Stockpiling Permit; and
- Water Service Permit.

All of these approvals are issued by the State of Hawai'i and the County of Kaua'i. No federal permits are required for the project.

[71] As an electrical utility, KIUC is exempt from building permit requirements for the substation and PV arrays. While not technically required, a grading permit will be sought.

7. HAWAI'I STATE ANTICIPATED DETERMINATION

7.1 SIGNIFICANCE CRITERIA

The information in this chapter applies only to the State of Hawai'i environmental review process, defined in Hawaii Revised Statutes Chapter 343 and its implementing regulations in Hawai'i Administrative Rules (HAR) §11-200; this information does not apply to the RUS federal review process. HAR §11-200-11.2 establishes procedures for determining if an environmental impact statement (EIS) should be prepared or if a finding of no significant impact is warranted. HAR §11-200-11.2 (1) provides that applicants should issue an environmental impact statement preparation notice (EISPN) for actions that it determines may have a significant effect on the environment. HAR §11-200-12 lists the following criteria to be used in making that determination:

In most instances, an action shall be determined to have a significant effect on the environment if it:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*
2. *Curtails the range of beneficial uses of the environment;*
3. *Conflicts with the State's long-term environmental policies or goals as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;*
4. *Substantially affects the economic or social welfare of the community or State;*
5. *Substantially affects public health;*
6. *Involves substantial secondary impacts, such as population changes or effects on public facilities;*
7. *Involves a substantial degradation of environmental quality;*
8. *Is individually limited but cumulatively has considerable effect on the environment or involves a commitment for larger actions;*
9. *Substantially affects a rare, threatened, or endangered species, or its habitat;*
10. *Detrimentally affects air or water quality or ambient noise levels;*
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;*
12. *Substantially affects scenic vistas and view planes identified in county or state plans or studies; or,*
13. *Requires substantial energy consumption.*

7.2 FINDINGS

The potential effects of the proposed work described earlier in this document were evaluated using these significance criteria. The findings with respect to each criterion are summarized below.

7.2.1 IRREVOCABLE LOSS OR DESTRUCTION OF VALUABLE RESOURCE

The proposed Anahola Solar Project would be constructed entirely within vacant agricultural lands. They do not involve the loss of any significant cultural or natural resources.

7.2.2 CURTAILS BENEFICIAL USES

Construction and operation of the new solar array and substation would not curtail other beneficial uses of the remainder of the parcel. In addition, should the photovoltaic arrays be decommissioned, those 53 acres could be converted back to agriculture. These facilities will not substantially modify any of the existing uses of the unused portion of the parcel.

7.2.3 CONFLICTS WITH LONG-TERM ENVIRONMENTAL POLICIES OR GOALS

The proposed project is consistent with the *County of Kaua'i General Plan* (see Section 6.1.1) and with the State's long-term environmental policies and goals as expressed in Chapter 344, Hawai'i Revised statutes and elsewhere in State law.

7.2.4 SUBSTANTIALLY AFFECTS ECONOMIC OR SOCIAL WELFARE

During the construction phase some short-term employment opportunities will be created and attempts will be made to hire locally. Once constructed, the proposed project will not substantially alter the economic or social welfare of the community, except insofar as they allow KIUC to improve the efficiency of its operations and continue to provide electricity at a low cost, while maintaining or improving environmental quality.

7.2.5 PUBLIC HEALTH EFFECTS

The proposed project will not adversely affect air quality or any water sources used for drinking or recreation. Neither will they generate large amounts of solid waste or produce other emissions that will have a significant adverse effect on public health.

7.2.6 PRODUCE SUBSTANTIAL SECONDARY IMPACTS

The proposed project will not produce significant secondary impacts. They are not designed or intended to foster population growth or promote economic development. Instead, they are intended to support KIUC's current operations.

7.2.7 SUBSTANTIALLY DEGRADE ENVIRONMENTAL QUALITY

The proposed project will not have substantial long-term environmental effects. The work will temporarily elevate noise levels and generate airborne dust during construction, but these impacts will be localized and of limited duration. So long as adequate measures are taken to control the intensity of the construction noise and the release of dust, effects will be minimal.

7.2.8 CUMULATIVE EFFECTS OR COMMITMENT TO A LARGER ACTION

The proposed project is not a commitment to a larger action and is not intended to facilitate substantial population growth in the region. They are part of KIUC's expansion of its renewable energy portfolio and of its regular, ongoing activities as the electrical utility provider for the island of Kaua'i.

7.2.9 EFFECTS ON RARE, THREATENED, OR ENDANGERED SPECIES

No rare, threatened, or endangered species are known to utilize the project sites. The projects will not utilize a resource needed for the protection of rare, threatened, or endangered species.

7.2.10 AFFECTS AIR OR WATER QUALITY OR AMBIENT NOISE LEVELS

Construction and operation of the proposed project will not have a measurable effect on water or air quality (see Sections 5.2.2 and 5.4.2). Noise levels will temporarily increase during construction of the improvements but are not anticipated to affect any noise-sensitive uses, as discussed in Section 5.6.

7.2.11 ENVIRONMENTALLY SENSITIVE AREAS

There are no environmentally sensitive areas or resources near the proposed project. The project site is outside defined flood and tsunami hazard zones. The structures built as part of the project will be constructed consistent with the Hawai'i Uniform Building Code for Earthquake Zone 1.

7.2.12 AFFECTS SCENIC VISTAS AND VIEW PLANES

The proposed project is located along a scenic highway corridor. However, the majority of the facility will be removed from the highway and would be screened by vegetation in a manner consistent with other construction in the area. The construction would be low-lying and would not significantly alter the visual character of the site or significantly change views across it (see Section 5.9).

7.2.13 REQUIRES SUBSTANTIAL ENERGY CONSUMPTION

Construction of the improvements will use some energy, however once operation commences, the structures will be net producers of energy and will require infrequent maintenance.

7.3 ANTICIPATED DETERMINATION

In view of the foregoing, KIUC and DHHL have concluded that the proposed project will not have a significant adverse impact on the environment. Consequently, DHHL anticipates issuing a Finding of No Significant Impact for the proposed project.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

8. REFERENCES

A Silicon Valley Toxics Coalition. (January 14, 2009). *Toward a Just and Sustainable Solar Energy Industry*. http://svtc.org/wp-content/uploads/Silicon_Valley_Toxics_Coalition_-_Toward_a_Just_and_Sust.pdf.

Donovan, Matt. (July 6, 2010). *Impact of PV Systems on Local Temperature*. SunPower Corporation. http://www.californiavalleysolarranch.com/deir/070710%20Data/Impact%20of%20PV%20Systems%20on%20Local%20Temps%207-6-10%20FINAL.pdf

Budikova, Dagmar. (2010). "Albedo." *Encyclopedia of Earth*. Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment. www.eoearth.org/article/Albedo.

Chock, Gary (n.d.) *Micro-zoned Design Maps of Topographic Wind Effects and Exposure in the State of Hawaii Building Code*. http://martinchock.com/_library/documents/papers/hawaiistatebuildingcodewindprovisions.pdf

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens (August 1972). *Soil Survey of Islands of Kaua'i, O'ahu, Maui, Molokai, and Lanai, State of Hawai'i.* U.S. Department of Agriculture Soil Conservation Service in cooperation with the University of Hawai'i Agricultural Experiment Station. US Government Printing Office, Washington, DC. 233 p.

Genchi, Yutaka, Masako Ishisaki, Yukitaka Ohashi, Yukihiro Kikegawa, Hiroshi Takahashi, and Atsushi Inaba. (2003) *Impacts of Large-Scale Photovoltaic Panel Installation on the Heat Island Effect in Tokyo*. http://nargeo.geo.uni.lodz.pl/~icuc5/text/O_14_3.pdf. The authors work at the National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan, Tokai University, Numazu, Japan, Fuji Research Institute corporation, Tokyo, Japan, and the University of Tokyo, Tokyo, Japan.

DOH (State of Hawai'i Department of Health) (2010); http://hawaii.gov/health/environmental/air/cab/cab_misc_pdf/ naaqs_sep_2010.pdf)

DOH (State of Hawai'i Department of Health). (2009). 2009 *Air Quality Data Book*, State of Hawai'i.

DOH (State of Hawai'i Department of Health). (2004). Hawai'i Administrative Rules, Title 11, Chapter 200. *Water Quality Standards.*

EPRI and California Energy Commission. (August 2004). *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells*. (Prepared by Tetra Tech, Inc., Principal Investigators K. Summer and J. Radde. Report P500-04-053 prepared For California Energy Commission Public Interest Energy Research Program (PIER) and the Electric Power Research Institute. CA.

Federal Interagency Committee on Urban Noise (June, 1980). *Guidelines for Considering Noise in Land Use Planning and Control*. Author: Washington, D.C.

Good Company, Inc. (March 24, 2011). *Potential Impacts from Reflection of Proposed Calipatria Solar Farm I & II (DRAFT]*. Eugene, Oregon.

HAZTECH Environmental Services, Inc. (November 28, 2011). *Phase 1 Environmental Site Assessment Proposed 60 Acre Photovoltaic Area Kamalomaloo, Kaua'i, Hawai'i TMK: (4) 4-7-004: 002*. Prepared for: the Kaua'i Island Utility Cooperative.

Luque and Hegedus. (2003). *Handbook of Photovoltaic Science and Engineering*. Wiley and Sons, New Jersey.

McAllister, J.G. (1933). *Archaeology of Oahu.* B.P. Bishop Museum Bulletin 104. Bishop Museum Press, Honolulu.

Millstein, Dev and Surabi Menon (July 1, 2011). "Regional climate consequences of large-scale cool roof and photovoltaic array deployment." *Environmental Research Letters* 6 (2011) 034001 (9pp) doi:10.1088/ 1748-9326/6/3/034001. IOP Publishing. Lawrence Berkeley National Laboratory, Berkeley, CA.

Mink, John F. and L. Stephen Lau. September 1992. Groundwater Protection Strategy for Hawai'i: Aquifer Identification and Classification for Kaua'i. Technical Report No. 186: University of Hawai'i Water Resources Research Center.

Moskowitz, V. M. and P. D. Fthenakis, (1997). *Emerging Photovoltaic Technologies: Environmental And Health Issues Update*, NREL/SNL Photovoltaics Program Review, AIP Press, New York.

Platzer, Michaela D. (June 13, 2012). U.S. Solar Photovoltaic Manufacturing: Industry Trends, Global Competition, Federal Support. Congressional Research Service Report R42509/7-5700, www.crs.gov. Washington, D.C.

REC Solar, Inc. [C. Nosti]. (January 2012). *REC Group Modules Wind Loading*. Memorandum prepared for Kaua'i Island Utility Cooperative. San Luis Obispo, CA

R.W. Beck Inc. (September 2009). Integrated Solid Waste Management Draft Plan. Prepared for the County of Kaua'i Department of Public Works – Solid Waste Division. Author:

State of Hawai'i (2002). *Hawai'i Statewide GIS Program*. Hazard Layer. URL: http://www.state.hi.us/dbedt/gis/hazard.htm

Sterling, Elspeth P. and Catherine C. Summers (comp.) (1978). *Sites of O`ahu*, Dept. of Anthropology, B.P. Bishop Museum, Honolulu.

Tetra Tech, Inc. [K. Summers and J. Radde]. (November 2003). Report prepared for the Public Interest Energy Research Program (PIER) and the Electric Power Research Institute (EPRI). *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells: Final Report*. California Energy Commission: Sacramento, California.

Thrum, Thomas G. (1906). *Heiaus and Heiau Sites Throughout the Hawaiian Islands,* IN Thos. G. Thrum, compiler, Hawaiian Almanac and Annual for 1907, pp. 38-47, Honolulu, HI.

US, Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, (2009). *Local Climatological Data, Annual Summary with Comparative Data, 2009*, "Normals, Means, and Extremes, Honolulu, HI" (annual) as cited in the *2009 State of Hawai'i Data Book*.

U.S. Geological Survey (2001). "Hazards in Hawai'i." http://hvo.wr.usgs.gov/earthquakes/hazards/

9. CONSULTATION & DISTRIBUTION

9.1 CONSULTATION

The Kauaʻi County Planning Department was consulted during the development of this Draft EA (DEA) in order to determine applicable County zoning designations. Government agencies and the public will also have an opportunity to comment on this *Draft EA*, as discussed in the following section.

9.2 DISTRIBUTION OF THE DRAFT EA

KIUC distributed copies of the *Draft EA* to the parties listed in Table 9.1.

Table 9.1. Draft EA Distribution List

State Agencies	**City and County of Kauaʻi**
Office of Environmental Quality Control (1 HC, 1 CD)	Department of Parks & Recreation
Department of Agriculture	Department of Planning & Permitting (5 copies)
Department of Accounting and General Services	Department of Public Works
Department of Business, Economic Development, and Tourism (DBEDT)	Department of Transportation
DBEDT - Energy Division	Department of Water
DBEDT – Office of Planning	Kauaʻi County Fire Department
Department of Defense	Kauaʻi County Police Department
Department of Education	
Department of Hawaiian Home Lands	
Environmental Planning Office, Department of Health	
Clean Air Branch, Department of Health	
Clean Water Branch, Department of Health	**Elected Officials**
Wastewater Branch, Department of Health	US Senator Brian Schatz
Department of Human Services	US Senator Colleen Hanabusa
Department of Labor and Industrial Relations	US Representative Mazie Hirono
Department of Land and Natural Resources (5 copies)	US Representative Tulsi Gabbard
DLNR Historic Preservation Division (1 HC)	State Senator Ronald D. Kouchi (Dist. 7)
Department of Transportation	State Representative Derek S.K. Kawakami (Dist. 14)
Hawaii Housing Finance and Development Corp.	Mayor Bernard P. Carvalho, Jr.
Office of Hawaiian Affairs	
UH Environmental Center	
Federal Agencies	**Libraries and Depositories**
US Department of the Army, Regulatory Branch	Hawaiʻi State Library Hawaiʻi Documents Center (1 HC)
US Department of Agriculture	
US Fish and Wildlife Service (1 HC)	Kapaʻa Public Library
US Department of the Interior, Geological Survey	Līhuʻe Regional Library
Utility Companies	
Hawaiian Telcom	
The Gas Company	
Oceanic Time Warner Cable	**News Media**
Other	Honolulu Star Advertiser
Anahola Homestead Association	Garden Island

Source: Compiled by Planning Solutions, Inc.

THIS PAGE WAS INTENTIONALLY LEFT BLANK