Draft Environmental Impact Statement

KAHEAWA WIND POWER II
WIND ENERGY GENERATION FACILITY

UKUMEHAME, MAUI, HAWAI'I

PREPARED FOR:

Kaheawa Wind Power II, LLC

PREPARED BY:

PLANNING SOLUTIONS

FEBRUARY 2, 2009

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SIGNATORY CERTIFICATION:

This Draft Environmental Impact Statement and all ancillary documents were prepared under my direction or supervision, and, to the best of my knowledge, the information submitted fully addresses the document content requirements as set forth in HAR §11-200-18.

Perry J. White February 2, 2009

PREPARED FOR:

Kaheawa Wind Power II, LLC

PREPARED BY:

PLANNING SOLUTIONS

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PROJECT SUMMARY

Project:	**Kaheawa Wind Power II**
Applicant	Kaheawa Wind Power II, LLC c/o First Wind 33 Lono Avenue, Suite 380 Kahului, HI 96732 Contact: Noe Kalipi Phone: (808) 344-0211
Approving Agency	Office of Conservation and Coastal Lands Department of Land and Natural Resources State of Hawai‘i P.O. Box 621 Honolulu, HI 96809 Contact: Sam Lemmo Phone: (808) 587-0381
Location	Kaheawa Pastures, Mā‘alaea, Ukumehame Ahupua’a, Lahaina District, Island of Maui
Tax Map Key	4-8-001:001 (Note: access road is in 3-6-001:014)
Parcel Area	1,387.71 acres
Project Site Area	333 acres
State Land Use District	Conservation
County Zoning	Not Applicable (State Conservation District)
Proposed Action	Construction of a new 21 MW wind power facility within the State Conservation District. The facility will be adjacent to the existing Kaheawa Wind Power facility above Mā‘alaea, Maui, Hawai‘i.
Associated Actions Requiring Environmental Assessment	Use of State-owned Conservation District Lands.
Required Permits & Approvals	Conservation District Use Permit, NPDES Construction Permit, PUC Approval, FAA Clearance, ESA Section 10 Incidental Take Permit, State Incidental Take License, Land Lease & Easements
Parties Consulted	The applicant consulted the State Department of Land and Natural Resources Office of Conservation and Coastal Lands, Division of Forestry and Wildlife, Land Division, State Historic Preservation Division, and the U.S. Fish and Wildlife Service during the preparation of this EIS. In addition, a copy of the EA/EISPN was mailed to the recipients listed in Table 10.1.
Determination	Completion of an Environmental Impact Statement
Consultant	Planning Solutions, Inc. 210 Ward Ave, Suite 330 Honolulu, HI 96814 Contact: Perry White Phone: (808) 550-4483

SUMMARY

S-1.0 PROJECT DESCRIPTION

S-1.1. PROPOSED ACTION

Kaheawa Wind Power II LLC (KWP II LLC) is proposing to establish a 21 megawatt (MW) wind power generating facility and related improvements at Kaheawa Pastures above Mā‘alaea, Maui, Hawai‘i. The proposed wind energy generation facility, Kaheawa Wind Power II (KWP II), would be located west of the existing 30 MW Kaheawa Wind Power project (hereinafter called KWP I), and like the existing project, would supply wind-generated electricity to Maui Electric Company Ltd. (MECO). If the required land use approvals and environmental permits are granted, KWP II LLC will:

- Obtain a lease from the State Department of Land and Natural Resources for an approximately 333-acre portion of parcel (2) 4-8-001:001, contiguous to the existing area leased by KWP I.
- Create new internal service roads that connect the facility to the existing KWP I access road.
- Erect 14 General Electric (GE) 1.5 MW wind turbine generators (WTGs).
- Construct an electrical substation and install interconnection facilities to connect the facility to the existing MECO power transmission system.
- Install underground electrical power lines connecting all of the turbines with the new substation.
- Install a Battery Energy Storage System (BESS) adjacent to the electrical substation.
- Construct a new operations and maintenance building to house operations personnel, equipment and facility spare parts.
- Construct two permanent meteorological towers to collect data during operations.

The project is designed to provide a source of affordable, renewable energy to Maui’s residents. It would provide economic benefits in the form of cost savings compared to fossil fuel-driven energy, as well as a hedge against future fossil or bio-fuel cost increases. It would also provide environmental benefits in the form of reduced emissions of green house gases and other pollutants. The expected life span of the facility is 20 years, after which time the owner will either exercise an option to extend the lease or remove the facilities.

S-1.2 ALTERNATIVES EVALUATED IN DETAIL

At the time the Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN) for the project was prepared, KWP II LLC was considering four siting areas (Upwind, Downwind, Downstring, and Downroad). Its analysis of wind data gathered at the site has subsequently led it to eliminate the Upwind and Downroad siting areas from further consideration. KWP II LLC has defined a proposed action, which is its preferred alternative, for detailed analysis in this Environmental Impact Statement (EIS) that utilizes only the Downwind and Downstring siting areas. This Proposed Action and the no action alternative are described below.

Proposed Action: 21 MW Facility in Downwind and Downstring Siting Areas at Kaheawa Pastures: The proposed action consists of KWP II LLC’s constructing 21 MW of wind energy generating capacity in the siting areas to the west and south of the existing KWP I facility (i.e., the Downwind and Downstring areas). Fourteen (14) General Electric (GE) 1.5 MW wind turbine generators (WTG) would be added to the site; 11 of these would be in a line roughly parallel to the existing turbines (i.e., the “Downwind” siting area). The remaining three turbines would be constructed in the “Downstring siting area” just south of the existing KWP I turbines that is in a rough continuation of the line of existing WTGs (i.e., the KWP I turbines). Connector roads would be installed to access the new turbines.

This proposal involves the fewest WTGs that KWP II LLC believes it is economical to construct and operate at this location. It also concentrates the wind farm development in the siting areas that have the least challenging terrain and are farthest from existing viewpoints in central and eastern Maui. It would meet all the project objectives listed in Section 1.3 and is KWP II LLC's preferred course of action. Consequently, it is evaluated in detail in the DEIS.

No Action Alternative. This alternative would not meet the project objectives listed in Section 1.3 but is included in conformance with HAR, §11-200-17(f)(1). It assumes that no additional wind generating capacity will be constructed at Kaheawa Pastures in the foreseeable future.

S-2.0 SIGNIFICANT BENEFICIAL & ADVERSE IMPACTS

S-2.1 PROBABLE IMPACTS OF THE PROPOSED ACTION

KWP II LLC commissioned multiple studies to determine the nature and extent of KWP II's potential impacts on natural and cultural resources such as biota, historic and archaeological sites, cultural beliefs and practices, soil, and air quality. Table S-1 below summarizes the kinds of impacts that could result from the proposed action, and these are discussed in further detail in Chapter 4. In general, the analyses showed that impacts were relatively small in comparison to the benefits that the proposed addition of renewable energy to Maui's grid would provide. Where impacts were determined to be likely or possible, KWP II LLC identified appropriate measures to avoid, minimize, and mitigate them to the maximum extent practicable.

S-2.2 PROBABLE IMPACTS OF THE NO ACTION ALTERNATIVE

The No Action alternative foregoes adding additional wind energy generating capacity at Kaheawa Pastures and its associated environmental and economic benefits. It also foregoes the opportunity to utilize a site with proven wind resources and existing infrastructure (e.g., existing access road, proximity to MECO transmission system, existing turbines). KWP II LLC strongly believes that the no action alternative is undesirable from a long-range energy planning standpoint, as discussed in detail in Chapter 5.0 of this DEIS.

S-3.0 PROPOSED MITIGATION MEASURES

Over the course of its impact analysis for the KWP II project, KWP II LLC identified categories of potential impacts and evaluated their nature and magnitude. In cases where some level of impact was determined to be unavoidable (i.e., ground disturbance, visual impacts, and impacts to terrestrial and avian biota), KWP II LLC incorporated design features and practices into its proposal in order to minimize and mitigate these impacts to the maximum extent practicable (e.g., minimizing new road construction, adopting erosion control and revegetation plans, developing a Habitat Conservation Plan for protected fauna, etc.). In other cases where adverse impacts were determined unlikely but could not be completely ruled out (i.e., archaeological and cultural impacts, construction-period air quality impacts), KWP II LLC likewise identified appropriate avoidance strategies and mitigation measures in accordance with the recommendations of the resource studies it commissioned. Proposed mitigation measures are discussed in detail under each relevant impact topic in Chapter 4. KWP II LLC will follow all mitigation measures recommended in the commissioned studies during construction and operation of the project.

S-4.0 CONSISTENCY WITH LAND USE POLICIES AND PLANS

The proposed project is located adjacent to an existing wind power generating facility and is consistent with State and County land use plans and controls. It would be constructed and operated in accordance with applicable environmental regulations. Table 6.1 lists the permits and other approvals that KWP II LLC will need to obtain to construct and operate the new facility.

S-5.0 OTHER CHAPTER 343 TOPICS

Notwithstanding the environmental and economic benefits associated with increased renewable energy capacity, the project would not lead to significant growth or changes in the character of economic activity on Maui (e.g., the opening of new industries not previously practical) that might have secondary impacts. Likewise, the project will not generate significant new employment opportunities. Hence, it does not have the ability to cause significant secondary impacts.

Constructing and operating the proposed wind energy generation facility would provide renewable energy to Maui's grid, thereby helping to reduce pressures on the existing grid and alleviate some of the island's dependence on imported fossil fuels. The facility would not preclude other uses of the property that might be more productive over the long term, nor does it preclude the use and development of other energy sources.

The construction of the proposed facility does not irrevocably commit any party to the continued use of the site for wind energy generation or to the continued use of wind energy to add power to MECO's grid. At the end of the estimated project lifetime of 20 years the land lease and power purchase agreements can be renegotiated or terminated.

At present, there are no known unresolved issues. However, numerous permits and approvals must still be obtained, and it is possible that issues may arise as applications for these are prepared and processed.

S-6.0 RATIONALE FOR PROCEEDING

Chapter 4 describes the environmental effects that could result from construction and operation of the proposed wind power generating facility. KWP II LLC is committed to avoiding or mitigating adverse effects to the greatest extent practical. KWP II LLC does not believe that there are alternatives that would achieve the same goals with fewer environmental effects. Consequently, it proposes to proceed with the proposed action.

S-7.0 PARTIES CONSULTED

KWP II LLC distributed the EISPN to the individuals and organizations listed in Table 10.1 and requested their comments on the proposed scope of the analysis and on the completeness of the alternatives that KWP II LLC proposed to evaluate. It also conducted community outreach through meetings and site visits with representatives of the Maui community, which are summarized in Chapter 10. The public will have an opportunity to review and comment on this EIS in accordance with HRS Chapter 343.

Table S-1 Summary of Proposed Action's Construction Period Impacts

EIS Section	*Impact Topic*	*Environmental Effect*
4.1	**Geology, Topography and Soils**	The existing road network serving Kaheawa Pastures will be extended and sites for the proposed facilities will be graded. The preliminary engineering plans indicate that this will require the disturbance of 53 acres of land and over 700,000 cubic yards of cut and fill. The actual area of disturbance and cut and fill volumes were minimized to the maximum extent practical during the project design process. Two-thirds of area will be revegetated following construction; the remainder will remain as gravel roads, facility footprints, and other stabilized areas.
4.2	**Impacts on Air Flow and Climate**	There will be no significant changes to air flow and climate.
4.3	**Air Quality**	Project-related construction activities will generate fugitive dust from earthmoving operations and exhaust emissions from construction vehicles; the former will be limited to the project area. Small quantities of construction-related fugitive dust emissions will also result from vehicles carrying equipment and workers up and down the existing Kaheawa access road.
4.4	**Hydrology and Water Resources**	Site and access road grading will alter storm water runoff paths, but the runoff will continue to flow into existing drainage basins. The project will not significantly increase the volume or alter the quality of storm water runoff leaving the project site. All water used on site during construction and operation would be trucked in; the small amount of domestic wastewater will be collected in a septic tank or portable toilets and trucked away for disposal.
4.5	**Natural Hazards**	Proposed facilities are outside flood hazard areas and tsunami inundation zones. The facilities would be exposed to seismic, hurricane, high wind and lightening strike hazards but minimal impacts are anticipated due to planned preventive and response measures.
4.6	**Terrestrial Flora**	No sensitive or endangered flora inhabits the areas to be directly affected by construction. The project includes a plan for immediate and long-term revegetation including invasive species prevention and control.
4.7	**Terrestrial & Avian Fauna**	The project will have no significant impact on non-protected species. However, incidental take may occur as a result of protected species colliding with the WTGs, equipment, vehicles and other proposed facilities. This is being addressed through a Habitat Conservation Plan that includes measures to avoid, minimize and mitigate take. The four protected species that could be impacted are the Hawaiian Petrel, Newell's Shearwater, Nēnē, and Hawaiian Hoary Bat.
4.8	**Noise Impacts**	Construction noise from excavators, trucks, and other heavy equipment will occur at the project site. No noise-sensitive uses are located nearby, but a construction noise permit may be required.

EIS Section	*Impact Topic*	*Environmental Effect*
4.9	**Archaeological, Historic, & Cultural Resources**	The proposed development would not affect the *heiau* adjacent to the existing wind farm or the Lahaina Pali Trail. No artifacts or burials were encountered during construction of KWP I which indicates a low probability of encountering subsurface remains at the KWP II project site. If any archaeological deposits or human burials are encountered, the contractor will halt work and contact the State Historic Preservation Division (SHPD). Cultural consultation and impact assessment conducted for the project show that so long as the measures that KWP II has agreed to are implemented it will not have a significant adverse effect.
4.10	**Land Use & Socioeconomic Effects**	The project will not interfere with other existing or potential uses of the State land that the proposed facilities would occupy. The presence of the WTGs, site access roads and related facilities would not limit access to other land served by the existing access road. The parcels in which the proposed project and existing access road are situated are designated as Section(b) Ceded Lands, and OHA will therefore receive a portion of the amount that KWP II LLC pays to the Department of Land and Natural Resources for the lease of the 333-acre project site. Direct socio-economic effects of the proposed facilities include: (1) construction employment and business activity; (2) ongoing employment of facility staff (which would be relatively limited); (3) ongoing expenditures for materials and outside services; and (4) State revenues in the form of taxes and lease revenues.
4.11	**Scenic and Aesthetic Resources**	During construction, visible components of the project will include construction equipment, transport and assembly of facility parts, and temporary dust and smoke from construction vehicles. The contractor will be required to minimize fugitive dust in accordance with applicable law, and the other visible activities during construction will be minor and temporary in nature.
4.12	**Hazardous Materials**	Construction will involve the use of small amounts of several hazardous materials that require special handling and storage. These will be identified, along with measures for containment and spill prevention, in a SPCC Plan for the KWP II facility. The risk of harm will be minimized by requiring the contractor to follow best management practices.
4.13	**Public Infrastructure & Services**	The project has little potential to affect public infrastructure and services adversely. It would consume only small amounts of electrical power. All of the water needed for the facility would be trucked up to the site; no new potable water service would be required. Minor traffic delays could result during transport of large parts & components (i.e., WTGs) to the site. KWP II LLC will require its contractors to coordinate and implement the traffic control measures described in Chapter 4 to minimize potential delays. No significant impacts on telecommunications or other utilities are anticipated.
Source: Compiled by Planning Solutions, Inc.		

Table S-2 Summary of Proposed Action's Operational Period Impacts.

EIS Section	*Impact Topic*	*Environmental Effect*
4.1	**Geology, Topography and Soils**	The design features that have been incorporated into KWP II to minimize erosion (i.e., minimal road construction, drainage culverts under site roads, minimization of cut/fill volumes), in addition to the revegetation plan in place for the facility will insure that the potential for erosion is minimized during operation of the proposed facility.
4.2	**Impacts on Air Flow and Climate**	The proposed WTGs do not have the potential to affect temperature, rainfall, humidity, or most other meteorological parameters. The project will reduce the combustion of fossil fuels and, therefore, the emissions of greenhouse gases that are contributing to global warming.
4.3	**Air Quality**	Once operational, the proposed facilities have limited potential to affect air quality aside from the indirect benefits of reducing fossil fuel consumption and minor emissions from certain project-related activities such as maintenance work, vehicle-trips made by staff and vendors traveling to and from the site, and the operation of the electrical substation and BESS equipment.
4.4	**Hydrology and Water Resources**	Same as construction period.
4.5	**Natural Hazards**	Same as construction period.
4.6	**Terrestrial Flora**	Same as construction period.
4.7	**Terrestrial & Avian Fauna**	Same as construction period.
4.8	**Noise Impacts**	KWP II may exceed the State nighttime property line sound level limit of 45 dBA at the parcel boundary but would be in general compliance with the 55 dBA daytime limit. The areas that might experience sound levels in excess of 45 dBA are uninhabited.
4.9	**Archaeological, Historic, & Cultural Resources**	Once in operation, the project will have virtually no potential to negatively impact archaeological or historic sites or cultural resources so long as the *Heiau Preservation Plan* and the outreach programs that have been initiated in conjunction with the existing wind generation facilities are continued and expanded. The project would not preclude or limit access to the area by cultural practitioners beyond existing conditions.
4.10	**Land Use & Socioeconomic Effects**	Same as construction period.

EIS Section	*Impact Topic*	*Environmental Effect*
4.11	**Scenic and Aesthetic Resources**	In general, the proposed WTGs are nearly identical in size and character to those existing at KWP I, and because they are situated further west they will be less visible to the more populous areas of Maui. Once constructed, the KWP II facility will produce no visible airborne emissions.
4.12	**Hazardous Materials**	Operation of the facility will require on-site storage of cleaning products and mineral, hydraulic and lubricating oils for maintenance of the substation and WTG equipment. Best management practices, including a SPCC Plan, will be employed to minimize the risk of harm and for containment and spill prevention for the KWP II facility.
4.13	**Public Infrastructure & Services**	The proposed project does not require utility connections and would place no additional burden on public services. It would generate fewer than 20 vehicle-trips per day.
Source: Compiled by Planning Solutions, Inc.		

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1.0 PURPOSE AND NEED

1.1 INTRODUCTION & OVERVIEW

1.1.1 APPLICANT BACKGROUND

Kaheawa Wind Power II LLC (KWP II LLC) is the project entity formed by Hawai‘i Holdings, LLC, which is comprised of First Wind (formerly UPC Wind Partners, LLC), a Boston-based wind energy company, and Makani Nui Associates, LLC, a Maui-based company dedicated to the development and operation of renewable energy projects, primarily wind energy, throughout the State of Hawai‘i. The principals of First Wind are wind power developers with experience in financing, constructing, operating and managing large wind energy projects in America and worldwide. In North America, First Wind has 129 megawatts (MW) of wind energy generation in operation, 328 MW in construction, and a large pipeline of future prospective projects under development.

1.1.2 PROJECT OVERVIEW

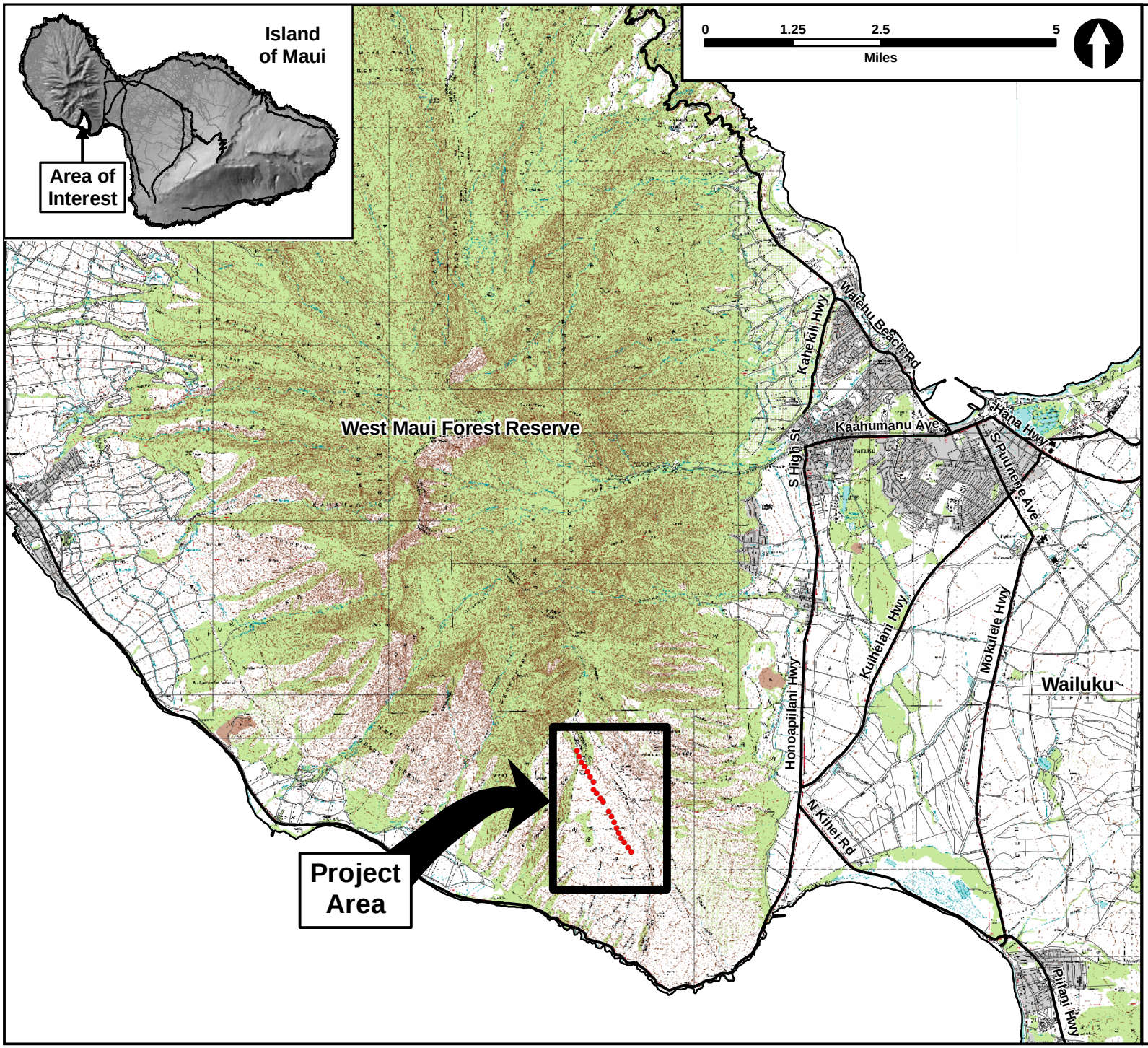
KWP II LLC is proposing to construct and operate a new 21 MW wind energy generation facility on State Conservation District land at Kaheawa Pastures above Mā‘alaea, Maui, Hawai‘i (see Figure 1.1). The proposed project, which is known as Kaheawa Wind Power II (KWP II), is situated immediately adjacent to the existing 30 MW Kaheawa Wind Power (KWP I) project, which commenced operation in the summer of 2006. Like the existing KWP I project, KWP II would supply wind-generated electricity to Maui Electric Company Ltd. (MECO) under the terms of a Public Utilities Commission (PUC) approved power purchase agreement (PPA).

KWP II will consist of 14 General Electric (GE) 1.5 MW wind turbine generators (WTGs), an operations and maintenance building, underground cables carrying electrical power from the individual wind generators to a new electrical substation, a Battery Energy Storage System (BESS), a short overhead transmission line connecting the substation with the MECO transmission system, a communications system, wind monitoring equipment, and service roadways to connect the new facilities to the existing main access road serving KWP I.

For the past year, KWP II LLC has collected meteorological data at the site to determine suitable siting areas for the proposed WTGs. The results of that data show that the most favorable areas are to the west and south of the existing KWP I turbines. Due to the characteristics of the wind resource, ease of constructability, and other factors, KWP II LLC has selected these areas (i.e., the “Downwind” and “Downstring” areas) as the preferred siting areas for the KWP II project. Under the proposed action identified in this DEIS, 11 WTGs would be constructed within the Downwind siting area and 3 WTGs would be constructed in the Downstring siting area (see Figure 1.2). The proposed action and the alternatives that were considered and eliminated from further analysis are discussed in detail in Chapter 2.0.

The remainder of this chapter is divided into two major parts:

- Section 1.2 explains the purpose of the project and describes the benefits associated with adding wind energy generating capacity to Maui’s electrical system.
- Section 1.3 lists the overall objectives that were used to define the proposed action and alternatives.



Legend:

- Existing KWP 1 Turbines

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

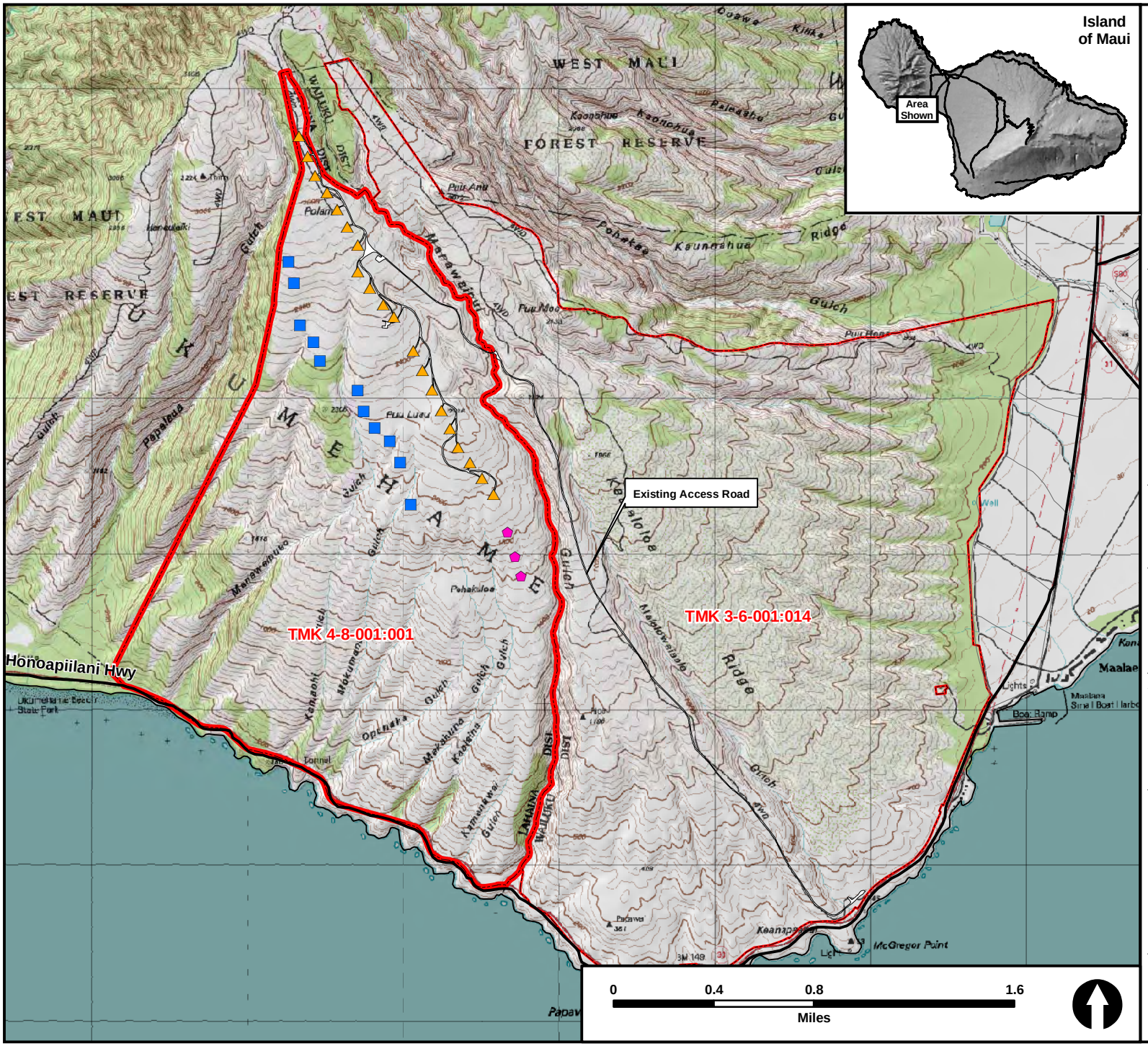
-UPC Wind Management, LLC
-State of Hawai'i GIS

Figure 1.1:

Location Map

Kaheawa Wind Power II

Figure 1-1 Location Map 2008-10-20.mxd



Legend:

- Existing KWP I Turbines
- Highways
- Roadways

Proposed KWP II Sites:

- Downwind Sites
- Downstring Sites

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

-UPC Wind Management, LLC
-State of Hawai'i GIS
-USGS 7.5' Quad Map
-AECOM

Figure 1.2:

Vicinity Map

Kaheawa Wind Power II

Figure 1-2 Vicinity Map 2009-01-13.mxd

1.2 PURPOSE & NEED FOR THE PROJECT

Maui presently depends heavily upon fossil fuels for its electrical energy needs. The geographic isolation of the State of Hawai‘i, coupled with its lack of an indigenous fossil fuel source, makes it particularly vulnerable to any interruption in the supply of fossil fuels to the islands. The importance of improving Hawai‘i’s energy security and its sustainable future has gained acceptance and momentum among the general public and elected officials leading to a number of renewable energy initiatives and incentives for energy conservation and efficiency.

The purpose of the proposed KWP II project is to reduce the current dependence on fossil fuels by generating additional electrical energy from wind. As currently proposed, the project will provide an estimated 70,000 megawatt-hours of electricity per year (MWh/year) to MECO’s system.[1] It is equivalent to well over 5 percent of the electricity produced on the island in 2007 or enough electricity to power about 7,700 average Maui homes (at 750 kilowatt-hours per month). By substituting a “local renewable” fuel source for imported fossil fuel, the project will help the State move toward its goal of energy independence and sustainability. Based on the best available projections of the cost of fossil fuel, it could also provide electricity to Maui’s residents at a lower cost than would be possible using fossil fuel. Each of these benefits is discussed in more detail in the following subsections.[2]

1.2.1 CONTRIBUTION TO MECO’S RENEWABLE ENERGY PORTFOLIO

As recently as 2005, less than 7 percent of Hawai‘i’s energy was provided by renewable sources (DBEDT 2006). Oil was used to produce 80 percent of electricity sold by the State’s utilities in that year. The remaining electricity generation was supplied by coal (13.9 percent), municipal solid waste (2.6 percent), geothermal (2 percent), hydroelectricity (0.7 percent), bagasse (sugarcane waste) (0.6 percent), wind (0.1 percent), and a very small amount from solar photovoltaics.

Since that time, the situation has changed significantly. On June 2, 2004, Hawaii’s governor signed Act 95 (Session Laws of Hawai‘i 2004) into law. Act 95 replaced the previous renewable portfolio standard (RPS) goal with an enforceable standard. These standards require utilities to make renewable energy generation an increasing percentage of their portfolio:

- 8 percent of net electricity sales by December 31, 2005;
- 10 percent of net electricity sales by December 31, 2010;
- 15 percent of net electricity sales by December 31, 2015; and
- 20 percent of net electricity sales by December 31, 2020.

The law allows utilities to count existing renewables in the total. It also allows an electric utility company and its electric utility affiliates to aggregate their renewable portfolios in order to achieve the renewable portfolio standard.[3]

MECO’s most recent Renewable Portfolio Standard Status Report to the State of Hawai‘i PUC states that in 2007 the utility achieved a Renewable Portfolio Standard of 24.7 percent.[4] In that year,

[1] This conservatively assumes that the turbines operate at an average of nearly 40% capacity over the course of a year. The actual number of megawatt-hours per year (MWh/year) is expected to be somewhat higher than this.

[2] For the purposes of consistency and transparency, the following assumptions are utilized in calculations throughout this document (unless otherwise noted): (a) Net capacity factor = 38%; (b) average heat rate for MECO-owned generation = 11,500 BTU/Net kWh; (c) BTU Savings = 803,905-1,148,436 MMBTU/yr; (d) 5.825 MMBTU/BBL of distillate (diesel) fuel oil and 21 MW installed capacity; (e) Annualized energy production = 8760 hours per year * Net Capacity Factor (.38); (f) Oil Prices at $80/barrel.

[3] This means that the Hawaiian Electric Company affiliates -- Hawaiian Electric, Maui Electric, and Hawaii Electric Light Company -- may add together their renewable energy numbers to meet the goal.

slightly under two-thirds of the electrical energy that was generated in MECO's system using renewable resources came from KWP I, with the bulk of the remainder coming from Hawaiian Commercial & Sugar Company (HC&S). The remaining third of the renewable portfolio standard credits that MECO reported to the PUC came from programs that displaced electricity from fossil fuel-fired sources (e.g., solar water heating) and from electrical savings achieved by switching to more energy-efficient technologies (e.g., fluorescent lighting).

KWP II LLC has since entered into discussions with MECO to negotiate a power purchase agreement (PPA) for the proposed KWP II facility. The terms of that agreement will determine the amount that will be paid to KWP II LLC and other aspects of energy delivery.

Since the establishment of the RPS, Hawai'i has continued to pass legislation intended to enhance the state's energy self-sufficiency and reduce greenhouse gas emissions. House bills passed in 2006 and 2007 provided Hawai'i with a framework to move toward energy self-sufficiency by focusing on energy efficiency and promoting renewable energy sources. In 2008, the Hawai'i State Legislature established a full-time, temporary renewable energy facilitator position within the Department of Business, Economic Development, and Tourism and provided funding for designated energy program personnel and activities. It also established a renewable energy facility siting process to expedite the review and action upon State and county permits necessary for the siting, development, construction, and operation of a renewable energy facility of at least 200 megawatts of electricity and established a renewable energy facility siting special fund.

The State of Hawai'i and the US Department of Energy (USDOE) have signed a Memorandum of Understanding (MOU) establishing the Hawai'i Clean Energy Initiative (HCEI). The HCEI MOU creates a long-term partnership designed to help transform Hawai'i's energy system into one that utilizes renewable energy and energy efficient technologies to supply 70 percent of its energy needs by 2030 (State of Hawai'i and USDOE 2008).

On October 20, 2008, the State of Hawai'i, the State Department of Business, Economic Development and Tourism (DBEDT), the State Division of Consumer Advocacy, Hawaiian Electric Industries, Inc. and Hawaiian Electric Company, Inc. (HECO), signed an Energy Agreement, which is a detailed agreement to implement the Hawai'i Clean Energy Initiative. The agreement includes a commitment by Hawaiian Electric Industries to encourage and explore the development of known project proposals, including Kaheawa Wind Power II, with the goal of bringing the maximum number of projects and renewable megawatts online as quickly as possible. The parties also agreed to amend Hawai'i Revised Statutes, §269-92 to provide that by 2030, 40 percent of the HECO Companies' total RPS must be from renewable sources, and that through 2015, not more than 30 percent of such total RPS may come from imported biofuels consumed by the utilities' units.

In order to focus the majority of its efforts on implementing the HCEI and Energy Agreement, MECO and the Consumer Advocate filed a joint request to the PUC on November 6, 2008, asking it to suspend MECO's pending Integrated Resource Plan 3 (IRP-3) docket and open a new docket to establish a Clean Energy Scenario Planning (CESP) process. The PUC issued the requested order closing the IRP Docket on December 8, 2008 (Docket No. 04-0077). The order suspends all activities pursuant to the IRP Framework citing the desire to focus resources on the development of the CESP framework.

1.2.2 ECONOMIC BENEFITS

Initially, the KWP II project would generate economic activity through construction employment and equipment and material sales. Over the long term, it will create additional operations and maintenance jobs, business activity (by suppliers), and tax and lease revenues. However, the

[4] *2007 Renewable Portfolio Standard Status Report for Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc., and Maui Electric Company, Limited, for the Year Ended December 31, 2007* as reported at www.heco.com/vcmcontent/StaticFiles/pdf/2007_RPs_Report-to-PUC_draft_080530_FINAL.pdf.

project's most important economic effect on the island will be to stabilize a portion of the energy fuel cost incurred by MECO as it generates electricity for Maui island residents and businesses under its fixed-price contract with MECO.

KWP II LLC forecasts two different kinds of quantifiable economic benefits of the project. One is associated with the construction of the new capital infrastructure that would be installed as part of the project. The second has to do with the economic benefits that will result from the reduced outflow of dollars that accompany lower fossil fuel use.

1.2.2.1 Construction of New Infrastructure

The proposed project involves the expenditure of approximately $17M for site construction contracts and services. This will result in local jobs during design, development, and construction. That expenditure will lead to approximately $1M in state excise tax revenues;

Over the life of the facility, it will also:

- Produce an estimated $6M of lease revenue to the state for land use; and
- Generate approximately $5M in job-related income (plus associated income tax revenues).

1.2.2.2 Effects of Reduced Fossil Fuel Purchases

Hawai'i's citizens pay the nation's highest energy costs, partly because Hawai'i is the most oil-dependent state. In 2005, Hawai'i relied on imported fossil fuels (petroleum and coal) for 94.5 percent of its primary energy needs, at a cost of $4.62 billion (Maui County 2008). Roughly 13 percent of Hawai'i's oil imports came from U.S. sources in 2005 and the remainder came from overseas. Hawai'i's coal is currently imported from Australia and Indonesia.

KWP II LLC estimates that the proposed project would reduce fossil fuel consumption by an estimated 138,000 barrels per year, significantly lowering Maui's dependence on imported fossil fuels.[5] Fossil fuel pricing has historically been volatile, while over time continuing to increase in real terms. The recent past is no exception, with crude reaching its historical inflation adjusted peak price of $147.27 on July 11, 2008. Fuel prices are subject to fluctuation based on supply and demand conditions as well as political concerns that can affect the long term availability of world supply. KWP II LLC estimates that if fuel prices remained constant over the life of the project, the substitution of wind energy for fossil fuel energy would reduce the amount that MECO spends on imported fuel by approximately $100M (based on oil at $80/barrel). Reducing the proportion of its energy that comes from fossil fuel would also buffer the system from the energy cost fluctuations that accompany volatile oil prices. The power purchase agreement that KWP II LLC is seeking to negotiate with MECO would provide MECO energy at rates that are below the utility's current avoided costs.[6]

[5] This estimate is based on the following: (a) Net capacity factor = 38%; (b) average heat rate for MECO-owned generation = 11,500 BTU/Net kWh; (c) BTU Savings = 803,905-1,148,436 MMBTU/yr; (d) 5.825 MMBTU/BBL of distillate (diesel) fuel oil; and 21 MW installed capacity.

[6] The term "avoided cost" means the amount that a utility does not have to spend if it obtains power from an outside source rather than from its own facilities. In this instance, it means the operation, maintenance, transmission, and fuel costs that MECO would not incur if it purchases electrical energy from KWP II. The State of Hawai'i Public Utilities Commission will be the ultimate arbiter of that rate. The avoided-cost concept became a public policy tool in the context of energy efficiency. Under the landmark Public Utility Regulatory Policy Act of 1978 (PURPA), electric utilities were required to consider pricing policies and other means of demand management. Frustrated with the high costs of supply-side means of balancing electrical supply with demand, many state regulators provided utilities with incentives for implementing demand-management strategies. PURPA also required electric utilities to consider purchasing power from qualifying facilities (that is, independent producers not primarily engaged in generating or selling electrical power, and meeting other conditions). PURPA requires utilities to compensate Independent Power Producers (IPPs) fairly by paying them the amount the utility avoids having to spend by not having to generate the power themselves (hence the term "avoided cost"). Avoided cost provides the basis of the rate required to be paid to qualifying facilities for purchased power under PURPA. Since PURPA was enacted, electricity production by independent producers and co-generators has been encouraged.

As fuel costs are a significant component of MECO's quarterly avoided cost calculations, those avoided costs can and do fluctuate dramatically. During the third quarter of 2007, MECO's avoided cost was $197/MWh during peak-use hours and $180/MWh during off-peak hours. As fuel costs go up or down in the future, avoided cost as defined by the Public Utility Regulatory Policy Act of 1978 (PURPA) will change proportionately. KWP II LLC's proposal to MECO offers to sell energy to MECO at a fixed price which is not correlated to avoided cost. Assuming the facility operates at an annual average of 40 percent capacity over its 20-year life span, this pricing structure could save MECO approximately $5M annually in fuel costs over the project lifetime as compared to today's PURPA-based avoided cost. The savings could potentially be greater if fossil fuel prices continue to increase over the term of the contract.

1.2.3 ENVIRONMENTAL AND PUBLIC HEALTH BENEFITS

Reducing the consumption of fossil fuel for energy generation by an estimated 138,000 barrels per year will benefit the environment in a number of ways. The most important of these is by reducing air pollutant emissions associated with the combustion of fossil fuels. Additional emission reductions will stem from the elimination of the need to transport petroleum fuels from distant ports to the island. These reductions in fossil fuel consumption would result in the following environmental benefits:

- Avoidance of approximately 107 million pounds of carbon dioxide (CO_2) annually emitted into the atmosphere.
- Elimination of approximately 0.75 million pounds of sulfur dioxide (SO_2) annually emitted into the atmosphere.
- Elimination of approximately 195,000 pounds of nitrogen oxides (NO_X) annually emitted into the atmosphere.

These gases are known to contribute to various undesirable environmental effects including global warming and acid rain. Additionally it has been shown that these gases are detrimental to human health and the health of other living organisms. In general, the elimination of these harmful pollutants should result in reduced health costs and respiratory illnesses.

1.3 OVERALL OBJECTIVES OF THE PROPOSED ACTION

KWP II LLC has identified the following objectives for the proposed action.

(1) Bring on-line at the earliest possible date a 21 MW wind power generating facility on the island of Maui to increase the portion of Maui's energy derived from renewable sources and reduce dependencies on fossil fuels.

(2) Minimize the cumulative costs, environmental and visual impacts of the new facility by sharing key infrastructure (i.e., access road, equipment parts, construction equipment) with the existing KWP I wind farm.

(3) Locate the additional generating capacity in such a way as to minimize the need for additional MECO power interconnection infrastructure, thereby avoiding unnecessary economic and environmental impacts associated with connecting to the MECO system.

(4) Ensure that the size and operating characteristics of the new wind farm are compatible with MECO's overall system requirements to facilitate its integration into the company's grid.

(5) Locate the wind farm in an area with compatible surrounding land uses.

(6) Ensure that the new facility is compatible and compliant with the approvals granted for the KWP I site and all their associated conditions.

(7) *Maintain environmental quality and contribute to maintaining energy costs at a reasonable level.*

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2.0 ALTERNATIVES CONSIDERED

2.1 INTRODUCTION

This chapter describes the physical and operational characteristics of the facilities that will be constructed if the proposed project receives all needed approvals. It also describes the alternative means of achieving the objectives for the proposed action identified in Section 1.3 above.

The description is divided into four major parts.

- Section 2.2 describes the facilities that KWP II proposes to construct and operate.
- Section 2.3 discusses the anticipated schedule for the construction of the project.
- Section 2.4 provides preliminary cost estimates for each of the major components.
- Finally, Section 2.5 discusses the alternatives to the proposed action.

2.2 DESCRIPTION OF THE PROPOSED ACTION

2.2.1 OVERVIEW

KWP II LLC's proposed action (presented as the preferred alternative in this EIS) consists of constructing a new 21 MW wind power generating facility and related improvements at Kaheawa Pastures above Mā'alaea, Maui, Hawai'i. The proposed wind energy generation facility, Kaheawa Wind Power II (KWP II) would be located west and south of the existing wind farm at Kaheawa Pastures (see Figure 2.1).[7] If the required land use approvals and environmental permits are granted, KWP II LLC will:

- Execute a directed lease from the State Department of Land and Natural Resources (DLNR) for approximately 333 acres of land within parcel (2) 4-8-001:001. This property is contiguous to the 200-acre area that the State has leased to KWP I.
- Obtain an easement for use of the existing main access road (which is in parcel (2) 3-6-001:014) from DLNR and execute licensing agreements with KWP I to use existing /construct new connector roads within the KWP I lease area.
- Construct new internal service roads that connect the facility to the existing KWP I access road.
- Install 14 General Electric (GE) 1.5 MW wind turbines and supporting equipment. Installation includes excavating and constructing foundations and erecting support towers and transformers.
- Install an underground electrical collection network connecting all of the turbines, including excavation and burying of all wires and re-vegetation of the disturbed areas.
- Construct a new electrical substation, install underground electrical power lines connecting all of the turbines with the new substation, and connect the new substation to the existing MECO power transmission lines that pass over the substation site using a short overhead cable.
- Construct a BESS adjacent to the substation. This stored energy will be used to improve the ability of the MECO system to absorb additional as-available wind resources.

[7] The proposed turbine locations shown on Figure 2.2 were selected based on constructability, topography, vegetation, and other micro-siting factors, however as additional geotechnical and engineering information becomes available, the WTG locations may shift slightly; this distance is expected to be a few to no more than 50 meters.

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Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Makani Nui Associates, LLC

Figure 2.1:

Aerial Photo of Project Area

Kaheawa Wind Power II

Figure 2-1 Aerial Photo of Project Area 2008-09-22.cdr

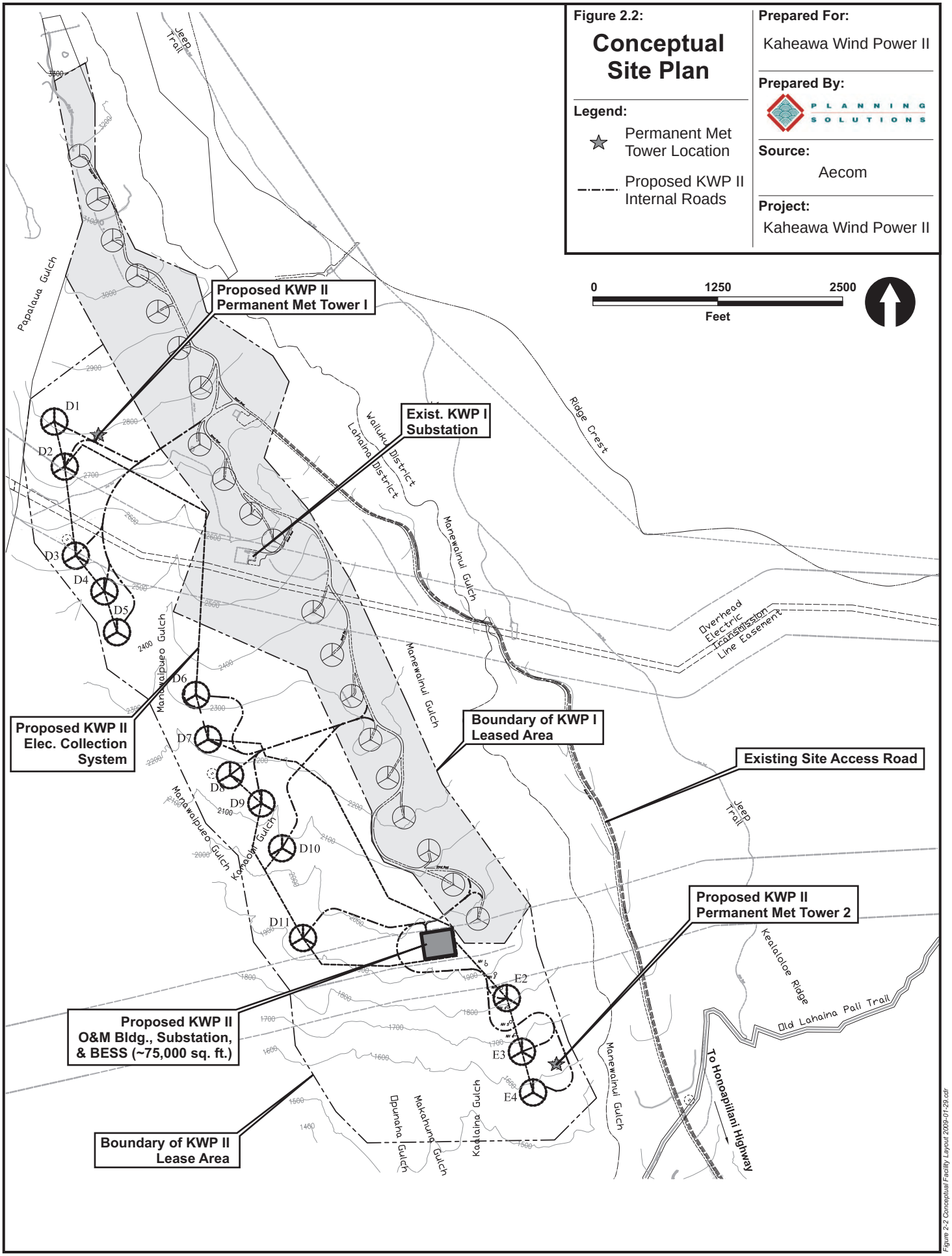

Figure 2-2 Conceptual Facility Layout 2009-01-29.cdr

- Construct a new operations and maintenance building to house operations personnel, wind generating facility controls, and maintenance equipment and spare parts, including shop facilities.
- Construct two permanent meteorological towers, a communications tower to support data gathering and control functions, and a temporary 65-meter test tower prior to construction of the WTGs.

Figure 2.3 contains photographs showing conditions on and immediately around the site in early 2006.[8] They provide a sense of the topography, vegetation, existing facilities, and overall character of the area within which the proposed project would be constructed. Access to the site from Honoapiʻilani Highway (State Highway 30) would be from the existing State-owned road that was improved during construction of KWP I. The proposed 14-turbine layout would fall within an overall leased area of approximately 333 acres. Construction of the proposed project components (access roads, WTG pads, substation, and operations and maintenance building) would disturb approximately 53 acres of land (i.e., approximately 16 percent of the leased area); the remainder would remain undisturbed.

Figure 2.4 contains photographs depicting the construction process at KWP I as an example of the nature and extent of activities proposed. Table 2.1 summarizes the area that would be occupied by each of the major components of the proposed project.

Table 2.1. Area Disturbed by Construction of Proposed Facilities

Project Component	***Approximate Area Occupied***
14 WTG Foundations & Pads[1]	21 acres
Trenching for Underground Electrical Cables[2]	1 acre
Two Permanent Meteorological Towers	1 acre
Baseyard (O&M Building, Substation, BESS)	4 acres
Access Roads[3]	26 acres
TOTAL	53 acres

Notes:
(1) Individual foundations occupy approximately 2,500 square feet each; total disturbed area is conservatively estimated as 1.5 acres per turbine.
(2) Trenches for underground cables will be 3’ wide and 4’ deep and backfilled to finish grade.
(3) Estimate based on 36-foot wide strip of “disturbance” (16’ road surface and two 10’ shoulders).

Source: KWP II LLC (2009); AECOM, January 12, 2009.

[8] In September 2006, an extensive brush fire affected a large portion of the West Maui Mountains from the coastal highway to the existing facility, including a large portion of the proposed KWP II site. The existing facility was not the cause of the fire. It was protected from damage by multiple firebreaks and by extensive watering, and the roadways constructed for the project were instrumental in providing firefighting crews access to the fireline.

A. View South across Manawaipueo Gulch.

B. View South down access road towards O/M building.

C. Existing 1.5 MW turbines at KWP I.

D. View South towards proposed KWP II downwind sites.

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Kaheawa Wind Power II

Prepared By:

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Source:

--Kaheawa Wind Power II (2006-09-09)
--Planning Solutions, Inc. (2006-09-06)
--Makana Nui Associates, LLC

Figure 2.3:

Photographs of Existing Conditions

Kaheawa Wind Power II

Figure 2-3 Photographs of Existing Conditions 2008-09-22.cdr

A. Aerial view of grading for roads and WTG pads.

B. Installation of poured concrete WTG foundation.

C. Partially erected WTGs.

D. Crane used to assemble WTGs. Note rotor on ground.

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PLANNING SOLUTIONS

Source:

First Wind

Figure 2.4:

KWP I Construction Photos

Kaheawa Wind Power II

Figure 2-4 KWP I Construction Photos 2008-11-05.cdr

2.2.2 METEOROLOGICAL MONITORING TOWERS

On July 20, 2007, the State of Hawai‘i Department of Land and Natural Resources approved the Conservation District Use Permit (CDUP) needed to erect 4 temporary 60-meter guy wire-supported meteorological towers on the KWP II site in order to gather wind speed and direction information (see photograph to left). The temporary monitoring towers were erected in September 2007 and are presently collecting data. Three of these will be removed when construction commences. The fourth will be relocated to one of the proposed WTG locations as a “test tower” until the WTG is constructed to replace it. Two permanent 65-meter latticed meteorological monitoring towers will be constructed at the site as well, and their locations are depicted on Figure 1.2.

2.2.3 WIND TURBINE GENERATORS

Figure 2.3 contains photographs of the proposed General Electric 1.5 MW WTGs. Each of the proposed WTGs has four principal elements: 1) a three-bladed rotor which converts the wind’s energy into rotational shaft energy; 2) a nacelle that houses a gearbox and a generator; 3) a tower that holds the rotor and drive train above the ground; and 4) electronic equipment at the base of the turbine such as controls, electrical cables, and a transformer.

Rotor. The three-bladed rotor on each WTG has a diameter of approximately 230 feet. When the blade tip is at the top of its arc it extends about 327 feet above the ground. The rotors turn at a rate of between 10 and 21 revolutions per minute depending on wind speed.

Nacelle. The nacelle atop each tower (see Figure 2.5) contains the gear box, low- and high-speed shafts, generator, controller, and brake; it is approximately 12 feet high by 12 feet wide by 27 feet long. The nacelles are mounted on the towers in a manner that enables them to rotate 360 degrees about a vertical axis so that they can always be oriented into the wind. Each WTG is equipped with sensors that monitor wind speed and direction. When the wind speed picks up to within operating range, the sensors cue the WTG to orient itself to face the wind, to switch its rotor from a dormant (i.e., feathered) to an active position, and to commence generating power.

Tower. The conical tubular steel towers supporting each unit will be 212 feet high; they will taper from a diameter of approximately 15 feet at the base to approximately 10 feet at the top. Each tower will contain an internal ladder that allows access to the nacelle and a 450-pound capacity load-lifting system that allows work equipment and parts to be hoisted from the ground to the nacelle. The reinforced concrete foundation supporting each tower is approximately 46 feet square. The exact depth will depend upon the results of geotechnical tests conducted at each of the final tower locations, but will probably on the order of 10 feet below finished grade.

Electronic Equipment. An electronics cabinet inside the base of each tower houses the electric switchgear and related controls. Additionally, a small (approximately 8-foot cube) pad-mounted transformer is located adjacent to the base of each tower to increase the electrical voltage of the energy produced by the generator to 34.5 kilovolts (kV).

WTG Pads & Foundations. A work area will be cleared and graded around the base of each WTG to provide room for delivery and laydown of turbine components, crane access, and foundation construction. This will be done using bulldozers, trucks and a crusher-screener, plus water trucks and cement mixers needed for the concrete foundations. Based on experience gained at KWP I the size and shape of each work area will vary depending on terrain and construction requirements. However,

it will generally be on the order of 180' x 200'. A gravel perimeter will be provided around each foundation to facilitate access and maintenance; weed-barrier material will be used beneath the gravel. Disturbed areas outside the gravel perimeter will be scarified and seeded to stabilize the soil.

Equipment Transport and Installation. The WTG components have been delivered to an interim storage site on Maui. The equipment will be transported to the site via the existing KWP I access road. Once at the site, the turbines will be erected by the 300-ton crane that is housed at the KWP I facility.

Figure 2.5. Schematic Drawing of GE 1.5 MW Wind Turbine Nacelle.

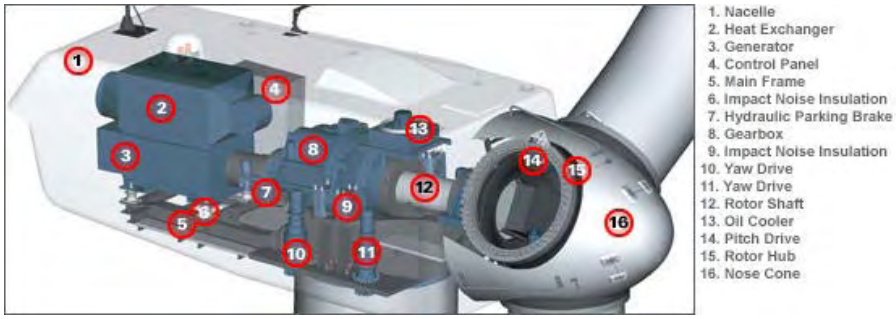
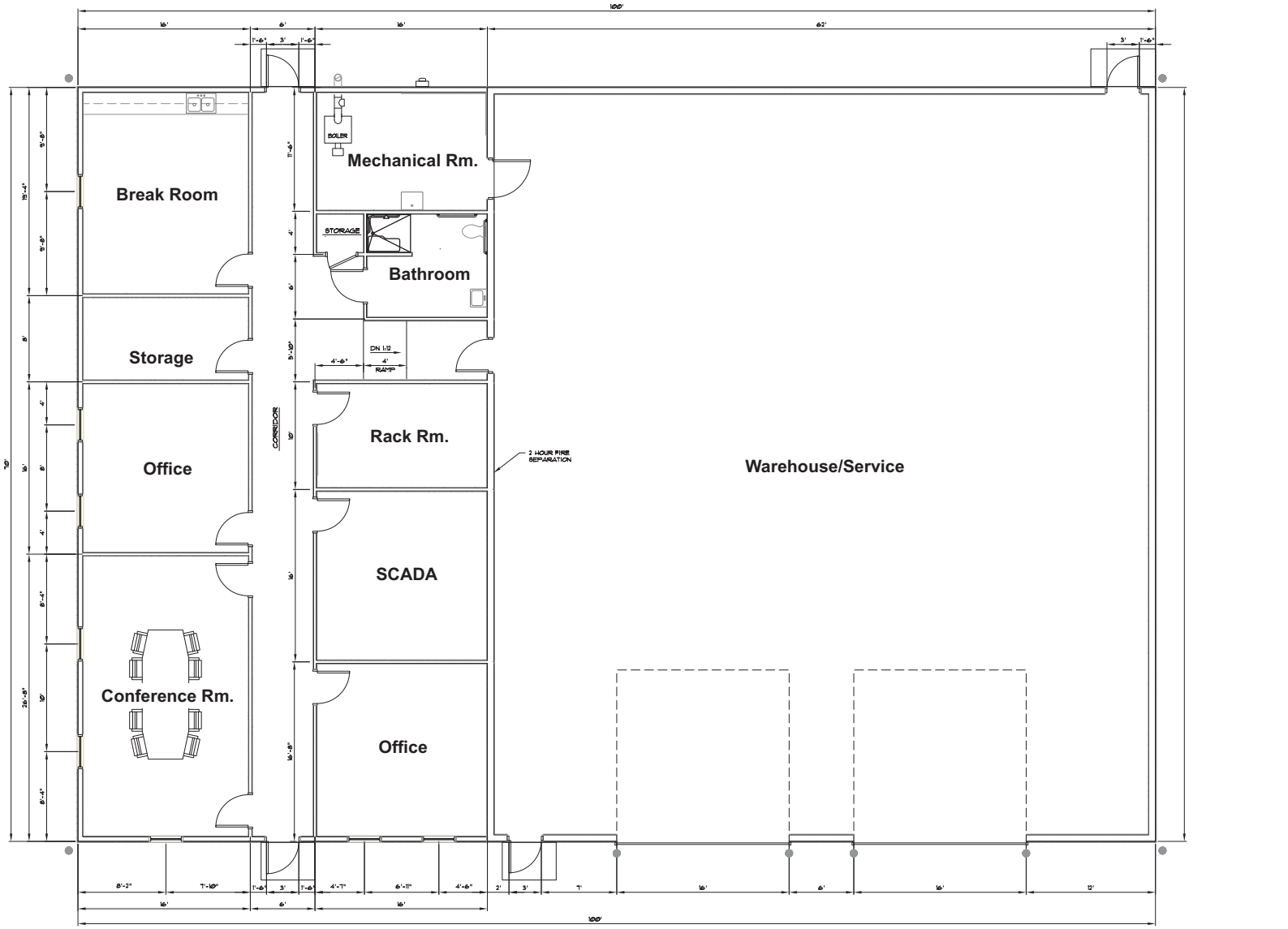


Table 2.2. Characteristics of 1.5 MW Wind Turbine.

Power Generation	1.5 MW each
Tower Structure and Height	Tubular; 212 feet
Rotor Diameter	231 feet
Total Height (Tower + ½ Rotor)	328 feet
Rotor Swept Area	50,130 square feet
Rotor Speed	10-21 rpm (variable)
Wind Speed at Which Generator Starts	8 miles per hour
Wind Speed at Which Generator Cuts Out	56 miles per hour
Rated wind speed (unit reaches maximum output)	27 miles per hour
Note: Based on GE Model 1.5sle on 64.7 m tower.	
Source: Kaheawa Wind Power LLC (2004).	

2.2.4 OPERATIONS & MAINTENANCE BUILDING

This prefabricated metal building would be approximately 70 feet wide and 100 feet long. A site plan is included as Figure 2.6 and elevation drawings are included in Figure 2.7. The operations and maintenance (O&M) building would house the wind farm's supervisory control and data acquisition racks, which monitor the performance of the overall system and the operational status and performance of individual turbines and wind monitoring equipment. The facility will also provide for two large maintenance bays as an indoor work area, shop facilities including an overhead crane to facilitate large equipment repair, and a storage area for spare parts. A fenced outdoor lay down area approximately 100 feet x 200 feet located next to the O&M building will be utilized for large equipment storage such as spare WTG blades and gear boxes. Outdoor parking will be provided for at least 10 vehicles.



FLOOR PLAN
SCALE: 1/4" = 1'-0"

Legend:

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

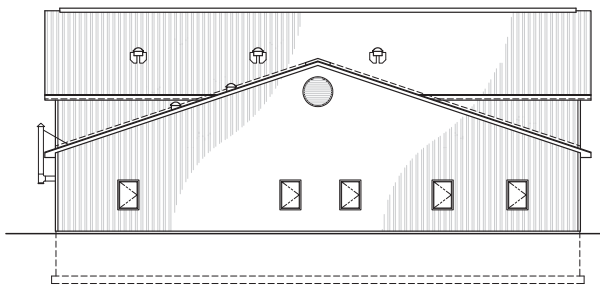
BRSA
B.R. Smith Associates, Inc.
Surveying Engineering

Figure 2.6:

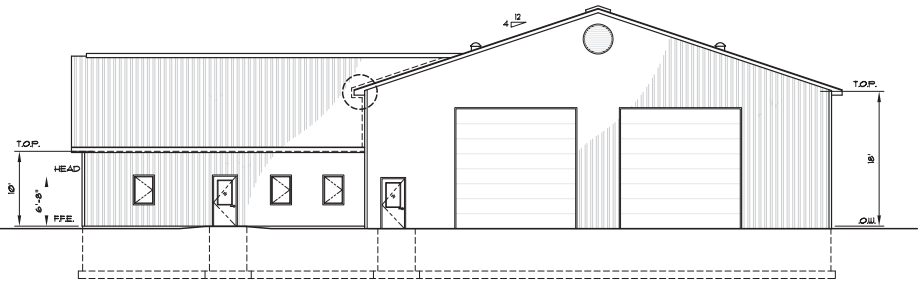
Operations & Maintenance Building Site Plan

Kaheawa Wind Power II

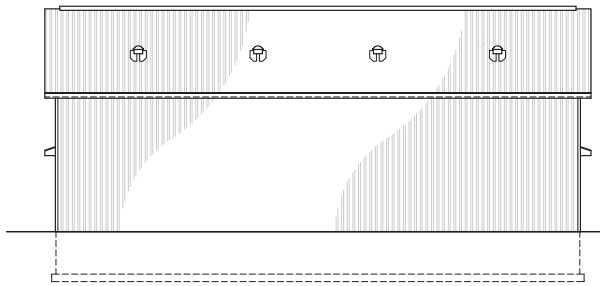
Figure 2-6 Operations & Maintenance Building Site Plan 2008-12-12.cdr



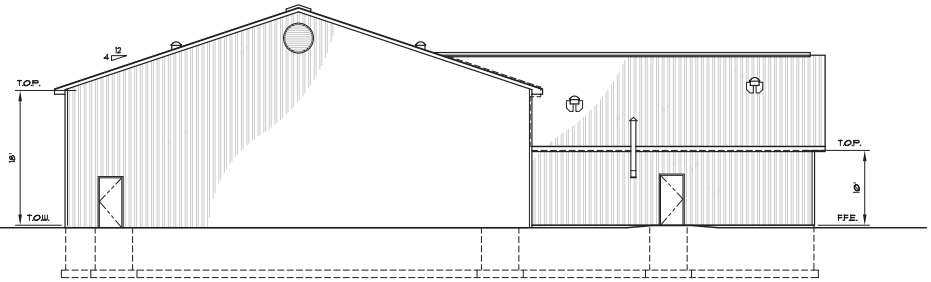
NORTH ELEVATION



WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION

Legend:

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

BRSA
B.R. Smith Associates, Inc.
Surveying Engineering

Figure 2.7:

Operations & Maintenance Building Elevation View

Kaheawa Wind Power II

Figure 2-7 Operations & Maintenance Building Elevation View 2008-12-15.cdr

2.2.5 SITE ACCESS AND INTERNAL ROAD NETWORK

The proposed KWP II facility will utilize the existing State-owned access road from Honoapi‘ilani Highway to KWP I. It will seek an easement from DLNR for that purpose. In addition, KWP II LLC will obtain an easement from KWP I LLC in order to cross its leased property en route to the new facility. KWP II LLC will construct an internal road network to connect the new WTGs that KWP II has proposed to the existing KWP I access road and to one another. The presence of two steep gulches cross-cutting the row of proposed WTGs means that excessive earth disturbance would be required to construct a continuous road that connects all 14 turbine sites. To avoid this, the KWP II plan shown on Figure 2.2 calls for 3 spur roads to be constructed to connect the Downwind and Downstring sites with the existing KWP I road.

The cleared and graded area for the proposed new internal access roads will be approximately 36 feet wide. Within that there will be a gravel surface approximately 16 feet wide and a 10-foot wide native soil shoulder on either side. The relatively wide right-of-way is needed to accommodate the large crawler crane that is used in erecting and periodically maintaining the WTGs and other oversized equipment. Individual spur roads will branch off from the main connector roads to each turbine site.

2.2.6 ELECTRICAL SYSTEM COMPONENTS

2.2.6.1 Transformers and WTG Interconnections

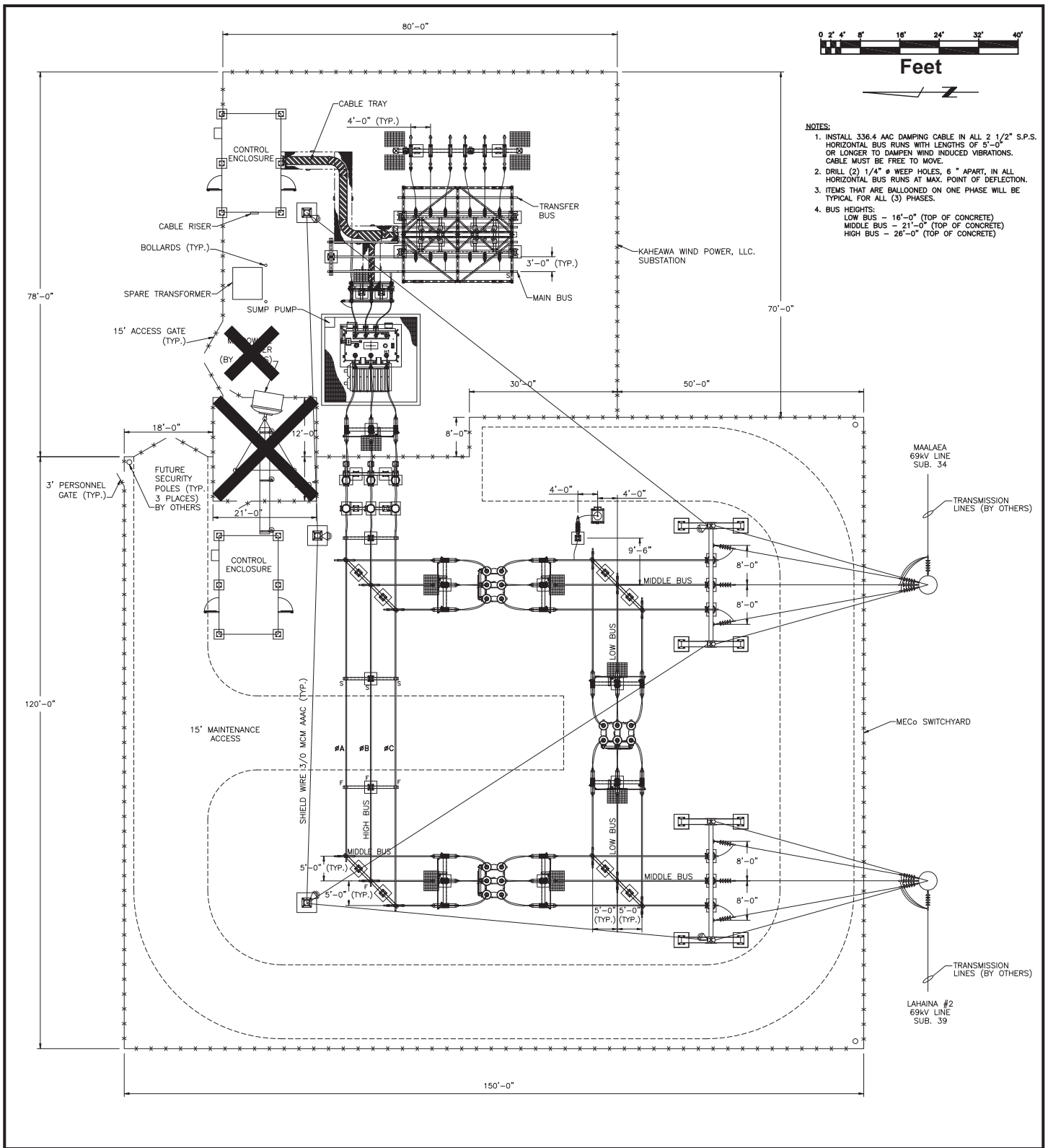
A pad-mounted transformer at the base of each tower will boost the lower-voltage electrical power produced by the nacelle-mounted generator to 34.5 kilovolts (kV). The 34.5 kV power will be carried by underground cable from the transformers to the on-site electrical substation described in Section 2.2.6.2. The cables would be direct-buried in four-foot deep trenches. It is anticipated that two collection circuits will be installed.

2.2.6.2 Electrical Substation

The substation will feed electricity from KWP II’s electrical power collection system into MECO’s transmission system. The substation will be an open steel switchrack design similar to that constructed for KWP I with associated power circuit breakers and disconnect switches. It will provide for the termination of the two 34.5 kV collection circuits, a 69/34.5 kV main step up power transformer, and a 69 kV interconnection to the MECO electric grid. All substation control, relaying, and primary metering equipment will be housed in a separate control room located in the Energy Storage building located adjacent to the substation. A fiber optic cable will run from the new substation to the communications tower at the existing substation to support off-site communications. The new substation would have a layout similar to that of the existing substation; a preliminary site plan is shown on Figure 2.8 and elevation drawings showing the substation equipment are given on Figure 2.9.

2.2.6.3 Electrical Transmission Lines

Three electrical transmission lines presently cross the mountainside in the vicinity of Kaheawa Pastures. The upper 2 transmission lines are at an elevation of approximately 2,300 feet, and electrical power from the KWP I substation is fed into the uppermost of these. The lower line crosses the pastures about a mile *makai* of the upper two lines at an elevation of about 1,800 feet. The new substation that is part of the KWP II proposal would connect to this lower transmission line.



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

ABB, Inc.
Drawing No. 707001
May 5, 2007

Legend:

◯ – REFERENCE BILL OF MATERIALS

EX – EXPANSION CONNECTION

F – FIXED CONNECTION

S – SLIP CONNECTION

△ – LIGHTS

Figure 2.8:

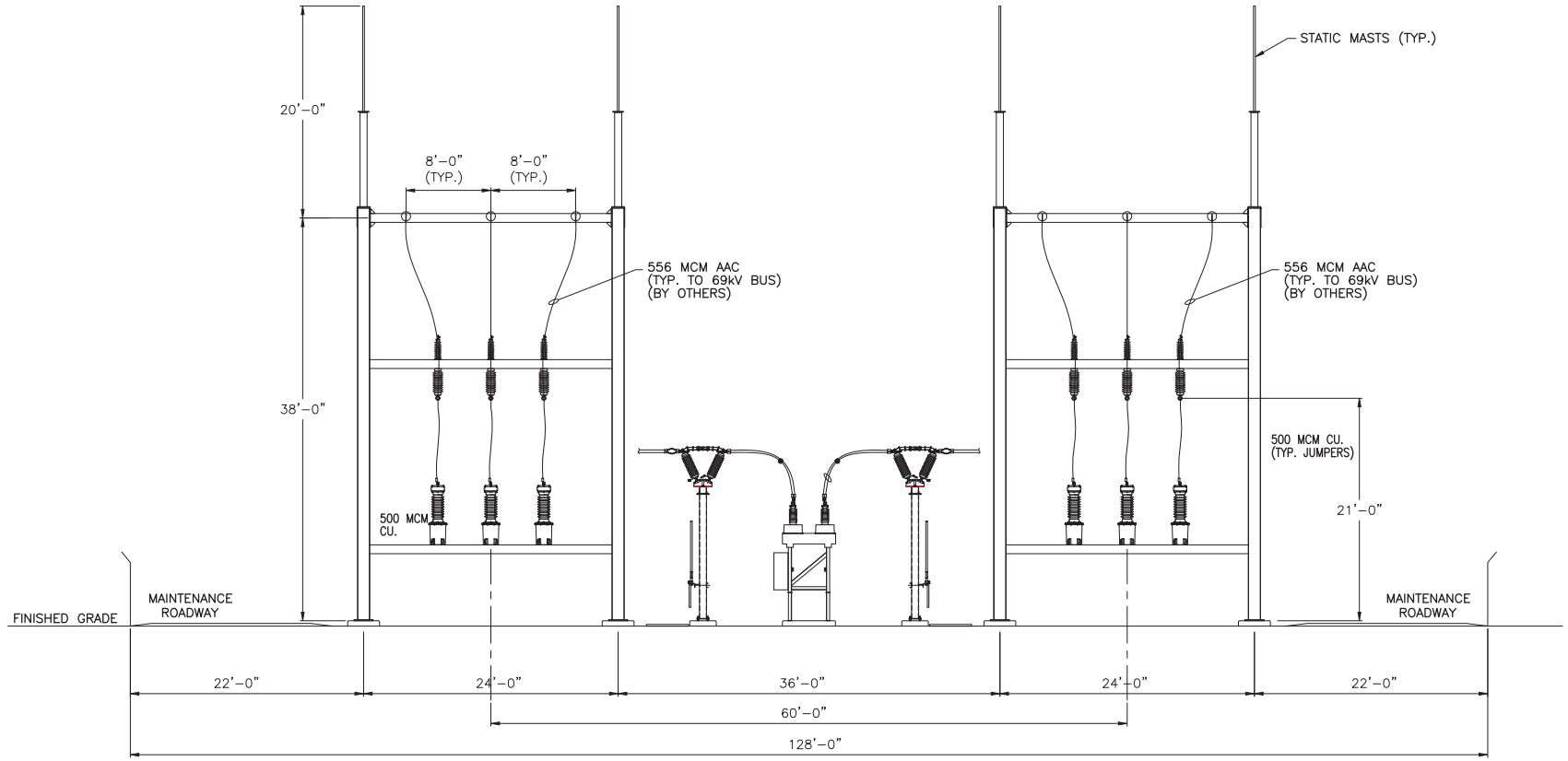
Electrical Substation: Preliminary Plan View

Kaheawa Wind Power II

Figure 2-8 Electrical Substation Site Plan 2009-01-27.cdr

NOTES:

1. ALL DIMENSIONS ARE FROM TOP OF CONCRETE.
2. ITEMS THAT ARE BALLOONED ON ONE PHASE WILL BE TYPICAL FOR ALL (3) PHASES.



ELECTRICAL ELEVATION

8' 16' 24' 32'

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

ABB, Inc.
Drawing No. 707004
May 5, 2007

Legend:

○ – REFERENCE BILL OF MATERIALS

EX – EXPANSION CONNECTION

F – FIXED CONNECTION

S – SLIP CONNECTION

Figure 2.9:

Electrical Substation: Preliminary Elevation View

Kaheawa Wind Power II

Figure 2-9 Electrical Substation Elevation Views 2009-01-27.cdr

2.2.6.4 Battery Energy Storage System (BESS)

Because of the size and operating characteristics of its system, MECO is requiring KWP II LLC to mitigate the variability of output power. In response to this request and to enhance the overall operation of the wind generating facility, KWP II LLC is proposing to install a commercial-scale BESS immediately adjacent to the KWP II substation. The BESS will utilize dry cell battery technology that has been used in various commercial and military applications. The material is non-hazardous and there is no potential for it to release harmful substances to the surrounding environment. The BESS will be sized at approximately 7 MW with 7 MWh of energy storage capability.[9]

The proposed BESS building will be a one-story, concrete block and steel structure with an angled roof totaling approximately 14,000 square feet in area. It will be located adjacent to the proposed substation. The building will house the power cell components and electrical equipment including control and switching panels, DC/AC inverters, and up to eight external pad mounted transformers to connect to the substation. The building will also accommodate the substation relaying, metering, and control equipment for MECO and KWP II, as well as the control equipment for the BESS.

2.2.6.5 Facility Maintenance/Operations

Personnel will generally be present at the facility on a daily basis throughout project operation. They will monitor the condition of the internal roadways and ensure that any needed maintenance is performed promptly, as well as ensuring that the turbines and supporting facilities are operating properly. Site maintenance will include weed control within graveled areas to eliminate any foraging attractions of new growth that might put wildlife at risk of vehicle collision. Finally, personnel carrying out the biological and other monitoring mandated by the permits under which the facility is operated will often be in the field at various locations within the leased area.

2.2.7 WATER SUPPLY/WASTEWATER DISPOSAL

KWP II has a very low on-site water requirement. Consequently, there will be no direct connection to the municipal water supply. Instead, potable water will be purchased from an existing off-site supplier and trucked to the site.

Non-potable water for dust control, landscape irrigation, emergency fire-fighting, and other similar purposes will be drawn from the existing 60,000-gallon tank at the base of the access road. This water will be trucked from the storage tank to required locations on the KWP II site. KWP II LLC is considering arranging for additional potable water to be trucked to the site periodically for domestic use and installing a septic tank to collect waste from sinks and restrooms. If this does not prove feasible due to permitting or cost considerations, KWP II LLC will use bottled water and portable toilets, as is currently done at the KWP I facility.

2.2.8 PROPOSED LAND LEASE

In September 2006 the Board of Land and Natural Resources authorized its Land Division to negotiate a lease with KWP II LLC. This negotiation includes rent as a percentage of total revenue generated, conditions for granting access to the site for certain types of visitors, and restoration of the site or replacing the equipment at the end of the lease period.

[9] This sizing means that when fully charged the BESS will be able to deliver a maximum of 7 megawatts of power to the MECO system for a period of up to an hour. It could provide half that amount (3.5 MW) for twice as long (2 hours) a third that amount for 3 hours, etc.

2.2.9 PROPOSED POWER PURCHASE AGREEMENT (MECO/KWP II)

KWP II LLC has submitted a Non-utility Generator Application for the proposed project to HECO, MECO's parent company. Currently, KWP II and HECO are conducting a Performance Requirements Study to determine what will be needed to interconnect the proposed project with the Maui grid. When the Performance Requirement Study is complete and the Interconnect Requirements Study has been conducted, KWP II LLC will negotiate a PPA with HECO for the proposed project. The proposed term for the agreement is 20 years with provisions for an extension to 25 years.

2.3 SCHEDULE

Major permitting and construction milestones associated with the proposed project are shown in Table 2.3.

Table 2.3. Preliminary Project Schedule

Milestone	*Estimated Completion Date*
Complete permitting process	September 30, 2009
Project Financing Notice to Proceed	Fourth Quarter 2009
Commence Construction	Fourth Quarter 2009
Complete WTG Installation	First Quarter 2010
Energize Substation	Second Quarter 2010
Commence Commercial Operations	Second Quarter 2010
Source: KWP II LLC (2008).	

2.4 ANTICIPATED COSTS

Table 2.4 summarizes KWP II LLC's preliminary estimates of the anticipated costs.

Table 2.4. Estimated Construction Costs

Item	*Order-of- Magnitude Cost (in million 2006$)*
Access Road/Site Development	$4
Wind Turbine Equipment	$31
Wind Turbine Installation/Balance of Plant	$8
Transportation and Logistics	$6
Electrical Substation, Collection Lines, and Interconnect	$18
Operation and Maintenance Facility	$1
TOTAL:	$68
Source: KWP II LLC	

2.5 ALTERNATIVES

2.5.1 FRAMEWORK FOR CONSIDERATION OF ALTERNATIVES

Hawai‘i Administrative Rules (HAR), §11-200-17 (a section in the Office of Environmental Quality Control’s Environmental Impact Statement Rules) addresses the content requirements of draft and final environmental impact statements (EIS). Subsection §11-200-17(f) states:

> *(f) The draft EIS shall describe in a separate and distinct section alternatives which could attain the objectives of the action, regardless of cost, in sufficient detail to explain why they were rejected. The section shall include a rigorous exploration of the environmental impacts of all such alternative actions. Particular attention shall be given to alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, or risks. Examples of alternatives include:*
>
> *(1) The alternative of no action;*
>
> *(2) Alternatives requiring actions of a significantly different nature which could provide similar benefits with different environmental impacts;*
>
> *(3) Alternatives related to different designs or details of the proposed action which would present different environmental impacts;*
>
> *(4) The alternative of postponing action pending further study; and*
>
> *(5) Alternative locations for the proposed project.*
>
> *In each case the analysis shall be sufficiently detailed to allow a comparative evaluation of the environmental benefits, costs, and risks of the proposed action and each reasonable alternative.*

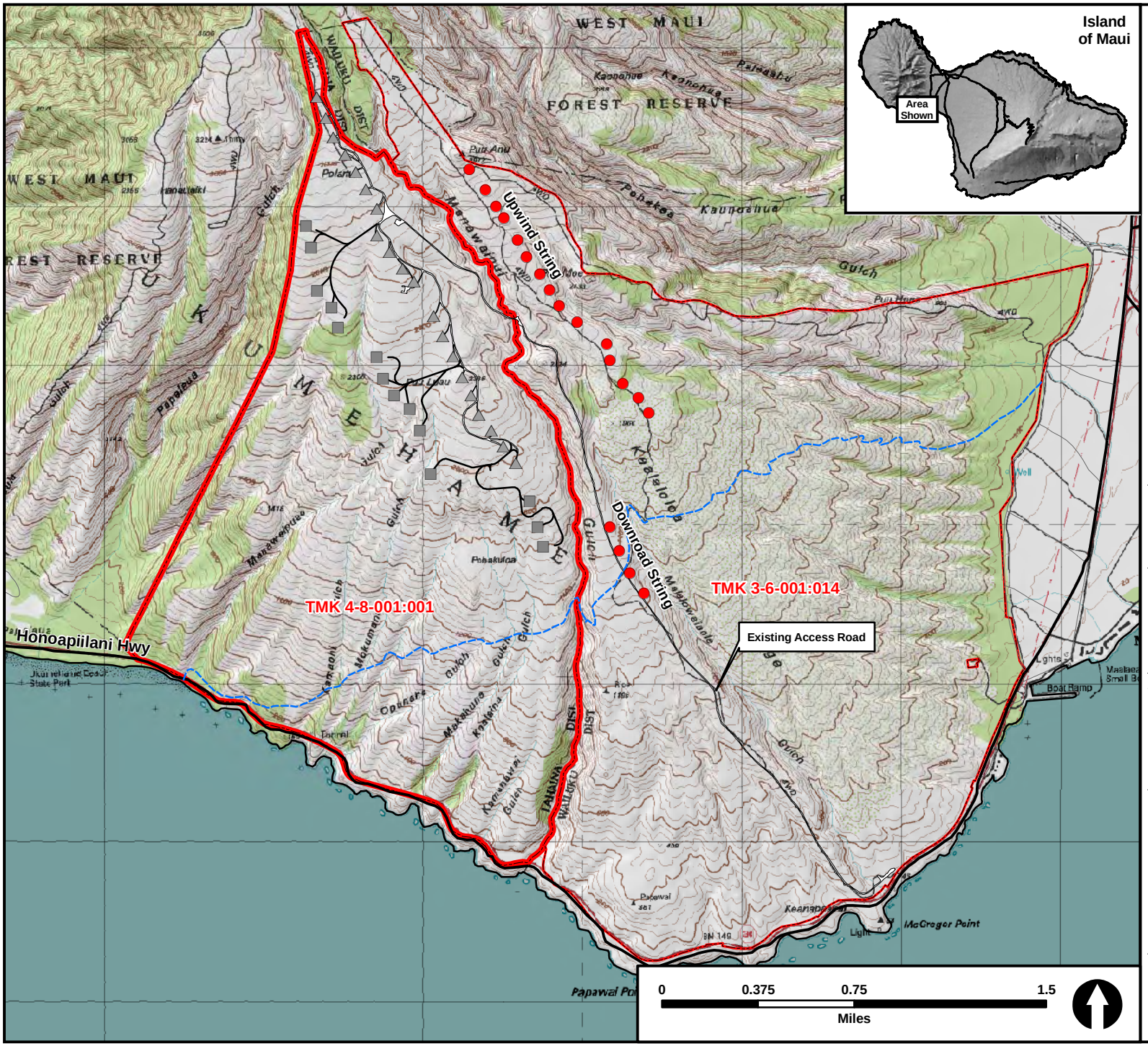
The objectives listed in Section 1.3 of this report and the meteorological data that KWP II LLC has been collecting at the site since August 2007 were used in identifying the alternatives described below for inclusion in this evaluation. Section 2.5.3 describes the alternatives that are evaluated in detail in this EIS. These include: 1) the proposed action of constructing a total of 14 WTGs (11 in the Downwind siting area and 3 in the Downstring siting area); and 2) No Action. Section 2.5.2 lists the alternatives that KWP II LLC considered but rejected during early planning phases and describes the reasons why they were excluded from further consideration in this impact analysis.

2.5.2 ALTERNATIVES ELIMINATED FROM DETAILED CONSIDERATION

Many action alternatives were evaluated during planning for the KWP II project but eliminated from detailed consideration. Those alternatives, and the reasons for their elimination, are summarized below.

2.5.2.1 Alternate WTG Locations at Kaheawa Pastures

As indicated in the EISPN, KWP II LLC initially considered and conducted detailed wind resource evaluations of four potential WTG siting areas (Upwind, Downwind, Downstring, and Downroad). The wind data that it gathered, as well as the results of visual impact and other analyses that it conducted subsequent to publication of that report have since led KWP II LLC to eliminate 2 of these - the Upwind siting area and the Downroad siting area - from further consideration and to site all 14 of the WTGs that it is proposing in the other 2. The two siting areas that are no longer being considered (along with the existing and proposed WTG layouts) are shown on Figure 2.10. KWP II LLC also used ground-truthing and meteorological data to confirm (or rule out) individual WTG locations.



Legend:

- Existing KWP I Turbines
- Proposed KWP II Layout
- Eliminated Sites
- Lahaina Pali Trail

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

-UPC Wind Management, LLC
-State of Hawai'i GIS
-USGS 7.5' Quad Map
-AECOM

Figure 2.10:

Siting Areas Eliminated From Further Consideration

Kaheawa Wind Power II

Figure 2-11 Vicinity Map 2009-01-30.mxd

The following subsections outline the reasons the Upwind and Downroad siting areas were eliminated. They also briefly discuss the criteria KWP II LLC is using for micro-siting individual WTGs within the remaining area.

2.5.2.1.1 Reasons for Eliminating the Upwind Siting Area

The Upwind siting area that was considered is located on the western side of the existing main access road approximately 2,000 feet to the east (i.e., on the Central Valley side) of the existing KWP I turbines. KWP II LLC's preliminary analyses indicated this siting area could accommodate up to 15 WTGs. However, subsequent investigations showed that the Upwind Siting Area had several drawbacks.

First, constructing turbines in this area would require KWP II LLC to lease additional land (up to an additional 250 acres) and to construct additional connector roads (including a major gulch crossing) in a presently undeveloped area. Second, it would also require construction of a new overhead transmission line to connect the turbines with the electrical substation and with the existing MECO power transmission system. Finally, in addition to these relatively large infrastructure requirements, a viewshed analysis confirmed that turbines placed in this siting area would be much more visible to surrounding communities than turbines placed in the Downwind and Downstring siting areas.

2.5.2.1.2 Reasons for Eliminating the Downroad Siting Area

The Downroad siting area is located along the existing access road approximately 2,000 feet southeast of the southern end of the existing KWP I turbine string. KWP II LLC's preliminary analyses indicated this siting area could accommodate up to four WTGs. Like the Upwind siting area, the Downroad siting area was considered less favorable because its lower position on the hillside increases its visibility from nearby areas and because of challenges with access to existing transmission lines. Analyses of the wind data that KWP II LLC started collecting in September 2007 have now shown that the Downroad siting area experiences excessive wind turbulence, making it undesirable for siting WTGs. KWP II LLC therefore has dropped the Downroad siting area from consideration.

2.5.2.1.3 Individual WTG Locations at Kaheawa Pastures

KWP II LLC considered several factors in selecting suitable locations for individual WTGs. These included the viability of the wind resource, proximity and orientation to the existing KWP I turbines (which can affect the efficiency and output of the facility), visibility to the Maui community, presence of sensitive resources (e.g., native flora and fauna, cultural features, etc.), and constructability (i.e., site topography, geological features, and extent of road-building required). Observed conditions at KWP I, as well as meteorological data collection and ground surveys at the KWP II site helped to support these decisions and contributed to the elimination of the Upwind and Downroad Siting areas, as well as to the micro-siting of WTGs within the preferred Downwind and Downstring Areas. KWP II LLC also used these criteria for early elimination of potential turbine sites, for example in the area north of the existing KWP I string which is rich in native biota and lacks the wind resource present in the Downwind and Downstring areas.

2.5.2.2 Greater or Lesser Wind Energy Generating Capacity

The EA/EISPN for the project identified a range of possible generating capacities for KWP II, from 10.5 MW (in accordance with the capacity that MECO's now superseded Integrated Resource Plan 3 identified as being appropriate for development by 2011) to 30 MW. Feedback on the EA/EISPN, analyses of the wind and meteorological data that KWP II LLC has collected, and the fixed costs of the required battery storage facilities have led KWP II LLC to conclude that 21 MW is the appropriate capacity for the facility. The following discussion describes the reasons why KWP II LLC has decided not to consider alternatives that involve greater or lesser generating capacity than the proposed 21 MW facility.

2.5.2.2.1 Reduced Scale Project (<21 MW)

KWP II LLC believes that reducing the size of the facility below 21 MW would decrease the benefits of further wind power development without providing off-setting environmental benefits. Moreover, lowering the number of wind generators does not produce an equivalent reduction in the cost of the support facilities and permitting. When combined with the high fixed costs of transportation, logistics, mobilization and other factors, the cost per megawatt of capacity increases as the number of turbines decreases. For these reasons, KWP II LLC believes it is financially infeasible to construct and operate a facility with fewer than fourteen 1.5-MW WTGs.[10]

2.5.2.2.2 Increased Scale Project (>21 MW)

There is sufficient room to construct more than 14 additional WTGs in the area. However, in order to limit visual effects and engineer a successful utility integration design, KWP II LLC does not believe it would be appropriate or practical to install more than the proposed number of 1.5MW wind generators at the site at this time.

2.5.2.3 Develop Wind Power Generating Facility on another Site

As discussed in Chapter 3, the wind regime at Kaheawa Pastures is extremely favorable in its consistency and strength. In addition, the site's proximity to KWP I allows KWP II to share infrastructure such as the main access road, some equipment storage and parts, and to a smaller extent, personnel, with the existing wind project, subject to licensing agreements between the parties. Other wind-rich sites on Maui are located in areas that lack adequate transmission capability, are closer to/more visible from populated areas, or have other constraints. KWP II LLC believes that duplicating this infrastructure at another site would likely result in greater costs and environmental impacts than would its proposed facility. Moreover, other sites suitable for wind development on Maui present comparable challenges in terms of topography, visibility, natural resources, flora and fauna without having comparable benefits. Therefore, KWP II LLC has concluded that the proposed site is superior to the alternatives that are available for its project.

2.5.2.4 Different Wind Turbine Size or Design

KWP I uses GE 1.5 MW wind turbines. These have been proven to be a good match for the wind regime at the proposed site. Moreover, while sufficiently large to take advantage of economies of scale and the higher wind speeds that are present at heights above those that can be reached by smaller/lower wind turbine generators, the GE units are considerably shorter and less massive than the larger WTGs that are now being put into service in some areas.[11] KWP II LLC plans to use GE 1.5 MW turbines as well, which will be nearly identical in appearance, though about 30 feet taller in overall height due to manufacturer's design changes.[12] Using the same type of wind energy generators in KWP II as have been used in KWP I will help ensure visual and logistical continuity for the facilities at Kaheawa Pastures. This decreases the overall visual impact of the WTGs and streamlines the delivery and exchange of parts.[13] KWP II LLC's economic analyses indicate that the 1.5 MW GE turbines are likely to be the most cost-effective choice for this site. Finally, the GE 1.5 turbines can meet the requirements that MECO is likely to set based on the Interconnect Requirement Study that it is conducting as part of the PPA negotiations.

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[10] The fact that the announced size of Shell Wind Energy's project is almost twice that of KWP II LLC's (40 MW of installed capacity) suggests that these economic limitations are not unique to KWP II LLC.

[11] Examples include General Electric's 2.5 MW series and 3.6 MW machines (which have overall heights reaching up to 500 feet) and the 3.0 MW Vestas V90, whose overall height is about the same as that of the large GE Unit.

[12] The GE Model 1.5se turbines that are presently in production are slightly taller than the ones that were utilized at KWP I. The current model, which is proposed for use at KWP II, has a tower height of 212 feet and the same rotor diameter (231 feet), for a total height of 328 feet. In comparison, the total height of the existing GE 1.5se turbines at KWP I is 296 feet.

[13] Because the ownership of KWP II is different from that of KWP I, the exchange/sharing of parts and services will be done on a commercial basis, but the co-location of the two sets of wind generators and support equipment will greatly facilitate this and will reduce overall costs.

2.5.2.5 Alternate Energy Storage Technologies

Various means have been used for storing wind energy, each of which is best-suited for certain situations (see Table 2.5 for examples). As described above in Section 2.2.6.4, KWP II LLC selected a BESS as the preferred technology for use at KWP II. This technology offers several environmental advantages, such as a small footprint and use of non-toxic materials. Electrical advantages are an instantaneous response time and a reasonably long cell life allowing thousands of charge and discharge.

KWP II LLC considered several alternate storage technologies prior to selecting a BESS for its project. These included pumped water storage, compressed air storage, thermal energy storage, flywheel storage, and superconducting magnetic energy storage.[14] Each of these is described briefly below, along with the reasons why KWP II LLC elected not to pursue it.

Table 2.5. Advantages and Disadvantages of Various Storage Technologies.

Storage Technology	***Main Advantages (relative)***	***Disadvantages (relative)***
Pumped Storage	High Capacity, Low Cost	Special Site Requirement
Compressed Air Energy Storage	High Capacity, Low Cost	Special Site Requirement, Needs Gas Fuel
Thermal Storage	Preserves Heating or Cooling Power for Later Application	Best Suited for Heat that Originates in an Enclosed Repository
Flywheels	High Power	Low Energy density
Superconducting Magnetic Energy Storage	High Power	Low Energy Density, High Production Cost
Source: Electricity Storage Association Website http://www.electricitystorage.org/tech/technologies_comparisons.htm		

- ***Pumped Water Storage***. Pumped water storage (often called "pumped hydro") is probably the best known large-scale technology. This consists of pumping water to a high storage reservoir using power that is available but not immediately needed and then releasing the stored water through turbo-generators to produce electricity when it is most needed (in this case when the wind is not blowing). Pumped storage recovers 80 to 90 percent of the energy consumed by the pumps (i.e., the electrical generator that is driven by the water that is released from the reservoir produces 80 to 90 percent as much electricity as is consumed pumping water into the storage reservoir). The chief challenge with pumped storage is that it usually requires two nearby reservoirs at considerably different heights and an adequate water supply. There are few locations on Maui that are well-suited for large-scale water storage of this sort; moreover, it often requires considerable capital expenditure, and this increases the cost of the electricity produced by such systems. Because of this, pumped hydro is most suitable for storage periods of a few hours, or a few days at most if the power output is greatly reduced. The lack of an available fresh water source combined with the steep topography and the fact that the KWP II site is in the State Conservation District precludes the use of pumped storage for this project.[15]

[14] Additional information can be found at www.electricitystorage.org/pubs/2004/EPRI-DOE%20Storage%20Costs-ESA.pdf.

[15] In theory, electrical energy from the WTGs could be used in a pump/reservoir system located elsewhere. However, the challenge of obtaining the permits and land/water rights needed for this introduces a high degree of uncertainty that KWP II LLC believes makes it unviable.

- ***Superconducting Magnetic Energy Storage (SMES)***. SMES systems store energy in the magnetic field created by the flow of direct current in a superconducting coil which has been cooled to a temperature below the point at which it becomes a superconductor. A typical SMES system includes three parts: (i) a superconducting coil, (ii) a power conditioning system, and (iii) a cryogenically cooled refrigerator. Once the superconducting coil is charged, the current will not decay and the magnetic energy can be stored indefinitely. The stored energy can be released back to the network by discharging the coil. SMES wastes less electricity in the energy storage process than other methods of storing energy (less than 5 percent). The advantage of having low losses is offset by the high energy requirements of refrigeration and of the superconducting wire that the technology requires. Because of this, SMES is currently used for short duration energy storage such as needed to improve power quality. In summary, SMES is not suitable for the KWP II project due to the very high costs, the energy requirements of refrigeration, and the limits in the total energy able to be stored.
- ***Compressed Air Storage (CAES)***. A CAES plant stores electrical energy in the form of air pressure, then recovers this energy as an input for future power generation.[16] When applied to wind energy, this technology uses electricity from WTGs to compress air, which is then stored it in airtight underground caverns. While it is a promising technology for some Mainland locations, this technology is not suitable for Maui because of the absence of suitable underground storage conditions.
- ***Thermal Storage***. Several technologies are available that can store energy in a thermal reservoir for later reuse. The thermal reservoir may be maintained at a temperature above (hotter) or below (colder) than that of the ambient environment. The principal application today is the production of ice or chilled water at night which is then used to cool environments during the day. Thermal energy storage technologies are most useful for storing energy that originates as heat in an insulated repository for later use for space heating or for domestic or process hot water heating. They are not well suited for storing electrical energy and consequently are not viable for KWP II.
- ***Flywheel Storage.*** This form of storage uses electricity from the wind energy generator to power an electric motor that accelerates a heavy rotating disc, which acts as a generator on reversal, slowing down the disc and producing electricity. Electricity is stored as the kinetic energy of the rotating disc. Mechanical inertia is the basis of this storage method. The ranges of power and energy storage technically and economically achievable with this technology are quite limited, however, making flywheels unsuitable for general power system application such as KWP II.

None of the storage technologies that are presently available (including battery storage) provide a cost-effective means of storing energy produced by wind energy sources for long periods (meaning days) of time at the Kaheawa site. Battery storage systems do, however, provide a means of mitigating energy output fluctuations from variable wind resources on the order of minutes and hours. This ability greatly increases the predictability of the energy output to the utility, thus allowing higher as-available penetrations in a small island electrical grid than would otherwise be feasible. Beyond that, other, firm energy sources (such as the existing fossil fuel-fired generating units on the island) are still needed.

[16] Essentially, the CAES cycle is a variation of a standard gas turbine generation cycle. In the typical simple cycle gas fired generation cycle, the turbine is physically connected to an air compressor. Therefore, when gas is combusted in the turbine, approximately two-thirds of the turbine's energy goes back into air compression. With a CAES plant, the compression cycle is separated from the combustion and generation cycle. When the CAES plant regenerates the power, the compressed air is released from the cavern and heated through a recuperator before being mixed with fuel and expanded through a turbine to generate electricity. Because the turbine's output no longer needs to be used to drive an air compressor, the turbine can generate almost three times as much electricity as the same size turbine in a simple cycle configuration, using far less fuel per MWh produced. The stored compressed air takes the place of gas that would otherwise have been burned in the generation cycle and used for compression power.

2.5.2.6 Delayed Action/Slower Implementation

Because of the substantial benefits that substituting wind energy for fossil fuel use has for the natural environment and for Maui's economy, KWP II LLC has concluded that postponing development of the project is not advantageous. It believes that the sooner that additional wind energy is brought online and replaces fossil fuels, the sooner the economic and environmental benefits described in Chapter 1 can be realized. Consequently, it is not considering a slower development schedule at the present time. Similarly, slowing development tends to increase costs, extends the time during which the site has been disturbed and increases the potential for erosion and other adverse effects on the natural environment.

2.5.2.7 Third KWP Increment (KWP III)

KWP II LLC considered proposing the construction of a third increment of KWP (KWP III) in the vicinity of KWP I and II that could take further advantage of the infrastructure that would already be in place (e.g., transmission lines, road access, substation). KWP II decided against proposing a third increment due to the limitations of the available electrical power storage technologies and the absence of a large enough market on Maui to justify wind energy development beyond the 21 MW that is now proposed. Based on the available information, KWP II LLC has concluded that with the efficiency of known technologies and the isolated small island grid requirements, it is unlikely that larger amounts of as available wind energy can be integrated into the Maui grid without significant technological improvements.

Should a better storage/buffering system, or an advancement in generator control technology become available at some time in the future and/or if greater than anticipated load growth should occur on Maui to allow room for additional wind power on the grid, then the option of constructing a third increment (i.e., KWP III) could be revisited.

2.5.2.8 Other Renewable Energy Sources

The principals of KWP II LLC specialize in wind energy generation and have extensive experience implementing it in a cost-effective and environmentally friendly manner. The wind facility being proposed is not intended to exclude or replace the use of other renewable energy sources; rather it will make a contribution to a diversified renewable energy portfolio on Maui. The Integrated Resource Plan (IRP) that MECO submitted to the PUC on April 30, 2007, includes 10.5 MW of wind capacity in its Preferred Plan, and the governor has expressed strong support for the development of wind energy. Hence, KWP II LLC did not evaluate other forms of renewable energy in depth.

2.5.3 ALTERNATIVES TO BE EVALUATED IN THE EIS

For reasons discussed above, most alternatives that were being considered at the time the *EIS Preparation Notice* for the project was issued have been eliminated. Hence, the remainder of this document focuses on the "Proposed Action" and the No Action Alternative.

2.5.3.1 Proposed Action: 21 MW Facility in Downwind and Downstring Siting Areas

The proposed action is described in detail in Section 2.2. Under this proposal, three WTGs would be installed in the Downstring siting area in a rough continuation of the line of KWP I turbines; the remaining 11 turbines would be constructed within the Downwind siting area. This alternative involves the fewest WTGs that KWP II believes it is economical to construct and operate at this location. It also concentrates the wind farm development in the siting areas that have the most desirable wind characteristics and that are farthest from existing viewpoints in central and eastern Maui. The proposed action would meet all the project objectives listed in Section 1.3.

2.5.3.2 Alternative 2: No Action

The EIS evaluates the "No Action" alternative in compliance with HAR, §11-200-17(f)(1). This alternative assumes that neither KWP II nor other developers will install additional wind generating capacity at Kaheawa Pastures for the foreseeable future. This would not satisfy the objectives listed in Section 1.3. This alternative and its implications are discussed in further detail in Chapter 5.0.

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3.0 OVERVIEW OF THE EXISTING ENVIRONMENT

This chapter discusses the environmental, cultural, and social characteristics of the areas that would be affected by the action described above. In most instances, the area affected by the project is limited to areas on and immediately around the proposed site at Kaheawa Pastures. However, the description broadens to a wider geographical scope where applicable. The discussion is organized by topic (e.g., topography, hydrology, noise, etc.). The information is intended as a means of orienting readers to the project area and to describe the general kinds of resources that will be examined in the impact analysis in Chapter 4. More detailed information on existing conditions needed to understand and evaluate potential impacts is provided in that Chapter.

3.1 TOPOGRAPHY, GEOLOGY AND SOILS

3.1.1 PHYSIOGRAPHY AND TOPOGRAPHY

The dominant topographic features in the project area are Manawainui Gulch, which borders the site on the east; Kealaloloa Ridge, which lies between the Kaheawa Pastures area and the isthmus of Maui to the east; Malalowaiaole Gulch, which is southeast and *makai* of the site; Pāpalaua Gulch which is west of the site; and several *pu‘u* (peaks or outcrops). The *pu‘u* include Pu‘u Lū‘au, which is near the existing MECO transmission lines at an elevation of about 2,300 feet, and Pōhakuloa, which is at about 1,600 feet elevation at the lower end of the project area.

The proposed KWP II facilities are located on a narrow band of land running *mauka* to *makai* between the Manawainui Gulch and the Pāpalaua Gulch, and on the ridge between Manawainui Gulch and Malalowaiaole Gulch where the current access road lies. The ground slope along the length (i.e., the *mauka-makai* axis) of the project area varies, but averages about 14 percent. The ground slope across the width of the interfluves on which the WTGs and other facilities would be constructed is also variable, but is typically no more than two to three percent.

3.1.2 GEOLOGY

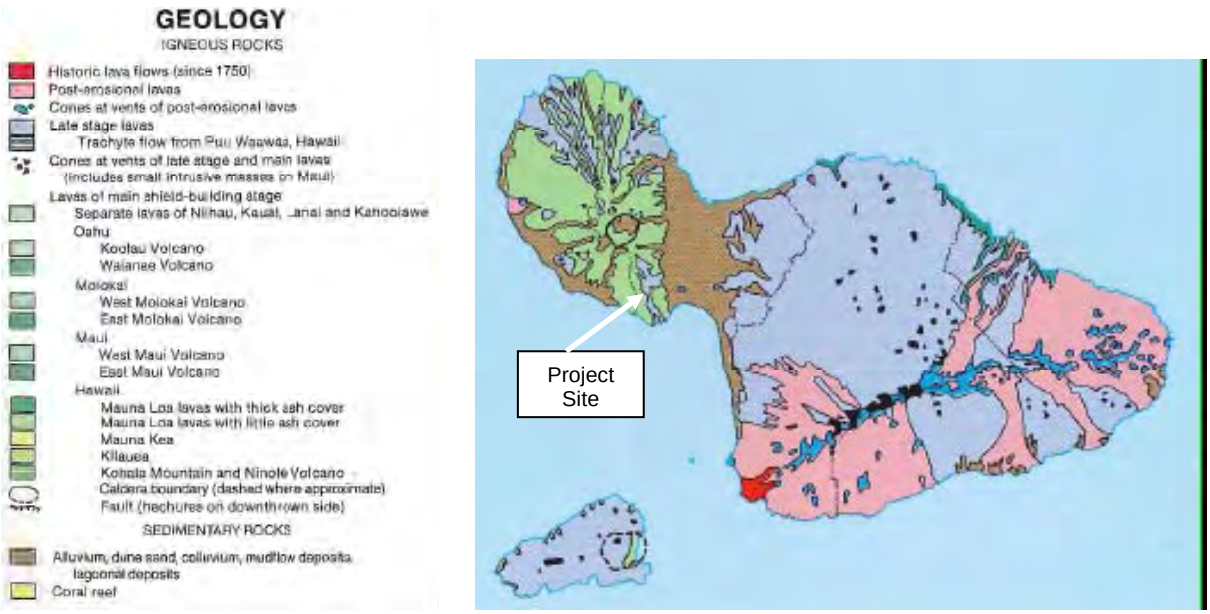
The extinct West Maui volcano where the proposed project is located evolved through shield (1.6 to 2.0 million years old), post-shield (1.5-1.2 million years old), and rejuvenated stages creating volcanic layers thousands of feet deep. Nearly a half-million years passed between the post-shield and rejuvenated phases with no evidence of volcanic activity. The rejuvenated stage is represented by only a handful of vents and flows. All the eruptions in the rejuvenated phase were from small cinder cones that grew briefly and then died. Lava flows were extruded from each, but the area covered by lava was generally only a few acres. West Maui’s rejuvenated-stage eruptions ended about 385,000 years ago. The oldest of the small cones is Kīlea, which lies a short distance inland from Olowalu on the southwest side of West Maui. The youngest cone, Pu‘uhele lies 2.5 km (1.6 mi) north of Mā‘alaea along the road to Wailuku. No lava flows issued outward from Pu‘uhele cone, and it has been quarried so extensively that the mound of the cinder cone is gone. The great age and limited extent of lava from these late-phase eruptions indicate that even if the volcano is not extinct, it poses little danger on the site of the proposed wind farm.

Figure 3.1 shows the generalized geology of the island. The present Island of Maui is part of “Maui Nui”, which consisted of six or seven coalesced volcanoes, including Haleakalā, West Maui, Kaho‘olawe, Lāna‘i, East Moloka‘i, West Moloka‘i, and Penguin Bank, which is believed to have been separate from West Moloka‘i.[17] At its largest, Maui Nui probably had a maximum size of about 6,200 square miles, some 2,150 square miles larger than present-day Hawai‘i Island. About 300,000

[17] Based on information from Volcano Watch by the U.S. Geological Survey / Hawaiian Volcano Observatory --- September 8, 1995; September 15, 1995; September 22, 1995; and September 29, 1995. http://users.bendnet.com/bjensen/volcano/eastpacific/hawaii-hawaii.html

to 400,000 years ago, Maui Nui, which grew from west to east, subsided to form two islands, one consisting of Penguin Bank, Molokaʻi, and Lānaʻi, and the other consisting of Maui and Kahoʻolawe. Kahoʻolawe then separated from Maui, and finally Lānaʻi separated from Molokaʻi, both within the last 100,000 to 200,000 years. Penguin Bank probably became submerged within the last several hundred thousand years. With continued subsidence at the present-day rates, Haleakalā and West Maui will become separate islands in about 15,000 years.

Figure 3.1. Geological Setting



Source: Atlas of Hawaiʻi, Second Edition (1983).

3.1.3 SOILS

The primary soil types on Maui belong to the Lahaina Volcanic Series, the Honolua Volcanic Series, and the Wailuku Basaltic Series. Kaheawa Pastures is mostly underlain by deep, well-drained volcanic soils, transitioning into the steep, rocky gulches to the east, south, and west of the project site. Table 3.1 lists the characteristics of the major soil types found at the proposed KWP II site.

Table 3.1. Characteristics of Soil Types within the Project Area

Soil Type	*Slope %*	*Permeability*	*Runoff*	*Erosion Hazard*	*Land Uses*
Nāʻiwa silty clay loam	3-20	Moderately Rapid	Medium	Moderate to Severe	Pasture, woodland, and wildlife habitat
Oli silt loam	3-10	Rapid	Medium	Moderate	Pasture and wildlife habitat
Rock land	-	-	-	-	Pasture, wildlife habitat, water supply, urban development
Source: General Soil Survey of Hawaiʻi, Foote et al. 1972 (U.S. Soil Conservation Service).					

3.2 CLIMATE

The climate of the Hawaiian Islands is characterized by a two-season year, mild and uniform temperatures everywhere (except at high elevations), marked geographic differences in rainfall, high relative humidity, extensive cloud formations (except on the driest coasts and at high elevations), and dominant trade-wind flow (especially at elevations below a few thousand feet). Maui itself has a wide range of climatic conditions and weather patterns that are influenced by several different factors in the physical environment. Among the most important of these are elevation, position on the windward or leeward side (relative to the prevailing northeast trade winds) of the island, and local terrain features (such as valleys and ridges).

3.2.1 TEMPERATURE

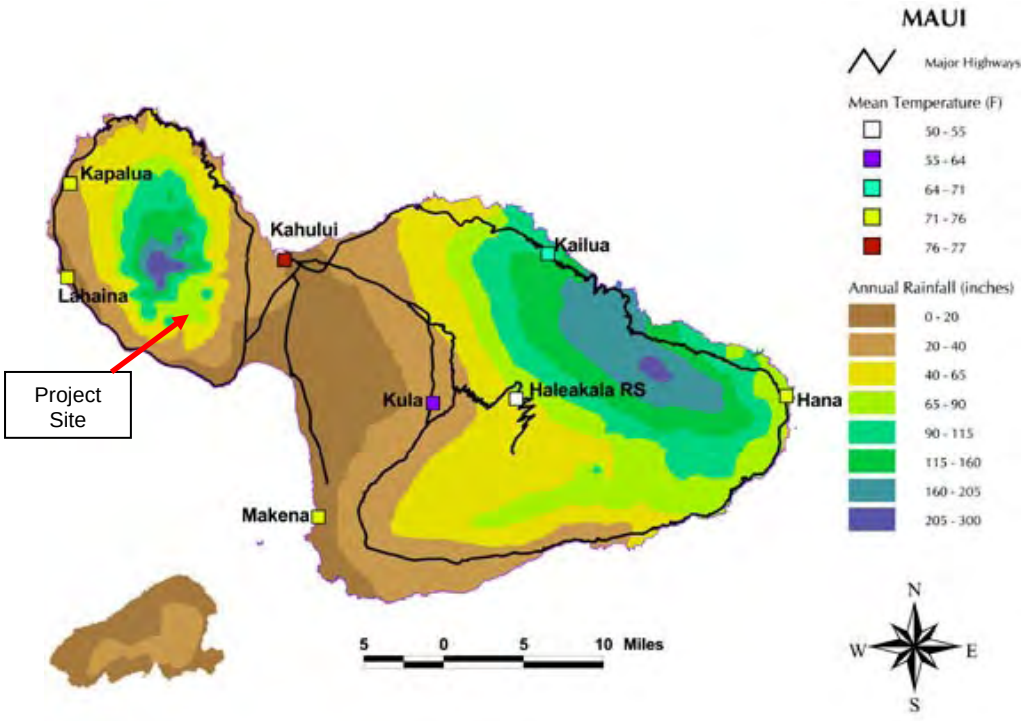
Due to the tempering influence of the surrounding Pacific Ocean and their low-latitude location, the Hawaiian Islands experience extremely small diurnal and seasonal variations in ambient temperature. Average temperatures in the coolest and warmest months at Kahului Airport are 63.4˚ Fahrenheit (F) (January) and 86.3˚F (July), respectively. These temperature variations are quite modest compared to those that occur at inland continental locations. Additional temperature data from Kahului Airport are summarized in Table 3.2. Figure 3.2 illustrates temperature and rainfall averages on Maui.

Table 3.2. Average Monthly Temperatures, Kahului Airport (1954-2000)

Month	*Normal Ambient Temperature, ºFahrenheit*		
	Monthly Average	*Monthly Average Maximum*	*Monthly Average Minimum*
January	71.7	80.0	63.4
February	71.7	80.0	63.3
March	72.7	81.0	64.4
April	74.0	82.0	66.0
May	75.5	83.7	67.2
June	77.3	85.5	69.2
July	78.5	86.3	70.7
August	79.2	87.1	71.2
September	78.8	87.4	70.1
October	77.8	86.2	69.3
November	75.7	83.6	67.8
December	73.1	81.0	65.2

Source: Hawai‘i State Climate Office (2008).

Figure 3.2. Mean Temperatures and Annual Rainfall on Maui



Source: Spatial Climate Analysis Service, Oregon State University (http://www.medb.org/communityprofile/geographic.cfm)

3.2.2 RAINFALL

As everywhere in the state, average annual rainfall on Maui varies greatly from place to place, ranging from about 20 inches at the coast to up to 400 inches in the higher elevations. Near the proposed project it ranges from less than 15 inches per year at the Honoapi‘ilani Highway/site access road intersection to slightly over 40 inches per year at the uppermost of the existing WTGs. Most of the rainfall occurs during winter months (80+ percent from November through April).

Rainfall variability is far greater during the winter, when occasional storms contribute appreciably to rainfall totals, than during summer, when trade-wind showers provide most of the rain. Major storms occur most frequently between October and March, including “Kona” storms, so named because they often generate winds coming from the Kona or southerly direction. During these months, there may be as many as six or seven major storm events in a year. Such storms bring heavy rains and are sometimes accompanied by strong local winds. The storms may be associated with the passage of a cold front – the leading edge of a mass of relatively cool air that is moving from west to east or from northwest to southeast. While rare storm events can produce relatively high rainfall amounts (e.g., the 24-hour rainfall with a 50-year recurrence interval is about 10 inches, and the 1-hour rainfall with the same recurrence interval is approximately 3 inches), even these are modest compared to those experienced in parts of the island that are wetter than Kaheawa Pastures.

3.2.3 WIND PATTERNS

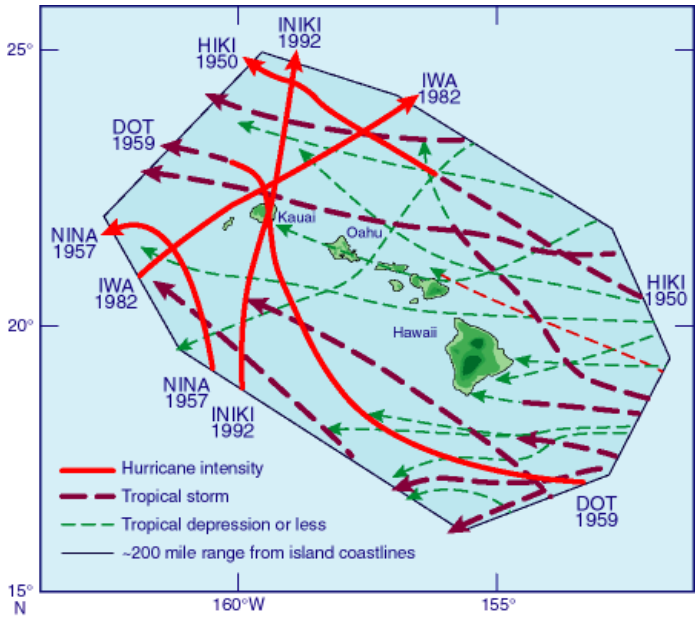
Prevailing surface winds in the project area are the northeasterly trade winds, which occur over 70 percent of the time; however, during “Kona” storm conditions the prevailing winds change to a south/southwesterly direction. Wind patterns vary on a daily basis, with trade winds generally being stronger in the afternoon. When the trade winds are weak or absent, a land-sea breeze pattern

sometimes develops. When this occurs, during the day, winds blow on shore toward the warmer land mass. In the evening, the reverse occurs, as breezes blow toward the relatively warm ocean.

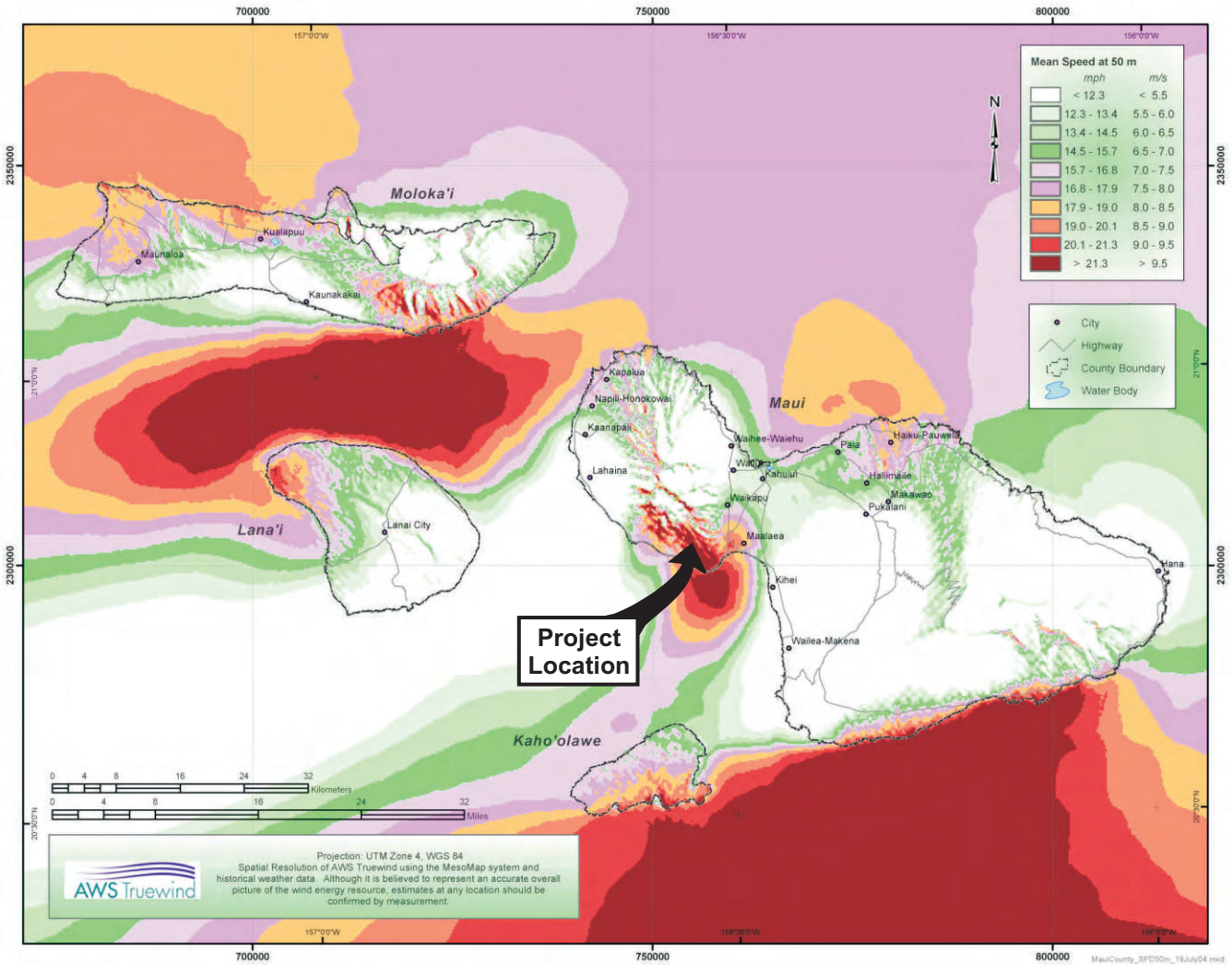
The topography of Maui and the West Maui Mountains is largely responsible for the heightened wind velocity and power at Kaheawa Pastures. The prevailing northeasterly trade winds tend to be split by Haleakalā, and the northern stream whips over the southwest flank of the West Maui Mountains while attempting to regain uniform flow, making that location the best wind resource on the island. The deep gulches and ravines that exist in the area can create additional acceleration of the wind speeds in the downslope direction, thereby increasing wind velocity on the ridges immediately above these gulches. Figure 3.3 and Figure 3.4 illustrate wind speed and power patterns in Maui County, respectively. The designers of KWP II have learned a great deal more about the specifics of wind on the proposed site, but consider the met tower data and/or forecasting data they have collected to be confidential and proprietary; hence, it cannot be included here.

3.2.4 HURRICANES & TROPICAL STORMS

True hurricanes are very rare in Hawai‘i, as indicated by the fact that only four have affected the islands during the past 65 years. Tropical storms are more frequent. These are similar to hurricanes but with more modest winds, below 74 mph. Because weak tropical storms resemble some Kona storms in the winds and rains they produce, and because early records do not distinguish clearly between them, it has been difficult to estimate the average frequency of tropical storms. A tropical storm will pass sufficiently close to Hawai‘i every year or two to affect the weather in some part of the Islands. Unlike cold front and Kona storms, hurricanes and tropical storms are not limited to the winter season. They are most likely to occur during the last half of the year, from July through December.



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



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

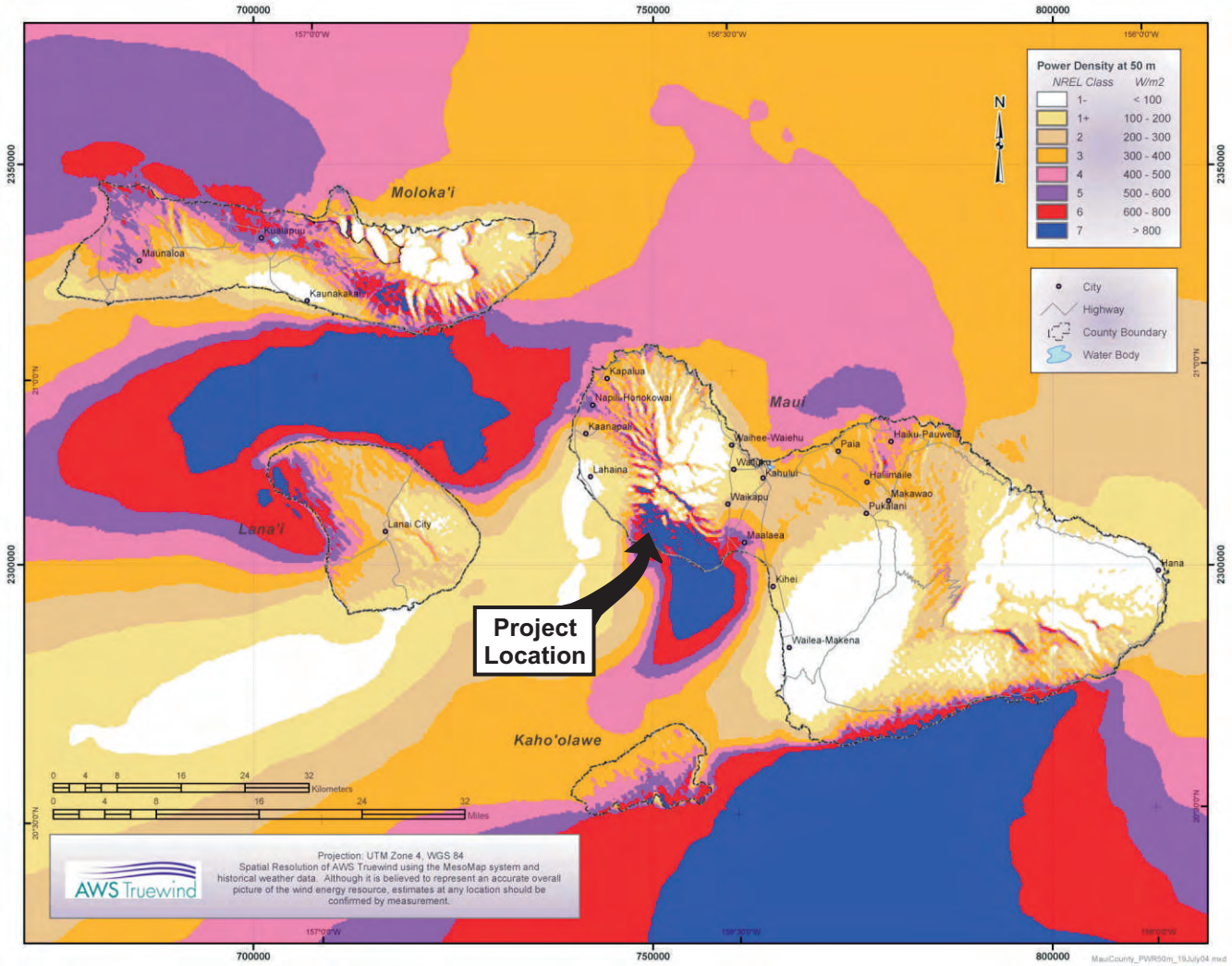
Hawaiian Electric Co., Inc.

Figure 3.3:

Wind Speed Patterns for Maui County

Kaheawa Wind Power II

Figure 3-3 Wind Speed 2008-09-23.cdr



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Hawaiian Electric Co., Inc.

Figure 3.4:

Wind Power Patterns for Maui County

Kaheawa Wind Power II

Figure 3-4 Wind Power 2008-09-23.cdr

3.3 AIR QUALITY

3.3.1 AIR QUALITY STANDARDS

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 adopted 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).

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. Table 3.3 presents the State and national ambient air quality standards for selected pollutants.

3.3.2 EXISTING AIR QUALITY

The State DOH maintains monitoring stations throughout the State in order to measure ambient air concentrations of the six criteria pollutants regulated by the NAAQS. The monitoring station nearest to the KWP II site is at Kīhei, Maui. This station monitors $PM_{2.5}$ and PM_{10} only. During 2005, the only exceedance of 24-hour PM_{10} standards occurred in July; DOH attributed this occurrence to agricultural tilling and flagged it as an exceptional event (DOH 2005). In general, the State of Hawai‘i was in attainment for all NAAQS during 2005.

There are few sources of air pollutants near the project site. The most significant is the dust that naturally arises when strong winds sweep across the open fields or exposed slopes during dry weather. Other sources of airborne contaminants on or near the project site include vehicle exhaust, intermittent fugitive dust and “Maui snow” from agricultural cultivation, dust from construction activities, and smoke from wildfires. Emissions from MECO’s power plants also affect air quality, but they are sufficiently far away that they do not have a strong effect on ambient concentrations of the pollutants. Particulate and other emissions from such activities are required to meet Federal and State air quality standards.

Table 3.3. State and National Ambient Air Quality Standards

Pollutant/Averaging Period	*Standard, μg/m³*		
	State Standard	*Federal Primary Standard* [1]	*Federal Secondary Standard* [2]
Nitrogen Dioxide (NO_2) Annual	70	100	100
Sulfur Dioxide (SO_2) 3-hour	1300	---	1300
24-hour	365	365	---
Annual	80	80	---
Carbon Monoxide (CO) 1-hour	10,000	40,000	40,000
8-hour	5,000	10,000	10,000
2.5-micron Particulate Matter ($PM_{2.5}$) 24-hour	---	65	65
Annual	---	15	15
10-micron Particulate Matter (PM_{10}) 24-hour	150	150	150
Annual	50	50	50
Ozone 1-hour	---	235	235
8-hour	157	157	157
Hydrogen Sulfide (H_2S) 1-hour	35	---	---
Lead 3 months	1.5	1.5	1.5

[1] Designated to prevent against adverse effects on public health.
[2] Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: State of Hawai‘i Department of Health (2005)

3.4 HYDROLOGY AND WATER RESOURCES

The land on which KWP II would be developed consists of a grassy ridge that contains no wetlands or other aquatic habitat (Hobdy 2004a, 2004b, and 2006). No perennial streams flow through the area, though storm runoff is present in Manawainui Gulch just to the east of the project site during rainy periods. On-site drainage is in a southerly direction toward the Pacific Ocean.

The State of Hawai‘i Commission on Water Resource Management (CWRM, October 27, 2004) has determined that Manawainui Gulch does not have sufficient water to support instream uses and is therefore not considered a stream. Consequently it is not subject to CWRM regulation. Similarly, the U.S. Army Corps of Engineers (USACE), concluded that the KWP I project site is located entirely within an upland area and does not contain or convey waters of the United States subject to USACE

jurisdiction (Young, November 8, 2004). Because the KWP II site is located on the same ridge as the KWP I project, these determinations also apply to KWP II.

The project site is located over the Ukumehame Sector of the Lahaina Aquifer (Aquifer Code 60206 as designated by the State of Hawai‘i Water Use Commission). The estimated depth to the basal groundwater varies throughout the subject site and is likely to be approximately 1,550 to 2,950 feet below the surface (depending on the location on the site) and likely flows in a southerly direction. Perched areas of groundwater may also underlie the site (VEC 2005). The KWP II site is located *mauka* of the Underground Injection Control (UIC) line. The UIC line is the designated boundary that divides protected inland areas situated over drinking water sources from seaward areas located over non-potable water sources.

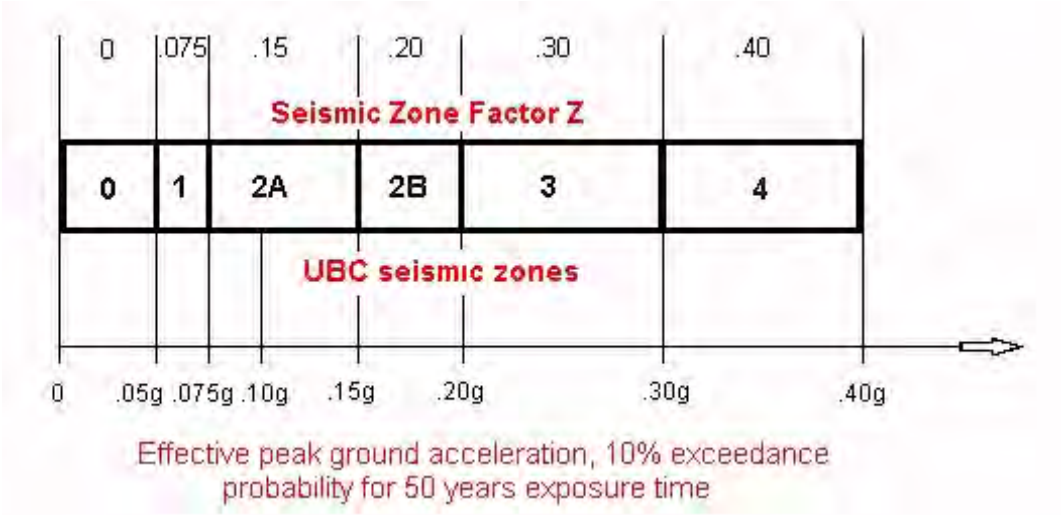
3.5 NATURAL HAZARDS

3.5.1 FLOODING & TSUNAMI

The proposed KWP II site is entirely within Flood Zone X, an area that is determined to have less than 0.2 percent annual risk of flood inundation. There are no 100-year flood zones identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) at or near the mouths of either of the gulches bordering the site. The Civil Defense Tsunami Evacuation Maps indicate the subject property is not within the Tsunami inundation zone.

3.5.2 SEISMIC HAZARDS

Seismic hazards are those related to ground shaking; they include landslides, ground cracks, rock falls, and tsunami. Scientists and engineers have devised a system of classifying seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The results are incorporated into the Uniform Building Code (UBC) seismic provisions, which establish minimum design criteria for structures to address the potential for damages due to seismic disturbances. These establish six seismic zones, ranging from “0” (where there is considered to be no chance of severe ground shaking) to “4” (10 percent chance of severe shaking in a 50-year interval). The shaking is quantified in terms of g-force (a unit of force equal to the force exerted by the earth’s gravity) as indicated in the following diagram:



The entire island of Maui is in Seismic Zone 2B, in which a force of 0.15g to 0.20 g is expected to occur once every 50 years (USGS 1997). This designation was the governing seismic code for KWP I, and is within the design envelope of the GE 1.5 gse turbines utilized on that project and proposed to be used at KWP II.

3.5.3 FIRE HAZARDS

With the cessation of cattle grazing in the West Maui Mountains, a number of grass and weed species have proliferated, creating a heightened fire hazard. A large fire swept across the mountain in 1999 consuming vegetation on more than 2,500 acres including most of the project area. In September 2006 (after the KWP I facility commenced operation), another extensive brush fire affected a large portion of the West Maui Mountains from the coastal highway to the existing facility, including a large portion of the proposed KWP II site. The existing KWP I facility was not the cause of the fire. The equipment was protected from damage by multiple firebreaks constructed by KWP I staff and by extensive watering, and the roadways constructed for the project were instrumental in providing firefighting crews access to the fire line.

On-site fire-fighting resources at the existing KWP I facility include fire extinguishers in the O&M building, at the substation, and in all project vehicles, as well as shovels and backpack pumps in the O&M building and maintenance vehicles. The existing facility also maintains graveled, vegetation-free buffers around the O&M building, the substation, and the WTG foundation pads. The KWP II site is approximately 10 miles from the Wailuku Fire Station and approximately 12 miles from the Kīhei Station (measured from access roadway entrance at the Honoapiʻilani Highway).

3.6 TERRESTRIAL FLORA

According to Hobdy (2006), in pre-contact times the area on which KWP II would be constructed is believed to have been entirely covered with native vegetation. The vegetation is thought to have been of low stature, with dry grass and shrublands below and mesic to wet windblown forests above. The Hawaiians made some uses of forest resources here and had a cross-island trail cresting the ridge at 1,600 feet elevation. This trail was upgraded during the mid-1800s and used as a horse trail to Lahaina. It was reopened in recent years and is the present Lahaina Pali Trail.

Cattle ranching in the area began in the late 1800s and continued for over 100 years. During this time the grazing animals consumed most of the native vegetation, which was gradually replaced by hardy weed species. During the 1950s MECO installed high voltage transmission lines and maintenance roads through this area. Increased traffic brought more disturbances and weeds. Fires became more frequent, further eliminating remnant native vegetation (Hobdy 2006).

With the cessation of cattle grazing a number of grass and weed species have proliferated, creating a heightened fire hazard. A large fire swept across the mountain in 1999 consuming more than 2,500 acres including most of the project area. In September 2006 another fire burned the same area scorching about 80 percent of the project area.

Hobdy conducted a botanical survey of the area that would be leased for the KWP II project in October 2006, noting that the portion of the project area that burned had only bare, blackened ground with a few charred stumps. Hobdy (2006) described the vegetation within unburned portions of the project area as a diverse array of grasses and low shrubs with a scattering of small trees. The most abundant species was molasses grass (*Melinis minutiflora*), which began taking over following the 1999 fire. Also common are broomsedge (*Andropogon virginicus*), Natal redtop (*Melinis repens*), hairy horseweed (*Conyza bonariensis*), kilau (*Pteridium aquilinum var. decompositum*), fire weed (*Senecio madagascariensis*), narrow-leaved plantain (*Plantago lanceolata*) and ʼūlei (*Osteomeles anthyllidifolia*). He recorded a total of 57 plant species during the course of the survey; these are listed in Table 3.4. Approximately one-third of the species detected were endemic or indigenous. The remainder39 species are non-native plants. A copy of the full report is included in Appendix A.

Table 3.4. Plant Species Observed in the KWP II Lease Area (2006 & 2009).

Scientific Name	***Common Name***	***Status***	***Presence/Abundance***	
			2006	***2009***
FERNS				
DENNSTAEDTIACEAE (Bracken Family)				
Pteridium aquilinum (L.) Kuhn. *var. decompositum* (Gaudich.) R.M. Tryon	kilau	endemic	common	common
PTERIDACEAE (Brake Fern Family)				
Pityrogramma austroamericana Domin.	Gold fern	Non-native	absent	rare
MONOCOTS				
CYPERACEAE (Sedge Family)				
Carex wahuensis C.A. Mey. subsp. *wahuensis*	----------	endemic	rare	uncommon
POACEAE (Grass Family)				
Andropogon virginicus L.	broomsedge	non-native	common	uncommon
Axonopus fissifolius (Raddi) Kuhlm.	narrow-leaved carpetgrass	non-native	rare	absent
Bothriochloa barbinodis (Lag.) Herter	Fuzzy top	non-native	absent	rare
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native	absent	common
Cenchrus ciliaris (Retz.) Koeler	Buffelgrass	non-native	absent	common
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	uncommon	rare
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	non-native	rare	rare
Digitaria insularis (L.) Mez ex Ekman	Sourgrass	non-native	absent	rare
Heteropogon contortus (L.) P.Beauv. ex Roem.&Schult.	pili	indigenous	rare	rare
Hyparrhenia rufa (Nees.) Stapf	Thatching grass	non-native	absent	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	abundant	abundant
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common	common
Panicum maximum Jacq.	Guinea grass	non-native	rare	rare
Paspalum conjugatum Bergius	Hilo grass	non-native	rare	rare
Paspalum dilatatum Poir.	Dallis grass	non-native	rare	rare
Pennisetum clandestinum Chiov.	Kikuyu grass	non-native	uncommon	uncommon
Rhytidosperma pilosum (R.Br.) Connor &Edgar	hairy oatgrass	non-native	rare	rare
Setaria parviflora (Poir.) Kerguelen	Yellow foxtail	non-native	absent	rare
Setaria verticillata (L.) P. Beauv.	Bristly foxtail	non-native	absent	rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	rare	uncommon
Stenotaphrum secundatum (Walter) Kuntze	St.Augustine grass	non-native	rare	absent
Trisetum inaequale Whitney	----------	endemic	absent	rare
DICOTS				
ANACARDIACEAE (Mango Family)				
Schinus terebinthifolius Raddi	Christmas berry	non-native	rare	uncommon
APOCYNACEAE (Dogbane Family)				
Stapelia gigantea N.E. Brown	Zulu giant	non-native	absent	rare
ASTERACEAE (Sunflower Family)				
Acanthospermum australe (Loefl.) Kuntze	Spiny bur	non-native	absent	rare

Scientific Name	***Common Name***	***Status***	***Presence/Abundance***	
			2006	***2009***
Ageratina adenophora (Spreng.) R.King & H.Robinson	Maui pamakani	non-native	absent	rare
Bidens cynapiifolia	--------	non-native	absent	rare
Bidens mauiensis (A. Gray) Sherff	ko‘oko‘olau	endemic	absent	rare
Bidens micrantha Gaud.	ko‘oko‘olau	endemic	rare	absent
Bidens micrantha Gaud. Subsp. *Micrantha*	ko‘oko‘olau	endemic	absent	uncommon
Bidens pilosa L.	Spanish needle	non-native	absent	rare
Conyza bonariensis L. Cronq.	hairy horseweed	non-native	common	uncommon
Conyza canadensis (L.) Cronq.	horseweed	non-native	absent	rare
Conyza canadensis (L.) Cronq. *var. pusilla* (Nutt.) Cronq.	little horseweed	non-native	rare	absent
Emilia fosbergii Nicolson	Red pualele	non-native	absent	rare
Erigeron karvinskianus DC.	daisy fleabane	non-native	rare	uncommon
Galinsoga parviflora Cav.	---------	non-native	absent	rare
Heterotheca grandiflora Nutt.	telegraph weed	non-native	uncommon	rare
Hypochoeris radicata L.	gosmore	non-native	rare	rare
Melanthera lavarum (Gaud.) Wagner &Rob	Nehe	endemic	rare	rare
Pluchea carolinensis (Jacq.) G. Don.	sourbush	non-native	rare	absent
Senecio madagascariensis Poir.	fireweed	non-native	common	common
Sonchus oleraceus L.	Pualele	non-native	absent	uncommon
Tridax procumbens L.	Coat buttons	non-native	absent	rare
Zinnia peruviana (L.) L.	Zinnia	non-native	absent	rare
BRASSICACEAE (Mustard Family)				
Sisymbrium officinale (L.) Scop.	Hedge Mustard	non-native	absent	rare
CACTACEAE (Cactus Family)				
Opuntia ficus-indica (L.) Mill.	Panini	non-native	rare	rare
CASUARINACEAE (She-oak Family)				
Casuarina equisetifolia L.	common ironwood	non-native	uncommon	common
Casuarina glauca Siebold ex Spreng.	longleaf ironwood	non-native	rare	rare
CONVOLVULACEAE (Morning Glory Family)				
Ipomoea indica (J. Burm.) Merr.	koali awahia	indigenous	rare	uncommon
Ipomoea tuboides Degener & Ooststr.	Hawaiian moon flower	endemic	absent	rare
ERICACEAE (Heath Family)				
Leptecophylla tameiameiae (Cham. & Schlect.) C.M. Weiller	Pukiawe	indigenous	uncommon	uncommon
EUPHORBIACEAE (Spurge Family)				
Chamaesyce celastroides (Boiss.) Croizat&Degener *var. amplectens* (Sherff) Degener&I.Degener	‘akoko	endemic	rare	rare
FABACEAE (Pea Family)				
Acacia farnesiana (L.) Willd.	Klu	non-native	uncommon	uncommon
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon	common
Crotalaria pallida Aiton	Smooth rattlepod	non-native	absent	rare

Scientific Name	***Common Name***	***Status***	***Presence/Abundance***	
			2006	***2009***
Crotalaria retusa L.	----------	non-native	absent	rare
Desmanthus pernambucanus (L.) Thellung	Slender mimosa	non-native	absent	uncommon
Desmanthus incanum DC.	Kaimi clover	non-native	absent	rare
Desmodium sandwicense E. Mey.	Spanish clover	non-native	rare	rare
Indigofera suffruticosa Mill.	iniko	non-native	uncommon	common
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	uncommon	uncommon
Macroptilium lathyroides (L.) Urb	Wild bean	non-native	absent	rare
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	non-native	rare	rare
GENTIANACEAE (Gentian Family)				
Centaurium erythraea Raf.	bitter herb	non-native	rare	absent
GOODENIACEAE (Goodenia Family)				
Scaevola gaudichaudii Hook. & Arnott	orange naupaka	endemic	rare	absent
LAMIACEAE (Mint Family)				
Salvia coccinea B. Juss. ex Murray	scarlet sage	non-native	rare	rare
MALVACEAE (Mallow Family)				
Abutilon grandifolium (Willd.) Sw.	Hairy abutilon	non-native	absent	rare
Malva parviflora L.	Cheese weed	non-native	absent	rare
Malvastrum coromandelianum (L.) Garcke	False mallow	non-native	absent	rare
Sida fallax Walp.	‘ilima	indigenous	uncommon	common
Waltheria indica L.	‘uhaloa	indigenous	uncommon	common
MENISPERMACEAE (Moonseed Family)				
Cocculus orbiculatus (L.) DC.	huehue	indigenous	rare	uncommon
MYOPORACEAE (Myoporum Family)				
Myoporum sandwicense A. Gray	naio	endemic	rare	rare
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud. *var. incana* (H. Lev.) St. John	‘ohi‘a	endemic	rare	rare
Psidium guajava L.	guava	non-native	rare	rare
OXALIDACEAE (Wood Sorrel Family)				
Oxalis corniculata L.	‘ihi	Polynesian	absent	rare
PLANTAGINACEAE (Plantain Family)				
Plantago lanceolata L.	narrow-leaved plantain	non-native	common	common
POLYGALACEAE (Milkwort Family)				
Polygala paniculata L.	----------	non-native	rare	uncommon
PORTULACACEAE (Purslane Family)				
Portulaca oleracea L.	Pigweed	non-native	absent	rare
PRIMULACEAE (Primrose Family)				
Anagallis arvensis L.	scarlet pimpernel	non-native	rare	rare
PROTEACEAE (Protea Family)				
Grevillea robusta A. Cunn. ex R.Br.	silk oak	non-native	rare	rare
ROSACEAE (Rose Family)				

Scientific Name	***Common Name***	***Status***	***Presence/Abundance***	
			2006	***2009***
Osteomeles anthyllidifolia (Sm.) Lindl.	‘ulei	indigenous	common	common
SANTALACEAE (Sandalwood Family)				
Santalum ellipticum Gaud.	‘iliahi alo‘e	endemic	rare	uncommon
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	‘a‘ali‘i	indigenous	uncommon	uncommon
SOLANACEAE (Nightshade Family)				
Solanum lycopersicum L.	Cherry tomato	non-native	absent	rare
THYMELAEACEAE (‘Akia Family)				
Wikstroemia oahuensis (A.Gray) Rock.	‘akia	endemic	rare	uncommon
VERBENACEAE (Verbena Family)				
Lantana camara L.	lantana	non-native	uncommon	rare
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain	non-native	absent	uncommon
Verbena littoralis Kunth.	‘owi	non-native	rare	absent
Source: Hobdy, October 2006 & January 2009.				

In January 2009, Hobdy conducted a second survey of the KWP II project area to document re-growth following the 2006 wildfire. He detected a total of 86 plant species, 20 of which are endemic or indigenous (see Table 3.4). All of the endemic and indigenous plants detected were present in either similar or higher numbers than observed in 2006, with the sole exception of orange naupaka (*Scaevola gaudichaudii*), which was detected in low numbers in 2006 but was absent in 2009. As with the 2006 survey, none of the species detected in 2009 are classified as threatened or endangered or are candidates for such status. A copy of the full report is included in Appendix A.

3.7 AVIAN AND TERRESTRIAL FAUNA

3.7.1 NON-PROTECTED SPECIES

The mixed grassland/shrubland vegetation on the project site is habitat for several mammals as well as endemic, indigenous and migratory birds. The mammals include mice (*Mus musculus*), rats (*Rattus* sp.), mongooses (*Herpestes auropunctatus*), feral cats (*Felis silvestris*), Axis deer (*Cervus axis*), and feral dogs (*Canis lupus*). As discussed below, the bird species are more varied.

Several ornithological surveys were conducted during the development of KWP I to identify avian species present in the project area and to determine that project's potential to negatively impact them (Nishibayashi 1997 & 1998). The first of these focused on the identification of downed birds near the six meteorological towers that were installed prior to the construction of KWP I (Nishibayashi 1997). While no downed birds were found, a number of non-native, introduced species were identified opportunistically in the project vicinity (see Table 3.5 below). None of the species observed during that survey is listed as endangered, threatened or protected by USFWS or the State of Hawai'i on Maui. Several of these species are, however, protected by the Migratory Bird Treaty Act (MBTA). These include the Pacific golden-plover (Pluvialis fulva), Hawaiian short-eared owl (*Asio flammeus sandwichensis*), Eurasian skylark (*Alauada arvensis*), and house finch (*Carpodacus mexicanus*).

Nishibayashi observed the Hawaiian short-eared owl or pueo near the project on 5 of 26 survey days in 1997. Some were observed near the guyed met towers and exhibited active avoidance behavior (Nishibayashi 1997). Day and Cooper (1999) also reported observations of Hawaiian short-eared owls during eight nights of surveys in May and June 1999, noting four to six individuals foraging in the area. Most owl activity was concentrated in the nearby gulches, although individuals occasionally were observed foraging over the open, flatter parts of the study area. During eight nights of surveys in October 2004, Cooper and Day (2004) noted two to three short-eared owls behaving similarly to the birds observed in 1997 and 1999. More recently, KWP I staff biologists conducting surveys and performing other work involved in implementing the HCP for the existing wind power facility report that they commonly observe Hawaiian short-eared owls in the area.

Another species, White-tailed tropicbirds (*Phaethon lepturus*), are sometimes seen near the project area by KWP I staff but usually remain associated with the deep gulches adjacent to the site. This species is known to nest in steep valley faces and canyon walls which are common features in nearby Ukumehame, Manawainui, and Malalowaiaole Gulches.

Table 3.5. Avian Species Identified in the Project Area (Nishibayashi 1997).

Common Name	*Scientific Name*	*Detections**	*Status*
Eurasian Skylark	*Alauda arvensis*	22	MBTA
Ring-Necked Pheasant	*Phasianus colchicus*	18	None
Black Francolin	*Francolinus francolinus*	7	None
House Finch	*Carpodacus mexicanus*	9	MBTA
Common Myna	*Acridotheres tristis*	7	None
Puʻeo or Hawaiian Short-eared Owl	*Asio flammeus sandwichensis*	5	MBTA, HI Species of Concern (informal)
Nutmeg Manikin	*Lonchura punctulata*	4	None
Gray Francolin	*Francolinus pondicerianus*	3	None
Northern Cardinal	*Cardiinalis cardinalis*	1	MBTA
Spotted Dove	*Streptopelia chinensis*	1	None
Kolea or Pacific Golden Plover	*Pluvialis fulva*	1**	MBTA

*Number of days (out of 26 total) on which species was detected by Nishibayashi (1997).

Source: Nishibayashi (1998).

3.7.2 PROTECTED SPECIES

Surveys conducted in support of the development of KWP I made it clear that several threatened and endangered species were present in the area, and extensive surveys were conducted to establish baseline numbers for these species, which include the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), the threatened Newell's Shearwater (*Puffinus auricularis newelli*), the endangered Nēnē (*Branta sandvicensis*), and the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) (Cooper & Day 1999, 2004a).

Once it was determined that the KWP I facilities had the potential to affect these listed species, its owner prepared, and is now implementing, a Habitat Conservation Plan (HCP) for the project. The HCP serves as the basis for the incidental take permit (ITP) from the U.S. Fish and Wildlife Service and the incidental take license (ITL) from the State of Hawaiʻi Department of Land and Natural Resources under which the existing WTGs are operating.[18] The following sections provide additional information about the four species that are present and that are addressed under the HCP.

3.7.2.1 Hawaiian Petrel & Newell's Shearwater

Hawaiian Petrel. The endangered Hawaiian Petrel was once abundant on all main Hawaiian islands except Niʻihau (Mitchell et al. 2005). Today, Hawaiian Petrels continue to breed in high-elevation colonies on Maui, Hawaiʻi, Kauaʻi and Lānaʻi (Richardson and Woodside 1954, Simons and Hodges 1998, Pyle 1983, Telfer et al. 1987, DOFAW unpublished data 2006, 2007). Radar studies conducted in 2002 suggest that breeding may occur on Molokaʻi (Day and Cooper 2002), but the number of pairs is unknown. The species is thought to be extirpated from Oʻahu (Harrison 1990).

There are estimated to be a total of 20,000 Hawaiian petrels with 4,000 to 5,000 breeding pairs, 1,000 of which were estimated to breed on Maui (Mitchell et al. 2005). Radar counts of petrels on the

[18] The term "incidental take" refers to harm that is caused to a threatened or endangered species that is incidental to an otherwise lawful activity. Thus, for example, it is possible to obtain a permit that allows one to accidentally harm a member of the species while one is driving a tractor or automobile as part of one's work but it is not possible to obtain a permit that would allow one to hunt a listed species for food.

perimeter of Maui and recent colony detections by KWP I researchers suggest that the Maui population is much higher than the 1,000 pairs previously estimated (Cooper and Day 2003). Survey work at a recently re-discovered Hawaiian petrel colony on Lanaʻi indicates that thousands of birds are present, rather than hundreds of birds as first surmised, and that the size of the breeding colony approaches that at Haleakalā, Maui where as many as a thousand pairs nest annually (Mitchell et al. 2005; Tetra Tech EC, Inc., June 2008).

Hawaiian Petrels are nocturnal and subsist primarily on squid, fish, and crustaceans that predatory fish and other factors bring near the sea surface. Unlike shearwaters, Hawaiian Petrels are not known to dive or swim below the surface (Pitman 1986). Foraging may take place thousands of miles from their home islands during both breeding and non-breeding seasons (Spear et al. 1995). In fact, recent studies conducted using satellites and transmitters attached to breeding Hawaiian Petrels have shown that they can range across more than 6,200 miles during two-week foraging expeditions (Adams 2008).

Adult members of the species are active in their nesting colonies for about nine months each year. The birds are long-lived (ca. 30 years) and return to the same nesting burrows each year between March and April. Females lay only 1 egg per year, which is incubated alternately by both parents for approximately 55 days. Eggs hatch in July or August, after which both adults spend their time flying to sea to feed themselves and to collect food which they provide for the nestling. The fledged young depart for sea in October and November. Adult birds do not breed until age six and may not breed every year, but pre-breeding and non-breeding birds nevertheless return to the colony each year to socialize.

Newell's Shearwater. The Newell's Shearwater is an endemic Hawaiian sub-species of the nominate species, the Townsend's shearwater (*Puffinus a. auricularis*) of the eastern Pacific. The Newell's Shearwater is considered "Highly Imperiled" in the Regional Seabird Conservation Plan (USFWS 2005b) and the North American Waterbird Conservation Plan (Kushlan et al. 2002). Species identified as "Highly Imperiled" have suffered significant population declines and have either low populations or experience some other high risk factor. The most recent population estimate of Newell's Shearwater was approximately 84,000 birds, with a possible range of 57,000 to 115,000 birds (Ainley et al. 1997). Radar studies on Kauaʻi showed a 63 percent decrease in detections of shearwaters between 1993 and 2001 (Day et al. 2003a). Declines in Newell's Shearwater populations are attributed to loss of nesting habitat, predation by introduced mammals (mongoose, feral cats, rats, and feral pigs) at nesting sites, and fallout of juvenile birds associated with disorientation from urban lighting (Ainley et al. 1997, Mitchell et al. 2005, Hays and Conant 2007).

Newell's Shearwaters nest on several of the main Hawaiian Islands, with the largest numbers occurring on Kauaʻi (Telfer et al. 1987, Day and Cooper 1995, Ainley et al. 1995, 1997, Day et al. 2003b). These birds also nest on Hawaiʻi (Reynolds and Richotte 1997, Reynolds et al. 1997, Day et al. 2003a) and almost certainly nest on Molokaʻi (Pratt 1988, Day and Cooper 2002). Recent radar studies suggest the species may also nest on Oʻahu (Day and Cooper 2008). On Maui, recent auditory observations suggest that one or more small colonies of Newell's Shearwaters are present in the West Maui Mountains ~9 miles north of the KWP I and II project areas in the upper portions of Kahakuloa Valley (G. Spencer, First Wind, pers. comm.). Newell's Shearwaters typically nest on steep slopes that are vegetated by ʻuluhe fern (*Dicranopteris linearis*) undergrowth and scattered ʻōhia trees (*Metrosideros polymorpha*). The birds nest in short burrows excavated into crumbly volcanic rock and ground, usually under dense vegetation and at the base of trees.

A single egg is laid in the burrow and one adult bird remains on the egg while the second adult goes to sea to feed. Once the chick has hatched and is large enough to withstand the cool temperatures of the mountains, both parents will go to sea to provide the growing chick with a continuous supply of food. Newell's Shearwaters arrive at and leave their burrows during darkness and birds are seldom

seen near land during daylight hours. During the day adults remain either in their burrows or at sea some distance from land.

First breeding occurs at approximately six years of age, after which breeding pairs produce one egg per year. A high rate of non-breeding is found among experienced adults that occupy breeding colonies during the summer breeding season, similar to some other seabird species (Ainley et al. 2001). No specific data exist on longevity for this species, but other shearwaters may reach 30 years of age or more (see for example Bradley et al. 1989, del Hoyo et al. 1992). The Newell's Shearwater breeding season begins in April, when birds return to prospect for nest sites. A pre-laying exodus follows in late April and possibly May; egg-laying begins in the first two weeks of June and likely continues through the early part of July. The average incubation period is thought to be approximately 51 days (Telfer 1986). The fledging period is approximately 90 days, and most fledging takes place in October and November, with a few birds still fledging into December (SOS Data).

Seabird Occurrence in the Project Area. ABR Inc. conducted radar and night-visual observations over the KWP I and KWP II project areas in summer 1999, the summer and fall of 2004, and the summer and fall of 2008. The goal of the latter surveys was to obtain estimates of seabird movement rates during evening inland and pre-dawn seaward flight periods over the proposed KWP II project area, and to observe any changes in flight behavior, such as alterations in flight trajectory, that might be evident as seabirds approached and passed the existing wind turbine layout at KWP I.

Movement rates and other observations on seabird occurrence in the area from these five radar studies are summarized below:

- In summer 1999, 40 targets detected on radar fit the criteria for petrel/shearwater targets. The mean nightly movement rate at both stations was estimated at 1.2 targets per hour. Overall movement rates were estimated at 1.7 targets per hour at the upper site, and 0.8 targets per hour at the lower site (Day & Cooper 1999).
- In summer 2004, average daily movement rates varied between 1.3 to 7.2 targets per hour and averaged 3.6 targets per hour overall at the upper site. Movement ranged between 0 and 1.6 targets per hour at the lower site with an average rate overall of 0.5 target per hour (Cooper and Day 2004a).
- In fall 2004, there were 37 petrel/shearwater targets recorded and an estimated mean nightly movement rate of 1.0 target per hour (Cooper and Day 2004a).
- In summer 2008, 19 radar targets that fit the criteria for petrels/shearwaters were observed during 40.6 hours of sampling. Of these targets, 7 were observed at the upper sampling station and 12 at the lower sampling station. The mean movement rate across both stations and all nights was 0.456 ± 0.15 target per hour. Mean movement rates were 0.336 ± 0.12 target per hour at the upper station and 0.576 ± 0.16 target per hour at the lower station. After adjusting sampling results for hours of the night that were not sampled (i.e., non-peak periods), Sanzenbacher & Cooper estimated a mean movement rate across all sampling stations of 2.8 petrel-like targets per night (Sanzenbacher & Cooper 2009).
- In fall 2008, 4 targets were recorded that fit the criteria for petrels/shearwaters during 38.9 hours sampling. All of these targets were recorded at the lower station. The mean movement rate across both stations and all nights was 0.094 ± 0.07 targets per hour. Mean movement rates were 0.0 target per hour at the upper station and 0.188 ± 0.09 target per hour at the lower station. After adjusting sampling results for hours of the night that were not sampled (i.e., non-peak periods), Sanzenbacher & Cooper estimated a mean movement rate across all sampling stations of 0.6 petrel/shearwater-like targets/night.

The cumulative research conducted in the project area confirms that movement rates of Newell's Shearwaters and Hawaiian Petrels in the Kaheawa Pastures area are relatively low compared to other

areas of Maui (Day and Cooper 1995, 2001, 2003). In the most recent and extensive survey, Sanzenbacher & Cooper (2009) estimate that ~348 Hawaiian Petrels and ~193 Newell's Shearwaters pass over the radar sampling area annually. They used data on flights at nearby Ukumehame contained in Cooper and Day (2003) to estimate the proportions of targets that were Hawaiian Petrels (60 percent) and those that were Newell's Shearwaters (40 percent).

3.7.2.2 Nēnē (Hawaiian Goose)

The Nēnē is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands with negligible dependence on freshwater habitat. Compared to the related Canada goose (*Branta canadensis*), Nēnē wings are reduced by about 16 percent in size and their flight capability is comparatively weak. Nonetheless, Nēnē are capable of both inter-island and high altitude flight (Miller 1937; Banko et al. 1999). Nēnē occupy various habitat types ranging from beach strand, shrubland, and grassland to lava rock, and elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999). The geese eat plant material, and composition of their diet depends largely on the vegetative composition of their surrounding habitats. They appear to be opportunistic in their choice of food plant as long as they meet nutritional demands (Banko et al. 1999; Woog and Black 2001).

The Nēnē has an extended breeding season with eggs reported from all months except May, June, and July, although the majority of birds in the wild nest during the rainy (winter) season between October and March (Banko et al. 1999, Kear and Berger 1980). Nēnē nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs and incubation lasts for 29 to 31 days. The female incubates the eggs, with the male standing guard nearby, often from an elevated location. Once hatched, the young remain in the nest for 1 to 2 days (Banko et al. 1999). Fledging of captive birds occurs at 10 to 12 weeks, but may occur later in the wild. During molt, adults are flightless for a period of 4 to 6 weeks. Molt occurs after hatching, such that the adults generally attain their flight feathers at about the same time as their offspring. When flightless, goslings and adults are extremely vulnerable to predators such as dogs, cats, and mongoose. From June to September, family groups join others in post-breeding aggregations (flocks), often far from nesting areas.

Currently, there are wild populations Nēnē on Hawai'i, Maui and Kaua'i composed of an estimated 349, 251, and 620 individuals, respectively (USFWS 2004a). After nearly becoming extinct in the 1940s and 1950s, this species' population slowly has been rebuilt through captive-breeding programs. As a result of such programs, the Nēnē has been re-introduced onto four of the main Hawaiian islands (Kaua'i, Maui, Moloka'i, and Hawai'i). The primary release site on Maui is located at Haleakalā National Park on East Maui where, as of 2003, 511 Nēnē have been released since 1962. Releases on Maui have ranged from a high of 72 birds in 1969, to a low of zero in several years including from 1979 through 1991. Annual releases were typically on the order of 20 to 50 birds at Haleakalā in the 1960s and 1970s.

Since 1995, the majority of Maui releases have been from a release pen in the Hana'ula in the region of West Maui in an effort to establish a second population on Maui on this part of the island (F. Duvall, Maui DOFAW, pers. comm.). This pen is located near the upper end of the Kaheawa Pastures project site. Since 1994, 104 Nēnē have been released at Hana'ula, compared with 18 at Haleakalā (USFWS 2004a). KWP I is currently working with Maui DOFAW and USFWS to establish a new Nēnē release pen on land owned by Haleakalā Ranch in East Maui. Nēnē will be released from this pen (total release numbers to be determined) for a period of 10 to 20 years in fulfillment of the KWP I HCP mitigation program for Nēnē.

Little is known about the exact distribution and movements of the birds released at the Hana'ula release pen near the project site, although they have been recorded as far west as Lahaina and as far east as Haleakalā National Park, indicating that at least some birds from this release site move extensively around the island (J. Medeiros, Maui DOFAW, pers. comm.). As of this writing, several

pairs of Nēnē are believed to nest each year near the area on which the proposed access road extension and additional WTGs would be constructed (J. Medeiros, Maui DOFAW, pers. comm.). The Nēnē population in this region is monitored closely under the existing HCP and survey effort is now well coordinated between DOFAW and KWP I biologists.

The Hanaʻula release pen is located approximately 1,800 feet above the nearest of the proposed WTGs. This distance is greater than the distance between the release pen and the nearest existing WTG. A number of Nēnē from the Hanaʻula release site have remained as residents within or near the project area; in 1998, four goslings were successfully fledged from the first nest reported in the area since reintroduction began (DOFAW 2000). Nēnē presence and nesting behavior has been regularly monitored in the project area prior to and after commencing operation of KWP I. Biologists monitoring Nēnē in the vicinity of the existing wind farm have found that many Nēnē transiting the site fly in an east-west direction, which is essentially perpendicular to the proposed north-south turbine layout and not surprising given the location of the Hanaʻula Nēnē release pen to the west and other favorable habitat to the east of Kaheawa Pastures. Nēnē were observed transiting near the existing wind farm during 17 (one-third) of the 53 surveys conducted between June 2006 and June 2007.

Nesting has been observed in the vicinity of the existing KWP I turbines since the facility commenced operation. One successful nest was discovered in 2007 about 330 feet to the west of WTG-15 while another pair was observed using a nearby nest site in 2008. Most nesting activity is observed well to the west and southwest of the proposed project area and is closely monitored on an annual basis. Birds commonly use the proposed project area and surrounding region during much of the year for shelter and browsing.

3.7.2.3 Hawaiian Hoary Bat

The Hawaiian Hoary Bat is the only extant native terrestrial mammal from the Hawaiian archipelago (USFWS 1998). Little is known about its biology, distribution, or habitat use in the Hawaiian Islands, beyond the fact that it is an insectivorous bat that roosts solitarily in tree foliage. This subspecies has been recorded between sea level and approximately 9,050 feet in elevation on Maui, with most records occurring at approximately 2,060 feet (USFWS 1998). The Hawaiian Hoary Bat has been recorded on Kauaʻi, Oʻahu, Molokaʻi, Maui and Hawaiʻi, is believed to be most abundant on the latter island, and is thought to be present in low numbers on Maui. The U.S. Fish and Wildlife Service's (1999) *Recovery Plan for the Hawaiian Hoary Bat* notes:

> *"No studies have been conducted that directly address the population size of this subspecies, and methods for estimating population numbers of a patchily distributed animal like the Hawaiian hoary bat are virtually nonexistent."*

Hawaiian Hoary Bats roost in native and non-native vegetation from 3 to 29 feet above ground level. They have been observed roosting in ʻōhiʻa, hala (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), kiawe (*Proscopis pallida*), avocado (*Persea americana*), shower trees (*Cassia javanica*), pūkiawe (*Styphelia tameiameiae*), and fern clumps; they are also suspected to roost in eucalyptus (Eucalyptus spp.) and Sugi pine (*Cyrptomeria japonica*) stands. The species is rarely observed using lava tubes, cracks in rocks, or man-made structures for roosting. While roosting during the day, Hawaiian Hoary Bats are solitary, although mothers and pups roost together (USFWS 1998).

It is thought that breeding occurs primarily between April and August. Breeding has only been documented on the islands of Hawaiʻi and Kauaʻi (Baldwin 1950, Kepler and Scott 1990, Menard 2001). It is not known whether bats observed on other islands breed locally or only visit these islands during non-breeding periods. Seasonal changes in the abundance of Hawaiian Hoary Bat at different elevations indicate that altitudinal migrations occur on the island of Hawaiʻi. During the breeding period, Hawaiian Hoary Bat occurrences increase in the lowlands and decrease at high elevation habitats. Hawaiian Hoary Bat occurrences are especially low from June until August in high

elevation areas. In the winter, especially during the post-lactation period in October, bat occurrences increase in high elevation areas and in the central highlands, possibly receiving bats from the lowlands (Menard 2001).

Hawaiian Hoary Bats feed on a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). They appear to prefer moths ranging between 0.60 and 0.89 inches in size (Bellwood and Fullard 1984, Fullard 2001). Prey is located using echolocation. Water courses and edges (e.g., coastlines and forest/pasture boundaries) appear to be important foraging areas. In addition, the species is attracted to insects that congregate near lights (USFWS 1998, Mitchell et al. 2005). They begin foraging either just before or after sunset depending on the time of year (USFWS 1998, Mitchell et al. 2005).

On Maui, this bat is believed to occur primarily in moist, forested areas, although little is known about its exact distribution and habitat use on the island, especially in the West Maui Mountains. No Hawaiian Hoary Bats were recorded in the area of the existing or proposed wind turbines during nighttime visual studies using night vision equipment conducted in summer 1999 (Day and Cooper 1999) or fall 2004 (Cooper and Day 2004a).

Since the HCP for KWP I was approved and the existing facilities began operation in the summer of 2006, KWP I has carried out regular bat monitoring in accordance with the provisions of its HCP. The results of these observations as summarized below, have greatly increased the information that is available on the presence of the Hawaiian Hoary Bat at Kaheawa Pastures and confirm that the species is present in low numbers in the KWP II project area.

Visual Surveys for Flying Bats. KWP I biologists have carried out regular crepuscular and nocturnal IR-enhanced visual surveys aimed at recording bat presence and activity at Kaheawa Pastures from June 2006 through June 2007. During this period, KWP I biologists performed 32 surveys totaling nearly 116 hours of observation effort in and around the KWP I site and adjacent countryside. Significant portions of the site were surveyed during winter and spring seasons and under a range of weather and survey conditions. Though there often appeared to be abundant aerial insect prey and favorable wind conditions for minimally encumbered flight, no positive observations of Hawaiian Hoary Bats were made during either survey period using visual survey techniques alone.

Visual Surveys for Downed Bats. KWP I biologists also look for bats as part of their year-round ground searches aimed at documenting all downed (i.e., injured or dead) covered species in the project area. On October 3, 2008, a single dead bat was found near WTG 8. Injuries to the bat suggested it had died of physical trauma, presumably having been hit by a blade or collided with the tower. This was the first observed bat fatality apparently associated with the KWP I project since monitoring began 2006.

On-Site Acoustic Monitoring of Bat Activity. During the third year of monitoring at KWP I, four Anabat detectors (Titley Electronics, NSW, Australia) were deployed at various locations in Kaheawa Pastures from August 8 to November 14, 2008 (KWP I LLC 2008). These detectors record ultrasonic sounds, which are then analyzed using Analook® computer software to determine whether echolocation calls made by bats were recorded. The first recorded call was made on 10 August and the last was made on 22 October. Failure to record any calls during the last 23 days of the survey suggests that bats may occur in the project area only seasonally, but this will need to be confirmed through further monitoring.

A total of 15 bat calls (of which 7 were bat passes) were recorded by the four detectors over the sampling period (see Table 3.6). This equates to a detection rate of 0.02 pass per detector per night (7 bat passes in 378 detector-nights). This is less than 3 percent of the detection rates measured during a study being conducted by the USGS at Hakalau National Wildlife Refuge on the Island of Hawai‘i (0.66 calls/detector/night) (Bonaccorso, unpub. 2008).

Table 3.6. Results of Acoustical Bat Monitoring: August 8 to November 14, 2008.

Summary of Bat Detector Survey Data - West Maui Mountains, Fall 2008						
Detector	***Location***	***Survey Dates****	***Number of Operating Nights***	***Number of Call Sequence Files***	***Qualifying Bat Passes*****	***Detection Rate (passes/detector-night)***
Unit F	KWP II	Aug 8 - Nov 14	81	3	2	0.025
Unit H	KWP I	Aug 8 - Nov 14	99	7	3	0.030
Unit I	KWP I	Aug 8 - Nov 14	99	4	2	0.020
Unit J	KWP II	Aug 8 - Nov 14	99	1	0	0.000
Subtotal KWP I			198	11	5	0.025
Subtotal KWP II			180	4	2	0.011
Overall Total			378	15	7	0.019
* Bat detector surveys are ongoing. Results represented here reflect all data recorded and analyzed to date.						
** "Qualifying Bat Passes" represent recorded call sequence files that conform to data quality standards (such as number of call pulses and signal strength) commonly used to report detector data. As such, those call sequence files that do not conform to those standards are not included in the calculation of Detection Rates. Detection rates using 'passes' provides a more comparable data set with other studies.						

3.7.2.4 Other Wildlife

Because it was thought possible that native land snails might be present, KWP II LLC commissioned a biologist to undertake a comprehensive investigation of this possibility. In the resulting report, Severns (2009) reported that over 1,300 species and subspecies of endemic land snails have been recorded in Hawai'i representing 7 widespread Indo-Pacific families. He concluded that native Hawaiians appear to have had very little effect on the land snail fauna but found that the ranching, large-scale agriculture, and other commerce that began immediately following the arrival of the first Europeans has had a major effect on this component of Hawaiian fauna. He reported that perhaps 90 percent of the known Hawaiian snail fauna is now extinct or is in imminent danger of extinction.

Severns' early 2009 survey of the KWP II site was aimed at determining if any species of native Hawaiian snails (particularly those listed as threatened, endangered, or of substantial conservation concern) are present and, if so, to identify them and to try to determine their habitat. The survey methodology entailed searching tree leaves, bark, and rock talus for living snails and screening soil, mosses and leaf litter samples for living and dead snails to 1 mm in diameter. In addition, Severns also searched exposed ground in gulches and road cuts for fresh and dead shells. He found no evidence of snails, fossil or extant, native or introduced. Moreover, Severns concluded that the habitat was unsuitable for native snails.

As part of his investigation, Severns also searched the collection data for records of subspecies specimens that may have been recorded by early collectors, but found none.[19] The absence of collecting data and specimens from Kaheawa Pastures when data are available for such a nearby

[19] The nearest location for which there is data for the collection of a snail species is along the ridge overlooking Ukumehame Valley on the trail leading to the reservoirs at Hana'ula, at a higher elevation, but parallel to the Kaheawa Pastures. There *Partulina fusoidea* was collected and still exists today.

location suggests that Kaheawa Pastures was unproductive for snail hunters from at least the early 19th century.

3.8 SOUND

3.8.1 APPLICABLE SOUND LIMITS

Hawai‘i Administrative Rules §11-46, “Community Noise Control” establishes maximum permissible sound levels (see Table 3.7) and provides for the prevention, control, and abatement of noise pollution in the State from stationary noise sources and from equipment related to agricultural, construction, and industrial activities. The standards are also intended to protect public health and welfare, and to prevent the significant degradation of the environment and quality of life. Note that the limits are applicable at the property line rather than at some pre-determined distance from the sound source.

Because the KWP II site is in the State Conservation District, the Class A limits are applicable. HAR §11-46-7 grants the Director of the Department of Health the authority to issue permits to operate a noise source which emits sound in excess of the maximum permissible levels specified in Table 3.7 if it is in the public interest and subject to any reasonable conditions. Those conditions can include requirements to employ the best available noise control technology.

Table 3.7. Maximum Permissible Sound Levels in dBA.

Zoning Districts	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Class A	55	45
Class B	60	50
Class C	70	70

Table Notes:

(1) Class A zoning districts include all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.

(2) Class B zoning districts include all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.

(3) Class C zoning districts include all areas equivalent to lands zoned agriculture, country, industrial, or similar type.

(4) The maximum permissible sound levels apply to any excessive noise source emanating within the specified zoning district, and at any point at or beyond (past) the property line of the premises. Noise levels may exceed the limit up to 10% of the time within any 20-minute period. Higher noise levels are allowed only by permit or variance issued under sections 11-46-7 and 11-46-8.

(5) For mixed zoning districts, the primary land use designation is used to determine the applicable zoning district class and the maximum permissible sound level.

(6) The maximum permissible sound level for impulsive noise is 10 dBA (as measured by the “Fast” meter response) above the maximum permissible sound levels shown.

Source: Hawaii Administrative Rules §11-46, “Community Noise Control”

3.8.2 EXISTING SOUND LEVELS

There are several ambient sound sources in the project area.[20] These include the turbines at the existing KWP I facility, vehicles traveling along the facility access road, rain, wind, birds and mammals. The wind turbines do not operate at wind speeds below three meters per second (6.7 mph). Thus, during periods of light or calm winds at hub height, sound level emissions from the wind farm are virtually non-existent. Table 3.8 presents the results of sound measurements made at the base of one of the KWP I turbines in September 2006 during a period of low wind speed. It is not meant to represent sound levels under a full range of operating conditions.

Table 3.8. Baseline Sound Levels in dBA at the Base of an Existing WTG at KWP I Site.

Station Description	***Baseline Sound Levels in dBA[1]***		
Existing KWP I Site at the Base of a Turbine	***Leq[2]***	***MaxP[3]***	***MaxL[4]***
	47.5	99.8	69.1

[1] A person's ability to hear a sound depends greatly on its frequency. Young, healthy people can hear frequencies as low as about 20 Hertz (Hz) and as high as about 20,000 Hz (one hertz is equivalent to one wave per second, or cycle, per second). People hear sounds best when the predominant sound energy is between 1,000 and 6,000 Hz. To measure sound on a scale that reflects the way people perceive it, more weight must be given to the frequencies that people hear more easily. The U.S. EPA recommends the A-weighting scale for environmental noise because it is convenient to use, accurate for most purposes, and is used extensively throughout the world.

[2] Equivalent Sound Level (Leq). This variable is the root-mean square (RMS) average of the time-varying sound energy measured during the 10-minute measurement interval. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns.

[3] Maximum Peak Level (MaxP). This is the instantaneous maximum sound level measured during the measurement interval.

[4] Maximum Sound Level (MaxL). This is the maximum sound level (1-second integrated value) recorded during the measurement interval.

Source: Planning Solutions, Inc. Sound levels were recorded continuously over a ten-minute period on September 6, 2006 using a Brüel & Kjær Type 2239A Integrating meter. The meter was set to integrate data every second using the A-weighting scheme.

Ambient sound level measurements have not been made at the property lines, but as they are well-removed from any existing sources of loud noise, including the KWP I WTGs, they are believed to be low.

3.9 ARCHAEOLOGICAL, HISTORIC, AND CULTURAL RESOURCES

3.9.1 PRE-HISTORIC AND HISTORIC LAND USES IN THE PROJECT AREA

3.9.1.1 Ukumehame Ahupua‘a

The project area is located at the upper reaches of the traditional land area of the Ukumehame, the easternmost *ahupua‘a* in the district of Lahaina. The *ahupua‘a* includes Ukumehame valley, a steep mountainous area, and several inter-valley tablelands. Archaeological evidence shows that taro was formerly cultivated in irrigated fields on the lowland plains and gulch bottom.

Because there was no reliable source of water, traditional wetland taro cultivation was not possible on the upland tablelands, such as the present-day Kaheawa Pastures area. However, the tablelands may

[20] Undesirable sound is generally referred to as noise; however, the terms sound and noise are commonly used interchangeably. The effects of sound depend on its frequency (or pitch), decibel level, and duration, particularly in relationship to changes in existing sound levels.

have been a resource area for the collection of native birds and an access route to the higher elevations of the West Maui Mountains (Tomonari-Tuggle 1998). If pili grass (*Heteropogon contortus*), common to leeward lowlands, had grown in this area, it would have been a prime resource since this was the most desired material for house thatching. In general, the tablelands were relatively inhospitable for intensive settlement or agriculture because of their steep and rugged terrain, lack of water sources, and limited access to the ocean. Similarly, although coastal trails once ringed much of Maui, no coastal trail was present fronting the KWP II project area because of the rough terrain, so "from Olowalu [to the west of the current project area] travelers were ferried by canoe to Māʻalaea [to the east of the current project area], thence to Mākena" (Handy et al. 1991).

By the 1850s, portions of Ukumehame *ahupuaʻa* were being leased for various enterprises, primarily cattle ranching (Tomonari-Tuggle 1998). In 1886, the western half of Ukumehame *ahupuaʻa* was listed as being leased to Olowalu Plantation Company, for sugarcane cultivation and sugar production, and the eastern half (including the KWP II project area) was listed as leased to John Richardson and Kahahawai for cattle ranching (Clark & Rechtman 2006). Cattle ranching continued in the area until the mid-1990s, while lower portions of the wetter, western half of Ukumehame *ahupuaʻa* continued to be used for sugarcane cultivation (Clark & Rechtman 2006).

3.9.1.2 Kaheawa Pastures

Clark and Rechtman (2006) synthesized information from archival resources and archaeological studies conducted in the project area in preparing their summary of prehistoric and historic uses of the entire Kaheawa Pastures area (extending from above the proposed KWP II site down to the coast). They concluded that pre-contact use of the project area centered on coastal habitation and the exploitation of marine resources.

Devereux et al. (1999) described a network of trails that may once have connected the coastal habitation area with inland resource areas. If a pre-contact *mauka/makai* trail route traversed Kaheawa Pastures, then it likely accessed inland resource areas, and may have connected to trails leading to other areas of West Maui. At some point in the mid-1940s the McGregor Point jeep road was bulldozed through the Kaheawa Pastures area, allowing vehicular access to the *mauka* land. This may account for the fact that Clark and Rechtman did not observe evidence of a pre-contact trail during their 2006 survey. Once constructed, the *mauka-makai* road was maintained by ranchers, MECO (for construction and maintenance of the transmission lines that it installed in the 1970s), and the State DLNR, with newer bulldozer routes approximating the older ones. Portions of the road were subsequently improved as part of the construction of KWP I. Athens (2002) reported that trails likely ran to Site 5232, an inland *heiau* located on Puʻu Luau, in late pre-contact times. He conjectured that isolated marine shell fragments and an adze fragment observed in the area may have been dropped along such a trail route leading to or from the *heiau*.

Historic-period sites in the vicinity of Kaheawa Pastures far outnumber those dated to the pre-contact period. The majority of these were relatively close to the old Honoapiʻilani Highway alignment. The date (1908) embedded in concrete stairs on the ridge to the west of Malalowaiaole Gulch (Site 5654) indicates that the area was being used in the early part of the 20th century. Other features (e.g., a terraced roadbed, a possible privy, and a hoist location) were also located in the area. All of these sites may relate to cattle ranching, which was ongoing in the area from the late 1850s to the early 1990s (Tomonari-Tuggle 1998). The only historic period site recorded close to the existing wind farm facilities is a concrete watering trough constructed in 1943 (Site 5402).

In addition to these sites the Lahaina Pali trail crosses the lower Kaheawa Pastures area, makai of the existing and proposed WTGs. This historic-period trail was constructed around 1841 for horse travel between Wailuku and Lahaina. The trail fell into disuse approximately 50 years later with the construction of a carriage road (Site 4696) along the coast (Tomonari-Tuggle and Tuggle 1991). The old trail brought numerous Historic travelers across the lower slopes of the West Maui Mountains,

and it continues to bring modern day visitors to the area as part of the Na Ala Hele Statewide Trail and Access System.

3.9.2 ARCHAEOLOGICAL AND HISTORIC FEATURES AT THE PROPOSED KWP II SITE

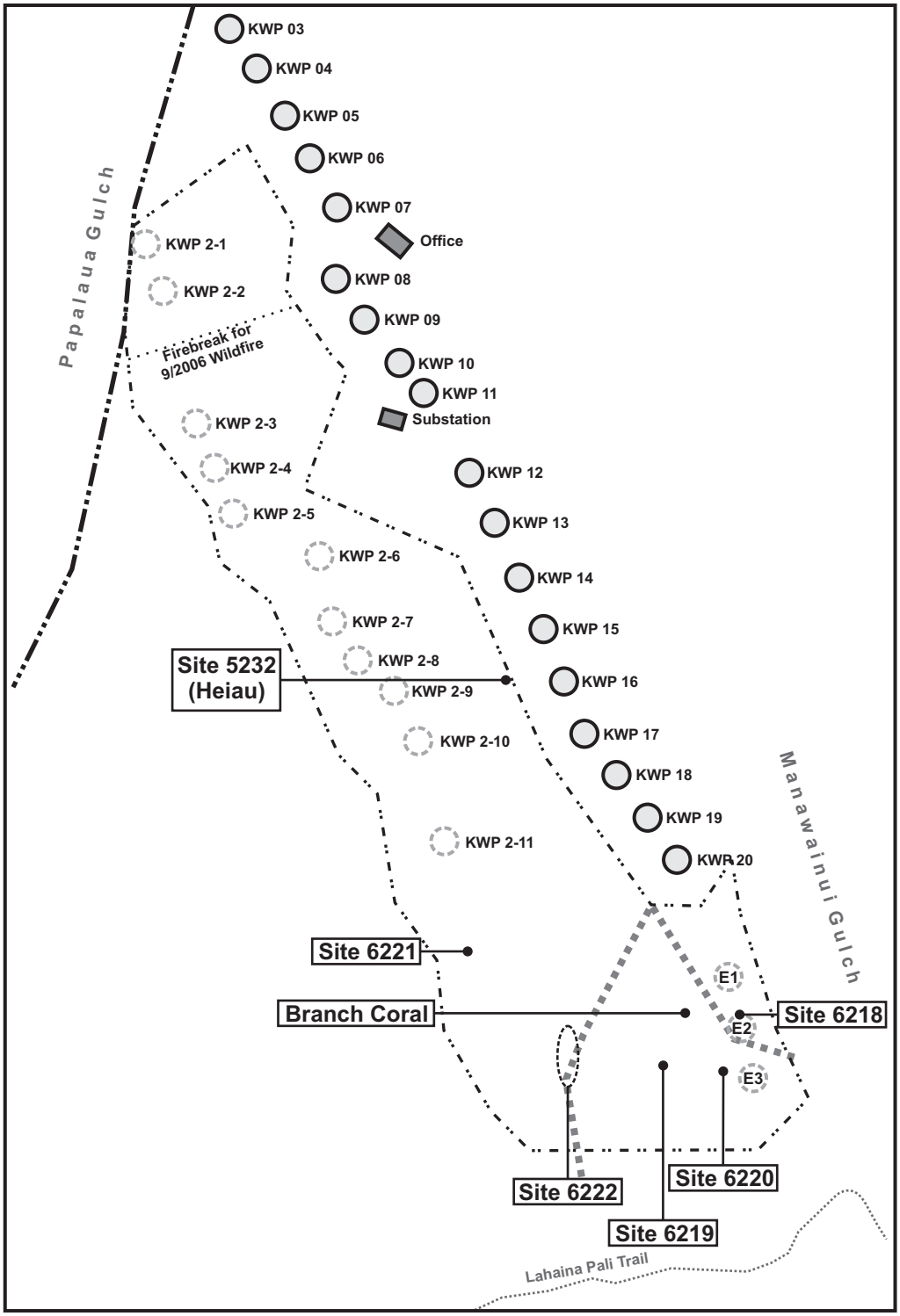
Eight archaeological studies were conducted in the Kaheawa Pastures area for the KWP I project. These studies included a reconnaissance survey of 27 wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the KWP I wind turbine pad alignments (Magnuson 2003), a supplemental survey for the proposed KWP I access road (Athens 2004), a reconnaissance survey of the southern portion of an alternative road route (Rasmussen 2005a), a supplemental reconnaissance survey within the SMA zone for the proposed KWP I staging area (Rasmussen 2005b), and an inventory survey of the entire proposed KWP I development area (Clark and Rechtman 2005). Three of these studies included portions of the KWP II project area (Athens 2002; Magnuson 2003; Tomonari-Tuggle and Rasmussen 2005). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali trail, a portion of which crosses *makai* of the KWP II project area, and an inventory survey was conducted for the MECO transmission lines that cross the current project area (Hammatt et al. 1996; Robins et al. 1994).

In 2006, Rechtman Consulting conducted an archaeological inventory survey of most of the proposed KWP II project area (Clark and Rechtman 2006, see Appendix B for full report). The survey team relocated SIHP Site 50-50-09-5232, an upland *heiau* previously recorded by Athens (2002). The survey also recorded five new sites. These included a windbreak shelter (SIHP Site 50-50-09-6218), three cairns (SIHP Sites 50-50-09-6219, 50-50-09-6220, and 50-50-09-6221), and a historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; SIHP Site 50-50-09-6222). The study noted two segments of an old metal waterline associated with Site 6222 crossing the project area from north to south. In addition to the recorded archaeological sites, a single, isolated piece of branch coral was found on ground surface to the west of Site 6218 and the old metal waterline.

With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites are within the southern portion of the KWP II project area *makai* of the existing KWP I facility. The *heiau* (Site 5232) is located along the southwestern flank of Pu‘u Luau near the western boundary of the existing wind farm. The Lahaina Pali Trail crosses the hillside several hundred feet south of the proposed KWP II project area. Each of these features is described in Table 3.8, and their locations are depicted on Figure 3.5.

Table 3.9. Archaeological Sites Identified in the Project Area

SIHP Site No.	*Time Period*	*Description*
50-50-09-6218	Unknown (probably historic)	A crude windbreak shelter constructed of cobbles and small boulders. May have been a rest area constructed by the ranch hands working on a metal waterline that was laid nearby in the 1940s. No indication of time or duration of use, although it would have taken very little effort to construct.
50-50-09-6219	Unknown	A cairn consisting of two boulders stacked one on top of the other on top of a natural bedrock boulder. Small stones exist beneath the two stacked boulders to balance them. The boulders are fairly large and would have required two people to lift. The cairn could have been erected at any time, perhaps to marks the route of a former trail, although no such route is apparent on the site.
50-50-09-6220	Unknown (probably modern)	A cairn constructed of three small cobbles stacked on top of a large bedrock boulder. This cairn could have been erected at any time, but it is likely that it was constructed during recent times, as the cobbles are rather precariously balanced and would fall over easily if disturbed. It is possible that the cairn marks the route of a former trail, although no such route is apparent.
50-50-09-6221	Unknown	A cairn constructed of approximately fifteen medium-sized cobbles that are loosely stacked/piled on and against two small bedrock boulders. It could have been erected at any time. Again, it is possible that the cairn marks the route of a former trail, although no such route was observed.
50-50-09-6222	Historic	A concrete water trough (Feature A) and the remnants of two recently burned wooden structures (Feature B), possibly troughs. The features are connected by an old metal waterline. An inscription in the concrete of Feature A reveals that construction of the concrete portion of the trough was completed on December 17, 1943. This water system was likely part of Hono‘ula Ranch, which was operating in Ukumehame in the 1940s.
50-50-09-5232	Pre-contact	An upland *heiau* (religious site or temple) approximately 400 feet to the west of the KWP I facility at an elevation of about 2,250 feet MSL. The *heiau* is thought to date from the late prehistoric period, between 1660 and 1760. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau* (Athens 2002). Several pieces of branch coral were recovered from the charcoal deposit, further confirming the religious nature of the site (branch coral was commonly brought to *heiau* as offerings). No food or tool remains were found during the extensive survey of the site (Athens 2002). The *heiau* is thought to be connected with Manawaipueo Gulch and is thereby associated with owls (pu‘eo). The *heiau* does not appear to have a recorded traditional or common name (Tomonari-Tuggle and Rasmussen 2005). Clark and Rechtman (2006) also noted that the southwestern corner of the *heiau* is oriented toward the tallest point on the Island of Kaho‘olawe, suggesting that it perhaps functioned as a navigation *heiau* (Kaho‘olawe is associated w/ navigation).
50-50-09-2946 and 50-50-09-2950	Historic	The Lahaina Pali Trail (Site Nos. 50-50-09-2946 and 50-50-09-2950) runs east-west across the Kaheawa area, approximately 3,000 feet down slope of the southernmost existing KWP I turbine. Evidence suggests that “the Lahaina Pali Trail was constructed for horse traffic around 1841 and was used for some fifty years as the shortest route between Lahaina and the isthmus of Maui. It fell out of use around the turn of the 20th century following construction of a carriage road along the base of the *pali*” (Tomonari-Tuggle, 1991, as cited in Tomonari-Tuggle and Rasmussen, 2005). Tomonari-Tuggle (1991) further states that “The terrain crossed by the Lahaina Pali Trail is relatively inhospitable for settlement or agriculture. Surface water is virtually nonexistent and there are few fresh water sources. The slopes are steep and rugged. Access to the ocean is limited to small, narrow, and rocky gulches.” Old Lahaina Pali Trail was selected as Maui’s Demonstration Trail for the Na Ala Hele Trails and Access Program.
Source: Clark and Rechtman (2006).		



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Prepared By:

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Source:

Rechtman Consulting, LLC (2006)

Legend:

Old Waterline

Extent of Survey

Parcel Boundary

0 250 500
Meters

Figure 3.5:

Archaeological Sites in the KWP II Project Area

Kaheawa Wind Power II

Figure 3-5 Archaeological Sites in KWP II Project Area 2008-10-20.cdr

3.9.3 CULTURAL USES AND RESOURCES AT THE KWP II PROJECT SITE

Wilson and Rechtman (2009) prepared a Cultural Impact Assessment (CIA) for KWP II in accordance with the provisions Chapter 343 HRS, Act 50, approved by the Governor on April 26, 2000, and the Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impact. While the physical study area is limited to the portion of Ukumehame Ahupuaʻa that encompasses Honuaʻula Ridge, the CIA considered resources in the entire ahupuaʻa (including its coastal and off-shore resources) and the site's relationship to neighboring lands within the larger region.

The archival-historical research and oral-historical interviews that were conducted as part of the CIA were performed in a manner consistent with federal and state laws and guidelines for such studies. The primary objective of the oral-historical component of this study was to identify the existing knowledge about former land use, traditions, practices, and cultural sites. Some of the information is derived from the archaeological studies that have been conducted in the area and the neighboring Kaheawa Wind Power I area (Athens 2002, 2004; Clark and Rechtman 2005, 2006; Rasmussen 2005a, 2005b, 2005c). Other information is from additional archival research conducted and additional oral-historical work completed specifically for the CIA. New interviewees included, but were not limited to, Kupuna Paolo Kamakehau Fujihiro, Kumu Hokulani Holt, Kupuna Walter Kanamu, Kupuna Ed Lindsey, and Glen Kamalani Mclean. All of the interview participants (past and present) have shared their personal knowledge of the land and practices of this portion of West Maui. The most pertinent aspects of it are summarized in the discussion of potential effects and mitigation measures that is presented in Section 4.9.2 of this report.

3.10 EXISTING LAND USE/SOCIOECONOMIC & CULTURAL ENVIRONMENT

3.10.1 LAND USE

3.10.1.1 Existing Land Use Controls

The proposed KWP II project site is in the General subzone of the State Conservation District (see Figure 3.6) as established and regulated by Chapter 205, HRS. Lands within the Conservation District are typically utilized for protecting watershed areas, preserving scenic and historic resources, and providing forest, park and beach reserves [subsection 205-2(e) HRS]. The entire project site is owned by the State of Hawaiʻi. As with other Conservation District lands, the parcel containing the project site is not subject to any County of Maui zoning or community plan designations or restrictions. A small portion of the existing KWP I access road (near Honoapiʻilani Highway) lies within the County Special Management Area (SMA). KWP I previously obtained a permit from the County of Maui for construction of the road within the SMA. However, the KWP II proposal does not involve development within that area.

3.10.1.2 Existing Land Use

In addition to the KWP I wind farm facilities, a few low-intensity uses are present near the area that is being considered for the proposed KWP II wind farm.

- The area *mauka* and west of the proposed wind farm is used by the State for the release of native Nēnē as part of an ongoing wildlife preservation program.
- The Sierra Club and other organizations utilize the Manawainui Plant Sanctuary *mauka* of the existing KWP I and proposed KWP II facility for education, management, and restoration of native plant habitat.

- The Lahaina Pali Trail traverses the hillside at an elevation of approximately 1,500 feet. Under the proposed layout, the lowest of the WTG sites would be approximately 900 feet from the trail.
- Two MECO transmission line easements cross Kaheawa Pastures in a southwesterly direction from Mā‘alaea. The first easement (with 2 power lines) crosses the pastures at an elevation of approximately 2,300 feet; the second easement (with 1 power line) crosses about 1,900 feet.

There are no planned land uses identified in the Maui County General Plan or the West Maui Community Plan for the study area.

3.10.2 POPULATION AND HOUSING

No one lives on the parcel on which facilities would be developed or on immediately adjoining parcels. The settlements nearest the proposed KWP II project area are Olowalu, which is over three miles to the southwest, and Mā‘alaea, which is approximately two miles to the east. Mā‘alaea’s population in 2000 was approximately 450; far fewer people lived in Olowalu.[21]

The County of Maui Planning Department *Socio-Economic Forecast: The Economic Projections for the Maui County General Plan 2030* (County of Maui Planning Department 2006: 11) projects Maui island’s de facto population (i.e., the average number of residents and visitor present) will increase from 175,147 in 2005 to 254,448 in 2030, a gain of about 45 percent. Local development potentials include time-share development, the development of large master-planned communities, and the development of Hawaiian Homelands lands. Proposals include the development of sizeable new residential communities at Olowalu and Mā‘alaea.[22]

3.10.3 ECONOMY

Maui County Planning Department’s 2006 Socio-economic Forecast made the following general predictions about the economy of Maui County to the year 2030:

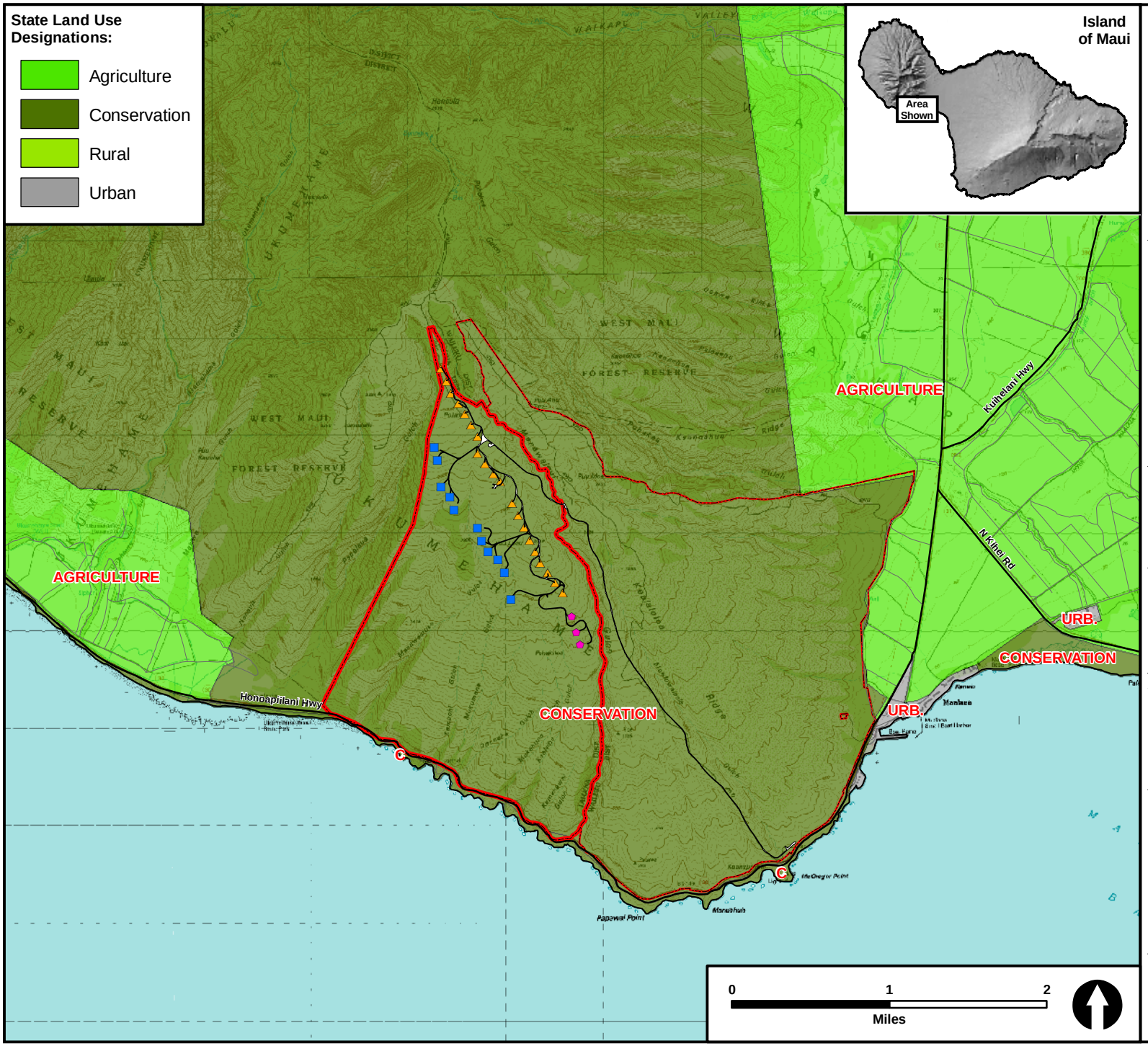
- Wage and salary jobs are expected to increase by about 1.7 percent annually;
- Per capita real income (i.e., using inflation-adjusted dollars) will increase very little;
- Visitor counts will increase by about 1.5 percent annually;
- With high occupancy rates, construction of new units is expected to resume, and the supply of visitor units will likely grow at 1 percent or more annually; and
- The rates of growth in resident population, housing, and jobs are higher than the rate of growth for visitors. This means the Maui economy has diversified and is less driven by tourism than in the past.

West Maui is considered one of Maui’s major centers for the visitor industry. In 2005 the total Maui County visitor expenditures were $3.2 billion. This represents a little more than a quarter of the statewide visitor expenditures of $11.9 billion during 2005 (DBEDT 2006b).

While Maui is very dependent on the visitor industry, the island’s agricultural industry, principally sugar and pineapple, provides a vital contribution to the economy. In 2004, Maui County had 34,800 acres of cane fields and generated a $46.2 million sugar crop. Pineapples were grown on 5,500 acres and produced a $28 million crop (DBEDT 2006a).

[21] U.S. Census Bureau, Census 2000 Redistricting Data Summary File, Matrices PL1 and PL2.

[22] The plan for Olowalu calls for realigning the highway inland and the development of 565 Single Family Lots, 785 Multi-Family / Apartments, 150 “Live/Work” Units, and 25,000 sq. ft. of commercial business space in the town centers for such things as a surf shop, doctor, café, restaurant, dentist, book store, market, video store, hardware store, drug store, bakery, and bar (http://www.olowalutown.net/index.cfm?fuseaction=ig.page&PageID=167).



Legend:

- Existing KWP I Turbines
- Highways
- Roadways
- TMK Boundaries

Proposed KWP II Sites:

- Downwind Sites
- Downstring Sites

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

-UPC Wind Management, LLC
-State of Hawai'i GIS
-AECOM

Figure 3.6:

State Land Use Map

Kaheawa Wind Power II

Figure 3-6 Land Use Map 2009-01-13.mxd

3.11 SCENIC AND AESTHETIC RESOURCES

The KWP II site is adjacent to the existing WTGs and other facilities that make up the existing KWP I wind farm. The area is not identified as having an important scenic vista or view plane in county or State plans or studies (KWP 2004). Both the existing wind turbines and the sites of the proposed new WTGs are visible from portions of the Lahaina Pali Trail, which passes below (i.e., to the south of) the nearest existing KWP I turbine. For the most part, intervening terrain and vegetation block views of all of the land on which additional wind power development is being proposed from Honoapiʻilani Highway and other public vantage points. Because of their height, the WTGs will be marginally visible from parts of eastern and central Maui, and this is discussed in Section 4.11. From the KWP II site there are sweeping panoramas of Haleakalā and Māʻalaea Bay to the east, of Kahoʻolawe and Molokini Islands to the south, and of the West Maui Mountains to the west. Like the existing KWP I WTGs, several of the proposed KWP II WTGs will be visible from Māʻalaea and Kīhei. Facing *mauka*, the site (on clear days) offers views of Papalaua and Manawainui Gulches flanking the pasture area. As is true of the existing WTGs, the KWP II site is most visible from aircraft on approach to Kahului airport. With the exception of the aforementioned trail and aircraft views, all of the public vantage points from which the KWP II site is visible are a minimum of several miles distant.

3.12 HAZARDOUS MATERIALS

Vuich Environmental Consultants, Inc (VEC 2005) conducted a Phase I Environmental Site Assessment of the KWP I project site. VEC concluded that no "recognized environmental conditions"[23] are present on the site or in the surrounding area. The proximity of the proposed KWP II site and the similarity of past uses suggest that conditions there are similar, but a Phase I Environmental Site Assessment will be conducted prior to construction to confirm this fact.

The Phase I environmental report for KWP I identified a few "products of concern relating to any future development project or land-clearing activity." These consisted of earthen material (silt), paints, oils, antifreezes, and other fluids from automobile or on-site machinery, or leaks from on-site stocked items. All of these were present in small quantities and were determined not to constrain use of the area.

Operation of the existing KWP I facility requires storage of several materials that require special handling and storage. These include mineral oil, hydraulic oil, waste oil, and cleaner/degreaser. These materials are presently stored in three container areas on the site: (1) the existing O&M building, (2) the 20 wind turbine sites; and (3) the existing substation. Table 3.10 lists the locations, quantities, and containment types in place for each of the on-site oil storage locations at KWP I. A Spill Prevention, Countermeasure, and Control (SPCC) Plan is in place for the facility and is updated every five years.

A follow-up Phase I assessment of the KWP I facility was conducted by Malama Environmental in August 2007, after that facility commenced operation. The report noted that regulated wastes and petroleum products are effectively managed on-site, and that secondary containment of petroleum-based wastes and effective spill management have been implemented in the daily operations of the facility. Further, it noted that petroleum-based wastes and all other regulated wastes generated on-site are being properly managed and disposed of by certified waste contractors (Malama Environmental 2007).

[23] Recognized environmental conditions, as defined by ASTM Standard E1527-00, are the presence or likely presence of any hazardous substance or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property, or into the ground, ground water, or surface water of the property.

Table 3.10. Oil Storage and Containment at KWP I.

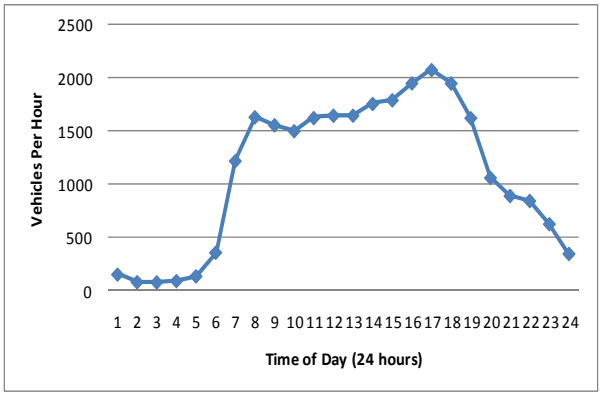
Location	*Container ID*	*No. of Units*	*Unit Capacity (gallons)*	*Total Capacity (gallons)*	*Product Stored*	*Containment Type*
Substation	Substation Transformer	1	3,465	3,465	Mineral Oil	Concrete Pit
Substation	Grounding Transformer – UPC side	1	30	30	Mineral Oil	Aerial Platform – 6 inches of ¾ inch washed gravel
Substation	Distribution Transformer	1	522	522	Mineral Oil	Pad-mounted and surrounded by – 6 inches of ¾ inch washed gravel
WTGs	Step-up Transformers	20	522	10,440	Mineral Oil	Pad-mounted
WTGs	Gear Boxes	20	64	1,280	Hydraulic and Lubricating Oils	Catch-basin and wind turbine structure
O&M Building	Mineral Oil	1	55	55	Extra Mineral Oil	Spill retentive skid
Source: Kaheawa Wind Power Project Spill Prevention, Control, and Countermeasure Plan (July 2007)						

3.13 PUBLIC INFRASTRUCTURE AND SERVICES

3.13.1 TRANSPORTATION FACILITIES

Roadways. The access road to the existing wind farm facilities begins at Honoapi‘ilani Highway, one of Maui’s major coastal roadways. The State-owned highway is heavily traveled by tourists and commuters, especially during daylight hours. It connects with other major highways and provides ready access to the harbor facilities at Kahului where the equipment and other construction materials needed for the proposed project would be landed.

The State Department of Transportation conducts regular traffic counts on Honoapi‘ilani Highway near McGregor’s Point (Site ID B740030000611) just a short distance to the west of the Kaheawa Pastures access road Honoapi‘ilani Highway access road intersection. The 24-hour volume on August 24th and 25th, 2007 was 24,973 and 25,559, respectively. With one exception, the volume exceeded 1,500 vehicles per hour every hour between 7:00 a.m. and 6:00 pm. The highest volume occurs between 4:00 p.m. and 5:00 p.m., when an average of over 2,100 vehicles per hour were recorded on the two days.



Harbors. Kahului Harbor is the only harbor on Maui suitable for unloading heavy equipment and construction materials needed for the proposed project. Most construction materials would arrive at the Kahului Harbor and be off-loaded before being trucked to the site.

Airports. The KWP II project is located approximately 10 miles from the Kapalua Airport and about 8 miles from Kahului International Airport. Because of the height of the proposed wind turbines, KWP II is required to submit a Notice of Intent to the Federal Aviation Administration (FAA) for construction of the proposed facility. The FAA reviewed the KWP I turbines on the land adjacent to the project site and determined that, with proper lighting, they would not constitute a hazard to air navigation.

3.13.2 UTILITIES & PUBLIC SERVICES

Electrical service to the site is provided by MECO. As described in Section 3.10.1.2, two MECO transmission line easements containing three transmission circuits cross the project area. The existing KWP I facility uses power from the uppermost of the three lines via step-down transformers located at the existing KWP I substation. Likewise, power generated by the KWP I facility is fed into the MECO grid via those transmission lines. At MECO's request, the proposed KWP II facility would utilize the lowermost line for extracting the small amount of power it needs and for distributing the power generated by the proposed turbines. MECO requested that the KWP II facility connect to different transmission lines than KWP I so as to provide greater redundancy and security to its system.

The nearest hospital to the proposed KWP II site is the Maui Memorial Hospital in Wailuku. In case of emergencies, paramedic/ambulance services are available from the Wailuku and Kīhei areas. The Maui Police Headquarters is located on Mahalani Street in Wailuku. The Maui main fire station is in Kahului on Dairy Road, additional fire stations are located in Wailuku, Kīhei and Lahaina.

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4.0 POTENTIAL IMPACTS & MITIGATION MEASURES

This Chapter describes the probable adverse and beneficial effects of the proposed action described in Section 2.2. The discussion is organized by type of potential impact (e.g., air quality, water quality, visual, etc.). The discussion within each topical area begins with a description of the components of the project that have the potential to impact the particular aspect of the environment being discussed. Because they typically involve substantially different types of impacts, the analysis also distinguishes between activities that are needed to construct the facilities and those associated with its operation. Where applicable, the discussion draws from experience and data gained during construction and operation of the existing KWP I facility.

Good design practice integrates features intended to avoid or minimize potential environmental effects into the fundamental design of the project as project design features (PDFs). Impacts that remain after implementation of the PDFs are then addressed with mitigation measures.

This Chapter is divided into the major subsections listed below, each corresponding to one aspect of the environment:

- Section 4.1 – Geology, Topography, and Soils;
- Section 4.2 – Air Flow and Climate;
- Section 4.3 – Air Quality;
- Section 4.4 – Hydrology and Water Resources;
- Section 4.5 – Natural Hazards;
- Section 4.6 – Terrestrial Flora;
- Section 4.7 – Terrestrial and Avian Fauna;
- Section 4.8 – Noise;
- Section 4.9 – Archaeological, Historic, and Cultural Resources;
- Section 4.10 – Land Use and Socio-Economic Effects;
- Section 4.11 – Scenic and Aesthetic Resources;
- Section 4.12 – Hazardous Materials;
- Section 4.13 – Public Infrastructure and Services.

4.1 GEOLOGY, TOPOGRAPY AND SOILS

4.1.1 INTRODUCTION

As discussed in Section 3.1.1, there are no known unique or unusual geologic resources or conditions at the proposed KWP II site.[24] Grading similar to that done for the KWP I project will be required for the turbine pads, internal access roads, substation, and control building associated with the proposed KWP II facility. However, because the proposed project can take advantage of the existing access road from Honoapiʻilani Highway rather than having to construct an entirely new road network, the earthwork is more limited than that required for KWP I and would not alter any of the major topographic features named in Section 3.1.1.

A detailed analysis was conducted to determine the extent and significance of the project's potential soils-related effects. The results of this assessment are described below. It begins with a brief description of the various elements of the project that involve ground disturbance (see Section 4.1.2).

[24] Seismicity (i.e., the potential for earthquakes) is discussed in Section 4.5.2 as part of a broader review of the natural hazards to which development in the area is exposed.

This is followed by a brief description of the agricultural characteristics of the soil and the extent to which agricultural productivity would be lost if the KWP II project is constructed (see Section 4.1.3). The discussion concludes with a review of the extent to which the proposed changes are likely to result in soil loss (see Section 4.1.4) from the affected area.

4.1.2 EXTENT OF GROUND DISTURBANCE

KWP II will require an extension of the existing road network on the hillside. In addition, it will require grading of the 14 WTG pads and the site for the baseyard that includes the substation, BESS, and O&M building. Although site civil design is still at an early stage, a preliminary estimate indicates that the project will involve the disturbance of approximately 53 acres of land and will require a substantial amount of earthmoving.[25] The actual area of disturbance and cut and fill volume will be minimized during the final design process.

4.1.3 EFFECT ON AGRICULTURAL PRODUCTIVITY

As mentioned in Chapter 3, most of the project area is underlain by rock land, Nāʻiwa silty clay loam, and Oli silt loam. According to the *Soil Survey of the State of Hawaiʻi* (Foote *et al.* 1972), these soil types are generally not suited to mechanized production of common field crops without special management; hence their agricultural usefulness is limited to pasture and wildlife habitat.[26] None of the land in the project area is identified as "Prime" or "Unique" on the Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) map.

While none of the land in the KWP II project area is suitable for crop production, portions of the area have been used in the past for pasture. The developed portion of the 333-acre leased area will no longer be suitable for pasturage, but the presence of the wind farm will not preclude grazing on the remainder, which comprises the great majority of the leased area.

4.1.4 LIKELY SOIL LOSS VIA EROSION

The proposed facilities are planned for moderately steep land and will require a substantial amount of grading. This will expose the area to increased erosion. The Best Management Practices (BMPs) outlined below will be employed to prevent construction and operation of the facilities from causing undue erosion.

4.1.4.1 Soil-Disturbing Construction Activities

Construction work will be done using graders, multiple cranes, dump trucks, concrete mix trucks, front end loaders, bulldozers, excavators, and heavy haul trucks. Each of the pads on which the proposed turbines would be erected is approximately 180 by 200 feet. When the adjacent cut and fill slopes are considered as well, the total ground disturbance will amount to approximately 1.5 acres per WTG.

The intra-site access roads that will connect the turbine pads with the existing KWP I access road will, when cut and fill slopes on either side of the roadway are considered, disturb a total of approximately 26 acres. Trenching is also required for emplacement of the underground power distribution lines connecting the WTGs with the substation. These will run from each WTG to the substation, in some cases cross-country and in other cases remaining within (and beneath) the new access roads. Table 2.1 above enumerates the approximate area to be disturbed during construction of each of these components.

[25] Estimates are from calculations by AECOM Water dated January 29, 2009.

[26] Rock land is suited for urban development (such as the warehouse that is planned for KWP II), so long as the foundations are designed with the relatively high shrink-swell potential in mind.

Temporary construction activities will include establishment of an on-site construction staging and stockpiling area. This staging area will be approximately 300 by 250 feet and will be surfaced with gravel to minimize erosion.

The facilities will be constructed and the WTGs and other equipment installed in a linear fashion, beginning with the construction baseyard and staging area, followed by the access roads and WTG pads. After these are in place, the WTGs will be erected. Construction of the substation will occur at the same time as the other work is being undertaken and will be timed to end at the same time.

4.1.4.2 Soil Erosion Prevention During Construction and Operation

Sections 4.3.1 and 4.4.3 below describe the best management practices that KWP II LLC will implement to prevent and minimize soil erosion during construction and operation of the proposed facility.

4.2 IMPACTS ON AIR FLOW AND CLIMATE

WTGs of the type and number that are proposed do not have the potential to affect temperature, rainfall, humidity, or most other meteorological parameters. By altering the atmospheric mixing that occurs as wind passes over a site, they do have the potential to affect certain aspects of the wind regime, but for several reasons the potential effects are minor.[27]

- First, they would extract only a small percentage of the wind energy that passes over Kaheawa Pastures; most would remain in the atmosphere.
- Second, because their blades are elevated well above ground level, the greatest of even these modest effects are greatly diminished at ground level.
- No uses are anticipated in the area that could be affected by minor changes in wind speed and/or velocity that have the potential to be harmed by what few changes might occur.

In view of the absence of significant localized effects, the most important effects on climate are positive ones that stem from the proposed project's ability to reduce the combustion of fossil fuels and, therefore, the emissions of greenhouse gases (GHGs) that are contributing to global warming.

The remainder of this section is divided into two parts. Section 4.2.1 discusses the concept of global warming and the contribution of emissions from the combustion of fossil fuels to that phenomenon. Section 4.2.2 describes the extent to which operation of the proposed project could eliminate a portion of those emissions.

4.2.1 GLOBAL WARMING: MAGNITUDE AND CAUSES

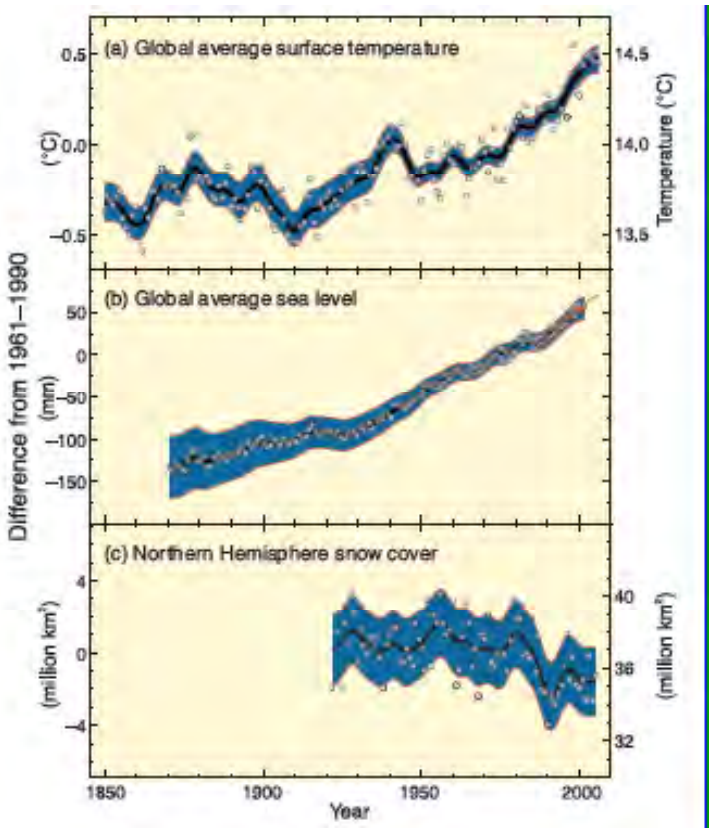
4.2.1.1 Magnitude of Global Warming

The global scientific community is in general agreement that human activities, specifically those resulting in the emission of GHGs, are contributing to a rise in average global temperatures. The GHGs associated with human activities that are of greatest concern are CO_2 from the combustion of fossil fuels and industrial processes (e.g., cement manufacturing), methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride. Of these six gases, CO_2 is the most prevalent.

[27] A theoretical study authored by Dr. Somnath Baidya Roy and reported in the November 2, 2004 edition of the *New York Times* modeled the impact of a hypothetical large-scale wind farm in the Great Plains. Published in *The Journal of Geophysical Research*, the study concluded that WTGs can affect local weather, but only when thousands of turbines are concentrated in one area. The authors conclude that the impact comes not so much from the turbines' rotor blades slowing down the air but rather from the atmospheric mixing that occurs in the blades' wake. The relatively few existing and proposed WTGs at Kaheawa are far below the threshold at which such an effect could occur.

The EPA (EPA September 1998) estimates that global mean surface temperatures increased 0.6-1.2°F between 1890 and 1996. The 9 warmest years in this century all have occurred in the last 14 years of that period. The average temperature in Honolulu has increased 4.4° F over the past century. Other observed environmental changes, including a decrease in Northern Hemisphere snow cover, a decrease in Arctic Sea ice, and continued melting of alpine glaciers, tend to corroborate the temperature data (see Figure 4.1). In addition, global sea levels have risen 4 to 10 inches over the past century, and precipitation over land has increased slightly.

Figure 4.1. Average Temperature, Sea Level, and N. Hemisphere Snow Cover Changes



Source: IPCC *Climate Change 2007 Synthesis Report: Summary for Policymakers (Figure SPM.1)*. Observed changes in (a) global average surface temperature; (b) global average sea level from tide gauge (blue) and satellite (red) data and (c) Northern Hemisphere snow cover for March-April. All differences are relative to corresponding averages for the period 1961-1990. Smoothed curves represent decadal averaged values while circles show yearly values. The shaded areas are the uncertainty intervals estimated from a comprehensive analysis of known uncertainties (a and b) and from the time series (c).

The Intergovernmental Panel on Climate Change (IPCC) has concluded that "…*the balance of evidence suggests a discernible human influence on global climate*." The IPCC estimates that a global average warming of 1.0 to 4.5°F (0.6-2.5°C) in the next 50 years and 2.5 to 10.4°F (1.4 to 5.8°C) by the year 2100, compared with the global average temperature in 1990. Model calculations by the EPA (EPA, September 1998) are on the same order of magnitude, suggesting that the global surface temperature could increase an average of 1.6 to 6.3°F by the year 2100, with significant regional variation. These temperature changes would be far greater than recent natural fluctuations, and they would occur significantly faster than any known changes in the last 10,000 years.

Projections by the IPCC and results from the United Kingdom Hadley Center's climate model (HadCM2) suggest that by 2100 temperatures in Hawai'i could increase by 3°F (with a range of 1-5°F) in all seasons, slightly more in fall (EPA, September 1998). The most obvious effect that an increase in average global temperature could have on Hawai'i is a rise in ocean level. It could also alter climatic patterns, and this, in turn, could have a number of secondary effects (e.g., changes in rainfall, increased air pollution, etc.). Future changes in precipitation in Hawai'i are highly uncertain. This is because they depend in part on how El Niño might change, and no reliable projections of this are available. However, it appears possible that quite large precipitation increases could occur in summer (particularly) and fall. Other climate models may show different results, especially regarding estimated changes in precipitation.

4.2.1.2 Factors Contributing to Global Warming

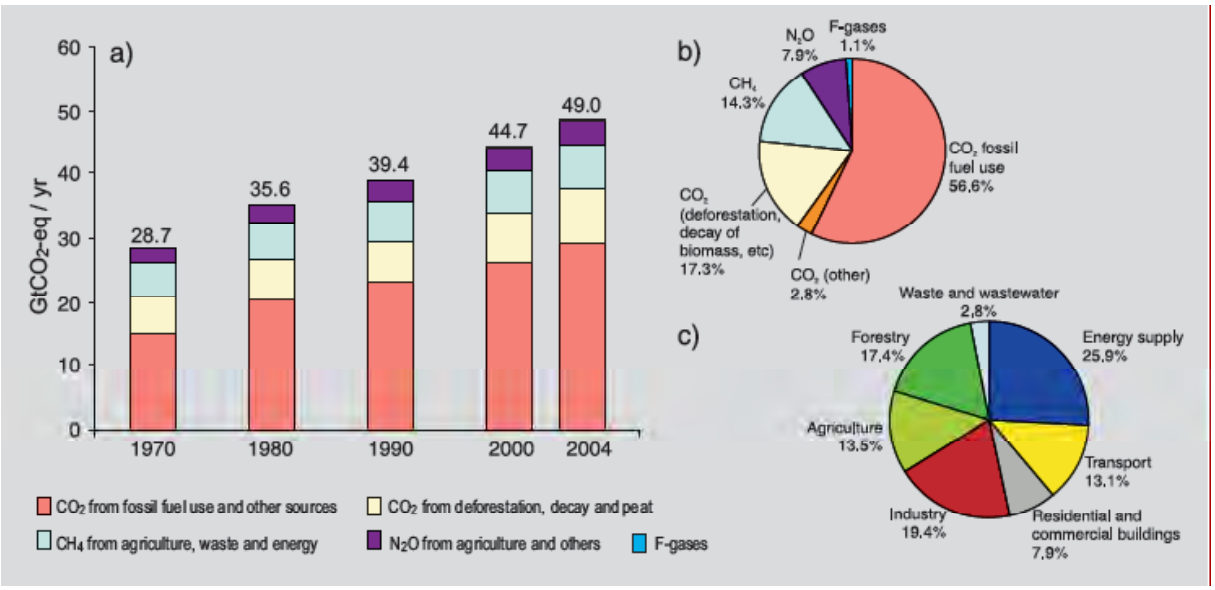
While it is clear that global temperatures fluctuated significantly long before there was any potential for them to be influenced by human activities, the scientific evidence indicates that the recent increase in global temperature is mainly due to the combustion of fossil fuels and deforestation.[28] Data from entrapped air inclusions in ice cores obtained from the Russian Vostok station in East Antarctica provide direct records of atmospheric trace-gas composition over the last 400,000 years. While the data indicate that temperature and atmospheric CO_2 concentrations have fluctuated substantially over that period, the recent values for CO_2 concentrations are well outside the historical range. The IPCC (2007) estimates that after remaining nearly constant during the thousand years before the Industrial Revolution, the concentration of carbon dioxide has grown by more than 30 percent since pre-industrial times and is still increasing at an unprecedented rate of on average 0.4 percent per year.[29]

The same source estimates that global greenhouse gas emissions produced by human activities (also called "anthropogenic" emissions) increased 70 percent between 1970 and 2004 (see Figure 4.2), with most of the increase attributable to combustion of fossil fuels. It is very likely that the observed increase in CH_4 concentration is predominantly due to agriculture and fossil fuel use. CH_4 growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. The increase in N_2O concentration is primarily due to agriculture.

[28] The changing isotopic composition of the atmospheric CO_2 shows the fossil origin of the increase, linking it to human activity. Currently, about 7 billion tons of carbon (as carbon dioxide) are emitted each year during the combustion of fossil fuels and 1-2 billion tons per year from land clearing.

[29] Analyses of the composition of air bubbles trapped in Antarctic ice shows that carbon dioxide concentrations are now higher than at any time in the past 400,000 years and that it may be higher than it has been for 20 million years. If proven representative, these results indicate that the current rate of increase of carbon dioxide is greater than at any time in the past 20,000 years.

Figure 4.2. Anthropogenic Greenhouse Gas Emissions



Source: IPCC *Climate Change 2007 Synthesis Report: Summary for Policymakers (Figure SPM.3)*

4.2.2 PROJECT-RELATED EFFECTS ON GREENHOUSE GAS EMISSIONS

The operation of the proposed wind turbine generators will provide MECO with approximately 70,000 MWh/year of electricity, on average. Based on the national average CO_2 emissions of slightly fewer than 2 pounds per kilowatt hour[30] the proposed project has the potential to reduce CO_2 emissions by approximately 126,000,000 pounds per year.[31] While this represents the theoretical maximum reduction that could be achieved by substituting wind-generated power for that derived from fossil fuels, the actual reduction will be less. This is because the variable nature of wind requires that MECO maintain some fossil fuel-fired backup capacity on line even while the wind power is being utilized.

The extent to which this occurs varies substantially over the course of a day and from day-to-day and estimates of it are necessarily imprecise. However, KWP II and MECO estimate that the actual reduction in the combustion of fossil fuel will be on the order of 85 percent. Assuming this is achieved, operation of the proposed facilities will reduce CO_2 emissions by 107 million pounds per year.

[30] Note that the CO_2 output rate (in pounds CO_2 per kWh) is based on the 1999 U.S. average for all generating units burning petroleum as reported by the U.S. Department of Energy and U.S. Environmental Protection Agency in (2000).

[31] Manufacturing the WTGs and transporting them to Kaheawa Pastures does involve activities that result in the release of GHGs. Similarly, vehicle-trips associated with the transport of operating personnel, supplies, and related items to the site also results in the release of small amounts of GHGs. The quantity of such releases is extremely small in relationship to the fuel combustion that is avoided and is not analyzed here.

4.3 AIR QUALITY

Construction and operation of the proposed facilities involves certain activities with the potential to affect air quality. The nature and magnitude of the likely changes are described below. Section 4.3.1 discusses construction-period effects, while Section 4.3.2 covers effects once the facilities are operational. Because it does not involve the operation of any significant sources of air pollutants, the principal regulatory standard that must be met is the requirement that reasonable precautions be taken to prevent particulate matter emissions during construction or material handling, and "best practical operation or treatment" must be implemented to prevent visible emissions of fugitive dust beyond the property line.

4.3.1 CONSTRUCTION PERIOD IMPACTS & MITIGATION MEASURES

Project-related construction activities will generate two types of air emissions: (*i*) exhaust emissions from construction vehicles and (*ii*) fugitive dust from earthmoving operations. Of the two, fugitive dust from earth-moving is by far the larger source. Nearly all of the fugitive dust emissions will be limited to the area in and around the proposed WTG pads, site access roads, substation site, and warehouse/control building sites. However, small quantities of construction-related fugitive dust emissions will also result from vehicles carrying equipment and workers up and down the existing Kaheawa access road.

All of the construction-related emissions would be short-term and all except the highway vehicle emissions would occur away from existing development. Consequently, none would be substantial so long as proper pollution control measures are implemented as part of the construction work. KWP II will limit fugitive dust emissions in compliance with HAR 11-60.1-33 (e.g., through the use of such measures as regular watering).

The proposed action involves road construction, site grading and preparation, and erection of the WTGs and structures. Engineers estimate that this will require work over the periods shown in Table 4.1.

Table 4.1. Forecast Duration of Construction and Earth Movement Quantities.

Project Element	***Assumed Characteristics***	***Area (ac)***	***Months Disturbed***		***Acre-Months***
			Fully	***Part***	
Wind Turbine Generator (WTG)	180 x 200 square feet; 2H:1V cut/embankment slopes	21.1	1.5	0.5	40.5
Site Road	16 foot-width with two 10' shoulders; uncrowned mono-cross-slope; 2H:1V cut/embankment slopes	25.9	1.5	3	105.7
Permanent Meteorological Towers	100 feet diameter	1.0	0.5	0.5	1.5
Baseyard	200 feet x375 feet; 10' perimeter gradeout bench; 2H:1V cut/embankment slopes	3.6	1.5	1.5	6.7
Buried Collector System	3 foot-wide trench; 4 foot depth; finish grade = existing grade	1.1	0.2	0.2	0.3
	Total	52.7			154.7
Source: AECOM Earthwork Calcs on January 29, 2009. Duration estimates by First Wind.					

Use of heavy equipment and earth moving operations during this work will generate fugitive dust and internal combustion engine emissions that may have temporary impacts on local air quality. Specific information concerning the construction equipment that would be used will not be available until a construction contractor is selected. Consequently, overall construction emissions were estimated using the information in screening emission rates and procedures recommended in 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, April 2003) (see Table 4.2).

Table 4.2. 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 (lbs)***
Diesel PM	2.2	0.0049[1]	737,000[2]	3,160
Carbon Monoxide (CO)	138.0	0.304	737,000	196,080
Reactive Organic Gases (ROG)	9.2	0.0203	737,000	13,093
Oxides of Nitrogen (NO_x)	42.4	0.0935	737,000	60,307
Sulfur Oxides (SO_x)	4.6	0.010	737,000	6,450
Fugitive Dust (PM_{10})	0.75 tons/acre-month of construction activity		155 acre-months	116 tons

Notes:
(1) These rates assume an average of 0.27 gallons of diesel fuel is burned for each cubic yard of earth moved.
(2) This preliminary estimate of earthwork includes both cut (383,400 cy) and fill (353,600 cy) volumes and is therefore conservative.

Sources: Bay Area Air Quality Monitoring District: *Guidelines for Assessing Impacts of Projects and Plans* - April 1996, and EPA-AP 42.

The emission estimates from Table 4.2 can be used to assess the relative significance of the emissions and, therefore, the extent to which mitigation is appropriate. shows the approximate level of construction activity that would require mitigation for each pollutant of concern <u>if the work were being conducted in an air-quality limited region</u> such as Southern California and compares these with the estimated emission from the proposed project.

The summary in Table 4.3 indicates that the magnitude of construction activity envisioned for KWP II would warrant careful attention if it were conducted in an air quality-limited area. However, in an area such as Kaheawa Pastures, where existing air quality is good and there is no potential for the ozone formation and other and where NO_x from vehicles is not a concern, particulate emissions are the only pollutant that may deserve special attention.

Table 4.3. Level of Construction Activity Where Mitigation May be Appropriate.

Pollutant of Concern	*Pollutant Emission Thresholds*		*Equivalent 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	Yes
	6.0	185	593,000	9,100	Yes
NO_x	2.5	185	53,500	2,000	Yes
	6.0	185	129,000	2,000	Yes
PM_{10}	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 PM_{10} quarterly threshold.		Yes

Note: Thresholds were approximated using the screening level emission rates from Table 4.2. Daily emission thresholds are based upon the level of daily emissions that may result in a short-term exceedance of the ozone standard.

In order to minimize any adverse effect on air quality, KWP II will require construction contractors to take the following measures to avoid or minimize potential air impacts.

- 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 of 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.
- Implement permanent dust control measures identified in the project landscape plans as soon as possible following completion of any soil disturbing activities.
- Stabilize all disturbed soil areas not subject to re-vegetation, paving, or development using approved chemical soil binders, jute netting, or other methods.
- Lay building pads and foundations 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.

4.3.2 OPERATIONAL PERIOD IMPACTS

Once operational, the proposed facilities have limited potential to affect air quality aside from the indirect benefits of reducing fossil fuel consumption and minor emissions from certain project-related activities such as maintenance work, vehicle-trips made by staff and vendors traveling to and from the site, and the operation of the electrical substation and BESS equipment. These are so limited in magnitude that we have not attempted to quantify them.

4.3.3 INDIRECT EFFECTS ON AMBIENT AIR QUALITY

The proposed WTGs are intended to provide power that would otherwise be provided by the island's existing fossil fuel-fired generating units. This will significantly reduce emissions from MECO's existing fossil-fuel-fired power plants at Mā‘alaea and Kahului and it will allow emissions from MECO's proposed new power plant at Waena to be less than would otherwise be the case. These reductions would have a beneficial effect on air quality.

While it is estimated that they will provide electricity that is equal to or less than the cost of the electricity that MECO would otherwise have available for sale to its customers, it will not be "cheap" power. Any potential change in electric rates resulting from the addition of this new electrical power generation would not markedly promote or discourage economic activity. Consequently, it would not lead to growth or changes in the character of economic activity (e.g., the opening of new industries not previously practical) that might have secondary air quality impacts.

4.4 HYDROLOGY AND WATER RESOURCES

4.4.1 PROJECT COMPONENTS WITH POTENTIAL IMPACTS ON HYDROLOGY

There are no streams, springs or ponds on the proposed WTG sites and no other hydrologic or water resources to be affected directly. During construction and operation of the wind farm, all water used on site would be trucked in and the very small amounts of domestic waste that will be generated would either be collected in a septic tank or portable toilets to be periodically trucked away for disposal at an approved facility. Because there is very little impervious surface in the proposed facilities, their presence would not measurably reduce groundwater recharge.[32] Hence, potential effects are limited to localized alterations in drainage patterns resulting from the construction of building pads and roads (see Section 4.4.2) and changes in water quality associated with development of presently undisturbed areas (see Section 4.4.3).

4.4.2 EFFECTS ON VOLUME AND ROUTING OF STORMWATER RUNOFF

Construction of the proposed facilities will involve substantial site grading and the construction of new site access roads that will alter the path taken by stormwater runoff. Drainage culverts will be constructed beneath these roads in order to maintain their integrity. While the facility will change the path of sheet flow across developed portions of the site, runoff that does not percolate into the ground or evaporate will continue to flow into the adjacent gulches. Because very little impermeable surface will be added to the site, the project will not significantly increase the volume of stormwater runoff leaving the project site.

4.4.3 EFFECTS ON STORMWATER RUNOFF QUALITY

The ground disturbance that will occur during construction of the proposed facilities will increase the potential for sediment and other pollutants present to become entrained in stormwater runoff and flow into adjacent gulches. Because the area to be disturbed is well over an acre, KWP II LLC is required to prepare a Notice of Intent for construction-related stormwater runoff pursuant to National Pollutant Discharge Elimination System (NPDES) regulations. The NPDES application will identify potential receiving waters for runoff leaving the site. In the case of KWP II the areas most likely to receive stormwater runoff are Manawaipueo Gulch, Pāpalaua Gulch, Mokumana Gulch, and Ka‘alaina Gulch, all of which are dry gulches, and the Pacific Ocean. The application will quantify the anticipated volume of runoff into each receiving water and identify Best Management Practices (BMPs) that will be used to prevent pollutants such as sediment, oil and gas, and concrete wash water from leaving the

[32] The only impermeable surfaces are the foundations of the Operations/Maintenance Building, the BESS enclosure, the foundations of each of the WTGs, and concrete pads within the electrical substation. Altogether they total approximately 42,000 square feet, or about the size of 20 typical single-family homes.

site via stormwater runoff. The remainder of this section estimates the nature of the anticipated changes and outlines the measures that KWP II will take to minimize sediment and other pollutant concentrations in the runoff from the property it will use.

The potential pollutants associated with construction activities and the BMPs that KWP II LLC will use to prevent them leaving the site are listed below in Table 4.4.

Table 4.4. Potential Pollutants from Construction Activities & Proposed Control Measures.

Pollutant	***Source/Activity***	***Control Measure (BMP)***
Vegetation/Rock	Excavation, Grubbing, Grading, Stockpiles	Silt Fences, Temporary Soil Stabilization
Soil/Sediment	Excavation, Grading, Stockpiles, Watering for dust control	Silt Fences, Protection of Stockpiles, Natural Vegetation, Sand Bags, Construction Entrance Stabilization, Temporary Soil Stabilization, Geotextile Mats (internal access road slopes), Avoid excess dust control watering
Oil and Gas	Construction Equipment, Vehicles	Regular vehicle and equipment inspection, Prohibition of on-site fuel storage, Drip pan for on-site tanker fueling, Spill kits
Construction Waste	Construction debris, select fill, paint, chemicals, etc.	Protection of stockpiles, Dumpsters, Periodic waste removal & disposal, Compaction & Swales (for rock fill), Containment Pallets (for chemicals).
Concrete Wash Water	Pouring of WTG foundations	Containment in Wash Water Pits, Silt Fences
Equipment & Vehicle Wash Water	Construction Equipment	Containment berms around equipment washing area, Off-site vehicle washing
Sanitary Waste	Portable Toilets or Septic Tank	Sanitary/Septic Waste Management
Note: Best Management Practices are adopted from and defined in the City and County of Honolulu's *"Best Management Practices Manual for Construction Sites in Honolulu"* (May 1999)		

In addition to the BMPs identified in Table 4.4, the following general construction management techniques will be implemented:

- Erosion and sediment control measures will be in place prior to initiating earth moving activities. Functionality will be maintained throughout the construction period.
- Clearing and grubbing will be held to the minimum necessary for grading, access and equipment operation.
- Existing vegetative ground cover will not be disturbed more than 20 days prior to scheduled construction work.
- Construction will be sequenced to minimize the exposure time of the cleared surface area.
- Temporary soil stabilization measures will be used on disturbed areas remaining exposed for more than 30 days.
- Disturbed areas will be protected and stabilized prior to initiating new disturbance.
- Control measures will be inspected once weekly during dry periods and repaired as necessary. Control measures will be inspected and repaired as needed within 24 hours after a rainfall event of

0.5 inches or greater in a 24-hour period. During periods of prolonged rainfall, daily inspection will occur.

- Records for all inspections and repairs will be maintained on site.
- Permanent soil stabilization (i.e., graveling or re-planting of vegetation) will be applied as soon as practical after final grading, as discussed in the draft *Kaheawa Wind Power II Post-Construction Revegetation and Restoration Plan* that is reproduced in Appendix D. KWP II LLC will coordinate with DLNR regarding selection of appropriate species for re-vegetation.

4.5 NATURAL HAZARDS

As discussed in Section 3.5.1, all of the proposed facilities would be well outside flood hazard areas identified in the FIRM maps and none would be within the tsunami inundation zone. Hence, constructing them as proposed would not increase the electrical system's exposure to these risks. The facilities would be exposed to certain other natural hazards, however. Hence, while they have been designed to meet all applicable codes and are outside of defined hazard zones, the WTGs, operation/maintenance building, substation, and site access roads are exposed to some risks, and these are discussed below.

4.5.1 SEISMIC HAZARDS

As discussed in Section 3.5.2, the entire island of Maui is in Seismic Zone 2B, in which an earthquake with a force ranging from 0.15 to 0.20 g is expected to occur once every 50 years (USGS 1997). This designation was the governing seismic code for KWP I, and is within the design envelope of the GE 1.5se turbine utilized on that project and proposed to be used at KWP II. All the structures planned as part of the project will conform to Seismic Zone 2B Building Standards, the level recommended by the U. S. Geological Survey. Structural analyses conducted by the manufacturer suggest that the WTGs are capable of withstanding seismic forces well above those that the standards are intended to protect against. Hence, it would take an extremely rare seismic event to damage the facilities. In the event such an extreme event was to occur it could lead to the toppling of one or more towers. Because of the large separation (minimum 400 feet) between each of the WTGs and the WTGs equally large separation from the substation, warehouse, and other above-ground facilities, there is no potential for the collapse of one tower to physically impact others on the site.

4.5.2 HURRICANE AND HIGH WIND HAZARDS

As outlined in Section 3.2.4, Hawai'i is periodically exposed to tropical storms and hurricanes that impose high wind loads on structures. Recognizing this, KWP II LLC has adopted a standard operating procedure (SOP) for implementation in the event of a "Weather Emergency." The SOP stipulates that when the National Weather Service has issued a severe weather watch for the site (for events such as a hurricane, a tornado, or a severe thunderstorm), the operations manager or his designee will determine if the warning affects its site location, and if so, immediately warn employees of the pending emergency. In addition to warning, KWP II LLC's corporate policy calls for employees to be provided with shelter or to be sent to a safe place offsite. At the time of the warning, all employees are responsible for evacuating to their assigned shelters. Head counts will be taken to ensure all employees have reached an area of safe refuge. KWP II LLC employees, as well as all contractors and site visitors, are prohibited from accessing wind turbines during such emergencies until such time as it is deemed safe to do so by the operations manager.

The GE 1.5 MW WTGs proposed for the KWP II project are designed to operate (i.e., generate power) in wind speeds between 9 and 55 mph. At winds above that velocity the WTGs automatically cut out and the blades feather to an inactive position (i.e., perpendicular to the wind). The structural design of the WTGs allows them to withstand winds of at least 120 mph when the blades are in the feathered position. KWP II engineers' analysis of the available wind data indicates that winds in

excess of the design speed are extremely rare at Kaheawa Pastures. Further, as of late 2008, GE reports that of the more than 5,000 of its turbines that have been erected worldwide, none of these have failed in a way that injured people or caused property damage to others.[33] Hence, KWP II LLC believes it is very unlikely that the equipment will be overstressed to the point of breakage during the 20-year project life span. In any event, the safety protocols described above, coupled with the distance of the facility from residences and other public areas make it virtually certain that an equipment failure would not cause significant damage to life or property (beyond the existing facilities at the site).[34]

4.5.3 FAILURE FROM LIGHTNING STRIKE

Because of their height and location in generally open areas WTGs are subject to lightning strikes. The frequency of lightning tends to be lower in Hawai‘i than in many areas where WTGs have been erected, but it does occur. While the grounding systems that are inherent in their design minimize the potential for adverse effect from this source, there have been instances where lightning strikes have shattered blades. Most of the blades have stayed partially attached to the WTGs, but in a few instances broken pieces of blade have detached and been thrown some distance. In no case has the distance exceeded the distance that would result from the more catastrophic event described above.

4.5.4 FIRE HAZARD

4.5.4.1 Potential Exposure and Impacts

Construction Period. During construction of the project, ignition sources for accidental fires include errant sparks from a variety of vehicles, equipment and tools, and wrongly discarded matches and cigarette butts. These are of limited intensity, and under most conditions are unlikely to spark a grass or other fire. Fire-fighting equipment is maintained in work vehicles and at the existing KWP I operations building, and would be available if needed. While they are being constructed, the facilities will also continue to be at risk for the kinds of naturally occurring wildfires discussed previously in Section 3.5.3.

Operational Period. The WTGs and other facilities that will be present for the operating life of the facility do not contain equipment or involve activities that represent an unusual fire hazard. Nonetheless, the presence of petroleum-fueled mobile equipment (trucks, cranes, etc.), petroleum-based lubricants, and other flammable materials means that some a slight potential for fire will exist that is not now present. The presence of the additional facilities also means that there will be a greater number of facilities exposed to naturally occurring wildfires than is currently the case.

If a fire does occur on (or spreads to) the proposed KWP II facility, some equipment damage is possible but is not expected to be significant.[35] The towers supporting the turbines are of 3/4-inch plate steel, mounted on concrete foundations; the interconnecting electrical systems are below ground; and the O&M facility will be constructed of noncombustible construction and exterior finishes (the building permit for the O&M facility will be reviewed by the County of Maui Department of Fire Control). Damage from fire could occur to the on-site substation and would potentially disrupt the facility's provision of electricity to MECO, though it would not jeopardize MECO’s ability to provide electricity services to its customers.

[33] http://www.gepower.com/prod_serv/products/wind_turbines/en/15mw/index.htm

[34] The only non-KWP II owned facilities in the project area which could be affected by an equipment failure are the Lahaina Pali Trail (which would almost certainly be unused during periods extremely high winds), and the existing MECO transmission lines. Only a few WTGs are in close enough range to potentially damage the transmission lines in the event of a failure. This, coupled with the already slim chances of a failure mean that risk to these facilities is extremely slight.

[35] The wildfire that affected the area in 2006 caused little damage to KWP I and did not interfere with its ability to supply electrical power to the grid.

4.5.4.2 Proposed Fire Prevention and Response Measures

KWP II LLC has developed a detailed fire contingency plan for KWP II. The two most important preventive measures consist of educating all on-site contractors and personnel and properly maintaining all vehicles, equipment, tools, and turbine hardware.

Firefighting Equipment. During all phases of the project, basic on-site fire-fighting resources will include fire extinguishers in the O&M facility, at the substation, and in all project vehicles, and shovels and backpack pumps in the O&M facility and maintenance vehicles. During construction, firefighting resources will include the provision of fire extinguishers in all construction vehicles and trailers. Additionally, during some periods of construction, earthmoving equipment will be present on-site and able to assist in creating fire breaks. Lastly, water that is stored in the existing tank at the base of the access road can also be used for firefighting.

Maintenance of Fire Buffers. Existing vegetation in the project area consists of low brush and grass that is subject to relatively fast-moving fires of modest intensity and duration. During and after construction, KWP II staff will maintain (i.e., cut and/or clear) vegetation adjacent to key facilities. Cleared areas around each wind turbine, the O&M facility, and the substation/interconnection facility will be covered with gravel to assist in fire prevention and to form fuel breaks around individual project components. It will maintain the following minimum vegetation-free buffers:[36]

- O&M Facility – 30 feet.
- Substation and BESS – 30 feet.
- WTG concrete foundation pad – 20 feet.

Additional fire breaks/fuel breaks will be provided by project roadways running along the turbine array and from the highway to the project site. Areas that will be cleared during construction will be re-vegetated with species currently present on-site or otherwise appropriate plants that both (a) present limited hazards from a fire control perspective and (b) are non-attractions for wildlife.

Ongoing operation and maintenance of the completed project will involve routine checks of electrical connections, washing substation equipment as outlined in the final design specifications, and periodic infrared reconnaissance of electrical components to identify potential faults before they lead to a failure. As previously noted, all project vehicles will carry fire extinguishers. State and County emergency response personnel will be given unrestricted access to the area so that they can carry out their duties.

Ongoing Vegetation Management. The operator will coordinate closely with DOFAW to ensure that appropriate vegetation control is implemented. This may include creating fire breaks near the Manawainui Plant Sanctuary or elsewhere as necessary.

[36] The size of these buffers will be increased if deemed necessary by State forestry and/or County fire personnel.

4.6 TERRESTRIAL FLORA

4.6.1 PROJECT COMPONENTS WITH POTENTIAL TO IMPACT FLORA

The principal means through which the proposed project could affect terrestrial flora is through ground-clearing. These would occur during the construction phase. Factors related to the ongoing operation of the facilities (e.g., noise, vehicular traffic, and other emissions associated with the ongoing operation of the facilities) are so limited that they do not have the potential to cause significant effects of this nature.

4.6.2 EFFECTS ON TERRESTRIAL FLORA

None of the 20 native plants thus far identified on the KWP II property is listed by the State or Federal government as a Threatened or Endangered species (USFWS 1999). Neither is any a candidate for such status or identified as species of concern (Hobdy 2006). All are widespread and fairly common in Hawai‘i.

Due to the general condition of the habitat and the specific lack of any environmentally sensitive native plant species on the project site, the proposed KWP II project is not expected to result in any significant negative impact on the botanical resources in this part of Maui. The following sections characterize the extent to which vegetation will be affected by the facility and describe the measures that KWP II will implement during construction and operation in order to protect and maintain vegetation on and around the project site. This information is drawn in part from the Wild Land Fire Contingency Plan that is in place for KWP I.

4.6.2.1 Invasive Species Prevention/Control

KWP I continues to work actively to minimize and reduce the ingress of certain undesirable invasive plant species in accordance with the requirements of its Conservation District Use Permit. For instance, KWP I biologists co-established the Fireweed Working Group (FWG), a coalition of conservationists on Maui, to address the fireweed issue and its effect on the landscape of West Maui, including Kaheawa Pastures. The group is composed of representatives from the County of Maui, State of Hawaii, Maui Invasive Species Committee, KWP I, and other concerned parties. This issue has been a concern as fireweed has apparently increased at KWP I and elsewhere since the 2006 wildfires swept through the region. Together with the Working Group participants, KWP I has developed and implemented collaborative work plans that include manual removal and disposal, coupled with substantial replanting of cleared areas with A‘ali‘i and other hearty native plant species that are fire-adapted and reduce fire risk, while continuing subsequent monitoring. The participants intend to share the findings of these kinds of trials, which do not rely on chemical treatments, with other land owners facing challenges with fireweed on Maui.

KWP II intends to continue measures to minimize and avoid the introduction of invasive species to the Kaheawa Pastures region during the proposed wind farm development. KWP II LLC will support and collaborate with the FWG on existing efforts to control and manage fireweed. These efforts include implementing measures during and after construction to reduce the likelihood of fireweed and other invasive species from being introduced to the area and include:

- Surveying areas proposed for expansion and ground clearing in advance to delineate proximity to established beds of fireweed;
- Implementing control and management initiatives aimed at excluding fireweed propagules on bare ground using manual and, where warranted, chemical treatments;
- Working in advance with local experts and stakeholders to obtain the best recommendations for control measures and to develop protocols for documentation and sharing results;

- Inspecting potential off-site sources of materials (gravel, fill, etc.), and prohibiting the import of materials from sites that are known or likely to contain seeds or propagules of invasive species;
- Requiring that vehicle operators transporting materials to KWP II from off-site follow protocols for removing soils and plant materials from vehicles and equipment prior to entry onto the site.

KWP II LLC will consult with the Hawai‘i Department of Agriculture and Maui Invasive Species Commission to establish protocols and training orientation methods for screening invasive species introductions. The Kaheawa Pastures region is particularly prone to the ingress of invasive flora in part due to its propensity for periodic wildfire inundation and the widespread occurrence of aggressive pasture weeds. The area receives a significant amount of wind-borne seed material from adjacent lands that harbor undesirable invasive species capable of quickly becoming established in disturbed (burned) landscapes. The invasive flora challenges at Kaheawa affect each rangeland and pasture manager in Hawai‘i and are being approached at Kaheawa based on the best management and scientific advice available while adhering to previously established requirements for the facility.

4.6.2.2 Revegetation

Approximately two-thirds of the approximately 53-acre area expected to be disturbed during construction consists of slopes that will be revegetated upon completion of earthwork. As discussed in detail in the draft *Post-Construction Revegetation and Restoration Plan* (attached in Appendix D), KWP II proposes to do this in two stages.

A hand-planted and maintained fill slope near WTG-13 at KWP I. For KWP II, grasses and other plants that will cover the areas in between the shrubs will be planted immediately following creation of the slopes.

4.6.2.2.1 Stage 1: Immediate Revegetation

The first stage entails immediate revegetation of disturbed areas to minimize soil erosion/maximize soil development and retention. This will be done applying a hydro-seed mixture of annual Rye and Kikuyu grass to areas of exposed soil along the edges of turbine pads and along road cuts and fill slopes. While not a native species, Kikuyu grass is a naturalized species that occurs at Kaheawa Pastures; it emerges quickly and becomes easily established as a ground cover. Equally important, it can be obtained in sufficient quantities to allow its use in this type of application. Incorporating

annual Rye grass into the seed mixture is expected to provide a more rapid cover than using Kikuyu alone because the Rye grass can be naturally over-taken by the Kikuyu and neighboring species.

Although its slower growth and limited availability make it unsuitable for immediate stabilization, Pili grass propagated in local nurseries has been successfully transplanted to cut and fill slopes at Kaheawa. KWP II expects to use it to supplement the grasses that are used for initial revegetation. The Kahoʻolawe Island Reserve Commission (KIRC) has been implementing a successful restoration program on the island of Kahoʻolawe using Pili grass to reduce soil erosion and promote the recovery of native botanical communities on substantial portions of the island. The NRCS Plant Materials Center on Molokaʻi has been instrumental in providing support for the KIRC's efforts by supplying commercial quantities of Pili grass in bale form to be used for a variety of soil stabilization applications. KWP II is working collaboratively with KWP I and the NRCS to coordinate and implement similar measures for use in both immediate and longer-term revegetation strategies.

4.6.2.2.2 Stage 2: Long-Term Revegetation

KWP II plans to approach this phase of the site revegetation plan following the native plant reintroduction efforts that have proven successful at the existing KWP I facilities. This will include collection of native seed on-site and propagation at local nurseries. The likely species are ʻakia (*Wikstroemia oahuensis*), koʻokoʻolau (*Bidens mauiensis*), ʻaʻaliʻi (*Dodonaea viscosa*), ʻulei (*Osteomeles anthyllidifolia*), ʻōhiʻa (*Metrosideros polymorpha*), and ʻilima (*Sida fallix*). These relatively fast-growing and easily propagated low-stature species provide excellent root structure for maintaining surface substrate retention; their presence also promotes the re-growth of important native elements of the vegetation community.

Because they will come later, many of these plantings will be installed in areas that were stabilized with the Kikuyu/rye mixture during Stage 1. In the case of the taller shrub species, the objective will be to have them eventually establish a shrub layer that is taller than, and partially shades out, the shorter grass layer. Some areas will also be planted with Pili grass or other lower-growing shrubs and vines. In such cases, it may be necessary to clear some areas of established grass cover. Due to the current prevalence of mostly non-native species at the site, revegetation efforts for KWP II are expected to enhance the biological integrity of the region beyond its present condition.

4.7 TERRESTRIAL & AVIAN FAUNA

4.7.1 IMPACTS ON NON-PROTECTED SPECIES

Based on preliminary plans, KWP II estimates that the clearing that will be undertaken for the proposed project will affect approximately 53 acres, most or all of which is presently vegetated with the array of grasses and low shrubs described in Section 3.6. Of this area, approximately two-thirds will be revegetated following construction. This will reduce the habitat available for the common bird or mammal species that are present. However, all are exotic species, the amount of suitable habitat that will be lost is a very small part of the total range available to them, and the reduction will not affect protected species that may depend upon them for survival.

4.7.2 IMPACTS ON PROTECTED SPECIES

The potential for wind energy turbines to adversely affect birds and bats is well-documented in the continental United States (e.g., Horn et al. 2008, Kunz et al. 2007, Kingsley and Whittam 2007, Kerlinger et al. 2005, Erickson 2003, Johnson et al. 2003a, 2003b). KWP II LLC anticipates that the incidental take of four listed species (Hawaiian Petrel, Newell's Shearwater, Nēnē, and Hawaiian Hoary Bat) may potentially occur as a result of the construction and operation of the proposed project. As discussed in Section 3.7.2, these species are known to be present in the project area and could be injured or killed if they collide with a wind turbine, construction equipment, or other facilities

proposed as part of KWP II. No other listed, proposed or candidate species have been found or are expected to occur in the project area.

SWCA (January 2009) estimated the potential for each of these protected species to collide with KWP II project components (i.e., "direct take") using the results of on-site surveys, information about the proposed project design, and the results of ongoing post-construction monitoring at the adjacent KWP I facility.[37] The seabird fatality estimate models developed for KWP I and adapted for KWP II incorporated rates of species occurrence, observed flight heights, encounter rates with turbines and met towers, and also considered the ability of birds to avoid project components.[38]

SWCA (January 2009) also estimated the level of "indirect take" that would occur. Indirect take occurs when a bird that is directly taken is tending to eggs, nestlings, or dependent fledglings (or in the case of bats has dependent juveniles) and the death of the adult leads to the loss of the eggs or dependent young. Loss of eggs or young would be "indirect take" attributable to the proposed project and are factored into the take estimates for KWP II.

The left-hand side of Table 4.5 below presents the baseline annual take estimates anticipated for each species based on modeling and the best available scientific information.[39] In order to account for the effects of unobserved direct take and to comply with the recommendations of DLNR and the Endangered Species Recovery Committee (which recommend that annual take limits allow for at least one observed take per year), the baseline take level for which KWP II LLC is requesting authorization under an ITP and ITL is higher than the actual anticipated take. Consequently, the Table also presents the take levels for which KWP II LLC is requesting authorization under its ITP and ITL.

Table 4.5. Estimated and Requested Authorized Take of Protected Species at KWP II

Species	***Expected Rate of Take***		***Requested ITP/ITL Take Authorization***	
	Annual	***20-Year Project Life***	***Annual***	***20-Year Project Life***
Nēnē	0.76 adults and 0.07 fledglings	16 adults and 2 fledglings	2 adults and 1 fledgling	24 adults and 12 fledglings
Hawaiian Petrel	0.66 adults and 0.30 chicks	14 adults and 6 chicks	2 adults and 1 chick	20 adults and 10 chicks
Newell's Shearwater	0.41 adults and 0.09 chicks	9 adults and 2 chicks	2 adults and 1 chick	20 adults and 10 chicks
Hawaiian Hoary Bat	0.6 adults and 1.1 juveniles	12 adults and 22 juveniles	5 adults and 3 juveniles	40 adults and 24 juveniles
Note: All figures are proposed and are subject to acceptance of the Draft HCP by the USFWS and DLNR.				
Source: Draft KWP II HCP (SWCA 2009).				

[37] SWCA derived fatality estimates for Nēnē and bats using data from post-construction monitoring at KWP to quantify direct take.

[38] The fatality estimates for KWP II also take into account "unobserved direct take" based on searcher efficiency and scavenging trial results. This will account for individuals that may be killed by collision with project components but that are not found during the monitoring effort. It is generally accepted that some birds and bats killed through collision with wind turbines are not found by searchers for various reasons, including heavy vegetation cover and scavenging.

[39] The HCP for KWP II also identifies annual take scenarios (and associated mitigation measures) that are lower and higher than the baseline take levels presented here. The other take levels are included in the HCP to allow for the probability that annual take from the project may vary, and that over time take from the proposed facility could be shown to be less or greater than Baseline, thus requiring KWP II LLC to adapt its mitigation program. These take levels (and their associated mitigation programs) would come into effect only in the event that post-construction monitoring shows lower or higher take levels after a period of five years and are discussed in detail in the HCP.

As shown by the Table, the estimated mortality resulting from the project is very low, commensurate with the very low level of observed bird and bat activity at KWP II and low documented mortality at KWP I. The following subsections discuss the bases of the take estimates for each of the four protected species.

4.7.2.1 Hawaiian Petrel

4.7.2.1.1 Risk of Hawaiian Petrel Collision with WTGs

KWP I is the only operating wind energy generating facility in Hawai‘i where potential mortality of Hawaiian Petrels and Newell’s Shearwaters is consistently being studied. KWP I and KWP II LLC have commissioned several independent studies using ornithological radar to estimate the movement rates for Hawaiian Petrels and Newell’s Shearwaters through the site during the roughly eight month spring-fall breeding season when these birds are present near Kaheawa Pastures. The earlier of these (Cooper and Day 2004b; Day and Cooper 1999) focused on the KWP I project area. The most recent and comprehensive study was performed in 2008 and considered both the KWP I and KWP II project areas (Sanzenbacher and Cooper 2009).

The primary objective of the 2008 study was to document movement rates of Hawaiian Petrels and Newell’s Shearwaters over the proposed KWP II project area. Movement rates were used to derive estimated annual fatality rates of petrels/shearwaters at the proposed turbine tower locations. Fatality estimates also took into account avoidance rates, which represent the proportion of birds that will detect and actively avoid turbines upon encountering them. Sanzenbacher and Cooper (2009) used avoidance rates of 90 percent, 95 percent and 99 percent because previous studies have indicated a high rate of avoidance of power lines and communication towers for these species (Cooper and Day 1998, TetraTech 2008). For the Hawaiian Petrel, fatality estimates range from 0.00355 to 0.0471 birds per turbine per year, or 0.050 to 0.660 for all 14 turbines combined based on 90 percent, 95 percent and 99 percent avoidance rates. The 95 percent avoidance rate (amounting to a mortality of 0.33 birds per year for all 14 turbines) was chosen as the basis for the KWP II take estimate because the take estimate it produces fits best with the per-turbine fatality rate that has been measured during the post-construction monitoring surveys at KWP I.

Fatality estimates occurring at the two proposed permanent met towers at KWP II were also modeled based on estimates provided by Sanzenbacher and Cooper (2009). KWP II LLC calculated fatality estimates for guyed lattice met towers as between 0.0226 to 0.226 petrels/met tower/year or 0.0452 to 0.452 petrels for both permanent met towers based on 90 percent, 95 percent and 99 percent avoidance rates.[40] For the purposes of estimating fatality rates at KWP II, the 95 percent avoidance level was chosen, resulting in an estimated fatality rate for Hawaiian Petrels at 0.113 birds/year/tower or 0.23 birds per year for both met towers combined.

4.7.2.1.2 Other Direct Take of Hawaiian Petrels

In addition to collisions with turbines and met towers, some limited potential exists for Hawaiian Petrels to collide with cranes during the construction phase of the project. Cranes used during construction are typically comparable in height to the turbine towers (Kaheawa Wind Power, LLC 2006). However, the construction phase is expected to last six to eight months, with cranes active on-site for only three to four months. Moreover, during that period and at other times when cranes are present, their booms will be lowered and stored in a horizontal position during the hours when Hawaiian Petrels are transiting the area. Hence, the potential for Hawaiian Petrels to collide with cranes during construction is negligible.

[40] Sanzenbacher and Cooper’s study modeled fatality based on 55 meter guyed lattice towers. The design has since changed to include 65 m guyed lattice towers. Consequently, the fatality estimates provided by Sanzenbacher and Cooper (2008) were modified to reflect the change in horizontal exposure due to the increased footprint of the taller met tower. The footprint was increased beyond its maximum expected size to provide a conservative estimate of fatality rates in the interim. Once final design specifications are available, a more accurate model will be substituted. It is expected that current interim fatality estimate will be a slight over-estimation of the expected fatality rate.

A crane will permanently be available for KWP II (probably shared with KWP I) for maintenance purposes and will be present at KWP II as needed. Except for emergencies, this crane would be used only during the day and stored in its horizontal position when not in use and at night. Consequently, this crane is not considered to pose a collision threat to Hawaiian Petrels.

Some potential exists for construction or maintenance vehicles to strike downed petrels (birds already injured by collision with turbines or towers) while traveling project roads. Project personnel will be trained to watch for downed petrels and other wildlife and speed limits (10 mph) will be enforced to minimize potential for vehicular strikes to result in death of birds that otherwise might have been able to be rehabilitated. Despite this, for the purposes of its HCP, KWP II LLC has assumed that day-to-day maintenance of the wind facility will result in the fatality of petrels at an average rate of 0.1 petrels/year or one bird every 10 years.

4.7.2.1.3 Indirect Take of Hawaiian Petrel

Adult birds have potential to collide with turbines and associated structures while commuting between nesting and feeding grounds during the incubation or chick-feeding periods (May through October). Thus, indirect take accounting for possible loss of eggs or chicks would be assessed to any direct take of Hawaiian Petrels occurring from May through October, but would not be assessed if direct take of this species occurs at other times of year. The risk of collision outside the breeding season is considered minimal as these birds do not return to land during that period. Indirect take would be assessed at the rate of 0.45 chicks per adult based on life history data for the species as shown in Table 4.6.

Table 4.6. Calculation of Indirect Take for Hawaiian Petrel

Hawaiian Petrel	*Season*	*Average no. of chicks per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect take (A*B*C)*
Male	May-Oct	1	0.89	0.5	0.45
Female	May-Oct	1	0.89	0.5	0.45
Adult	Nov - Apr	--	0.00	--	0.00
Immature	All year	--	0.00	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.1.4 Population-Level Impacts on Hawaiian Petrels

There are estimated to be a total of 20,000 Hawaiian Petrels with 4,000 to 5,000 breeding pairs (Mitchell et al 2005). The seabird colony at Haleakalā, Maui is composed of as many as 1,000 nesting pairs, or approximately one-fifth to one-quarter of the breeding population (Mitchell et al. 2005, Tetra Tech EC, Inc., June 2008). For the expected KWP II baseline take level, the risk of adverse effects to Hawaiian Petrel at the population level is considered to be low given their current estimated population size.

Predation by introduced mammals and downing due to urban lighting are considered the primary threats to recovery of Hawaiian Petrel. The proposed mitigation measures described in Section 4.7.4 and in the Draft HCP for KWP II are expected to more than offset the anticipated take and contribute to recovery of the species by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the species' overall populations, and no significant cumulative impacts to the species, are anticipated.

4.7.2.2 Newell's Shearwater

4.7.2.2.1 Risk of Newell's Shearwater Collision with WTGs

In the study conducted by Sanzenbacher and Cooper (2009), fatality estimates for Newell's Shearwater ranged from 0.002 to 0.026 birds per turbine per year or 0.028 to 0.364 for all 14 turbines combined based on avoidance rates ranging from 90 percent to 99 percent. To date, no Newell's Shearwater fatalities have been recorded at KWP I. Despite this, the fatality estimates were prepared using only a 95 percent avoidance level. This assumption is both conservative (i.e., avoids underestimating impacts) and consistent with that made for the Hawaiian Petrel. Using the 95 percent avoidance rate, the estimated average fatality rate of Newell's Shearwater at KWP II is 0.18 birds per year for all 14 turbines combined.

Fatality estimates occurring at the two proposed permanent met towers at KWP II were also modeled based on previous estimates provided by Sanzenbacher and Cooper (2009). KWP II LLC calculated fatality estimates for guyed 65 meter lattice met towers as between 0.0125 to 0.125 petrels/met tower/year or 0.025 to 0.25 shearwaters for both permanent met towers based on 90 percent, 95 percent and 99 percent avoidance rates.[41] For the purposes of estimating fatality rates at KWP II, the 95 percent avoidance level was chosen, resulting in an estimated fatality rate for Newell's Shearwater at 0.0627 birds/year/tower or 0.13 birds per year for both met towers combined.

4.7.2.2.2 Other Direct Take of Newell's Shearwaters

The possibility that Newell's Shearwaters might collide with construction cranes or other equipment was also considered. However, as explained in the preceding discussion for Hawaiian Petrel, the fact that the cranes are stored in a horizontal position during the time periods when the birds overfly the site means that the potential for collision is virtually non-existent.

As with Hawaiian Petrels, some potential exists for construction or maintenance vehicles to strike downed shearwaters while traveling project roads. Project personnel will be trained to watch for downed shearwaters and other wildlife and speed limits (10 mph) will be enforced to minimize potential for vehicular strikes to result in death of birds that otherwise might have been able to be rehabilitated. Despite this, for the purpose of its HCP, KWP II LLC assumes that day-to-day maintenance of the KWP II facility will result in the fatality of this species at an average rate of 0.1 shearwaters/year or one bird every 10 years.

4.7.2.2.3 Indirect Take of Newell's Shearwater

As with Hawaiian Petrels, adult Newell's Shearwaters are most likely to collide with turbines or associated structures while commuting between nesting and feeding grounds during incubation and chick-feeding periods. This is generally the period of June through October. Potential also exists for shearwaters to collide with turbines in April, when scouting for nest sites takes place. Newell's Shearwaters are not expected to be flying across the project area at other times of year. Based on the above, an indirect take assessment would be applied to any adult shearwaters found directly taken from June through October. Indirect take would not be assessed to adult shearwaters found at other times of year or applied to immature shearwaters. Indirect take would be applied at the rate of 0.23 chicks per adult. The calculation used to reach this number is presented in Table 4.7 below.

[41] Sanzenbacher and Cooper's study modeled fatality based on 55 meter guyed lattice towers. The design has since changed to include 65 m guyed lattice towers. Consequently, the fatality estimates provided by Sanzenbacher and Cooper (2008) were modified to reflect the change in horizontal exposure due to the increased footprint of the taller met tower. The footprint was increased beyond its maximum expected size to provide a conservative estimate of fatality rates in the interim. Once final design specifications are available, a more accurate model will be substituted. It is expected that current interim fatality estimate will be a slight over-estimation of the expected fatality rate.

Table 4.7. Calculation of indirect take for Newell's Shearwater

Newell's Shearwater	*Season*	*Average no. of chicks per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect take (A*B*C)*
Male	Jun-Oct	1	0.46	0.5	0.23
Female	Jun-Oct	1	0.46	0.5	0.23
Adult	Nov - May	--	0.00	--	0.00
Immature	All year	--	0.00	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.2.4 Population Level Impacts on Newell's Shearwaters

The most recent population estimate of Newell's Shearwater was approximately 84,000 birds, with a possible range of 57,000 to 115,000 birds (Ainley et al. 1997). However, radar studies and population modeling have indicated that the population of Newell's Shearwater is likely on a decline especially on Kaua'i (Ainley et al. 2001, Day and Cooper 2003a). Declines in Newell's Shearwater populations are attributed to loss of nesting habitat, predation by introduced mammals (mongoose, feral cats, rats, and feral pigs) at nesting sites, and fallout of juvenile birds associated with disorientation from urban lighting (Ainley et al. 1997, Mitchell et al. 2005, Hays and Conant 2007).

At KWP II, because a direct take of less than one Newell's Shearwater per year is expected, the take is not expected to exacerbate the apparent decline of the species. Moreover, the proposed mitigation measures described in Section 4.7.4 and the other provisions in the HCP for the project are expected to more than offset the anticipated take and contribute to the species' recovery by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the species' overall population, and no significant cumulative impacts to the species, are anticipated.

4.7.2.3 Nēnē

4.7.2.3.1 Nēnē Collision Risk & Avoidance Behavior

Nēnē at KWP I are commonly observed displaying avoidance behavior and maneuverability in the vicinity of project structures and moving rotors (Spencer pers. comm., First Wind and Kaheawa Wind Power 2008). While this indicates that the geese generally see and avoid the WTGs, since June 2006, when the existing 20 KWP I WTGs became operational, biologists have documented two Nēnē mortalities, concluding that collision with a WTG rotor was the most likely cause of death in both cases. The second incident was closely correlated with a powerful winter storm that lasted for several days, significantly reducing visibility of the WTGs.

After adjusting the observed direct take at KWP I for the effects of searcher efficiency and carcass removal, the assumed total direct take at this facility after 2.75 years of operation has been 1.1 birds/year or 0.054 birds/turbine. Assuming that the fatality rate per turbine at KWP II would be similar to that realized at KWP I, the estimated rate of direct take of Nēnē at KWP II is 0.76 birds/year (0.054 x 14) for all 14 turbines combined.

In addition to collisions with WTGs, some potential theoretically exists for Nēnē to collide with met towers and with construction equipment such as cranes during the construction phase of the project. To date, no Nēnē have been found to have collided with met towers at KWP I, and no Nēnē collided with any cranes during the construction phase of that project. This likely was and has been the result of these birds largely being diurnal and highly capable of avoiding stationary objects. Given the brevity of the construction period, the high avoidance behavior exhibited by the species, and the absence of any known collisions with construction equipment to date, the potential for Nēnē to collide with cranes or other similar equipment is considered to be negligible. Because the collision rate

reported for turbines is derived from KWP I data that considers met towers as well, no additional adjustment is needed to account for this.

As discussed for the two seabird species, the one permanently stationed crane is not expected to pose a collision threat to the Nēnē because it is expected to be used during the daytime and stored in a horizontal position when not in use. Because Nēnē are comparatively large and visible birds, the potential for construction or maintenance vehicles to strike downed Nēnē is considered to be negligible because of the proposed staff training measures and project road speed limit of 10 mph.

4.7.2.3.2 Ground Displacement of Nēnē

Total area expected to be disturbed by turbine pads, roads, and other project-related facilities is approximately 53 acres out of the 333-acre KWP II project area. Disturbed areas currently support vegetation that provides browse and shelter for Nēnē.

Biologists with KWP I have been working cooperatively with Maui DOFAW personnel and routinely exchange information useful for estimating annual productivity, overall survival, and factors limiting natural productivity of Nēnē in the Kaheawa region. For the first year of project operations, KWP I biologists performed surveys to evaluate the degree of interaction between Nēnē and wind turbines and to evaluate how Nēnē used portions of the KWP I site throughout the year. Many of these observations extended to adjacent areas, including the KWP II project area.

Nēnē are observed using portions of the KWP I and KWP II area by KWP I and DOFAW biologists throughout the year with no evidence of apparent or direct displacement (Kaheawa Wind Power 2008; DLNR, unpublished data). Annual surveys indicate that Nēnē continue to nest successfully within the area leased for KWP I. Annual recruitment among this population remains poorly understood; however, no decline in overall productivity is apparent at this time (DLNR pers. comm.). The implication of these observations is that Nēnē appear to readily adapt to the presence of WTGs and continue to successfully utilize available habitat in the vicinity of the KWP I wind facilities for critical life history requirements.

Hence, while the proposed conversion of 53 acres of open field habitat for KWP II project-related purposes reduces to a small degree the amount of suitable habitat available for Nēnē in the project area, the magnitude of the change (approximately 16 percent of the 333-acre leased area and a much smaller percentage of the total habitat area available at Kaheawa Pastures) is small and is considered unlikely to measurably displace any individuals of the resident population.

4.7.2.3.3 Indirect Take of Nēnē

It is assumed that adult Nēnē are most likely to collide with turbines and associated structures during non-breeding periods (May through July) or toward the end of their breeding period when attending to recently fledged young. Nēnē are highly territorial during the breeding season (Banko et al. 1999) and males are likely to be defending nesting territories while the females are incubating. Upon hatching, both parents would be attending to heavily dependent young; adult Nēnē also molt while in the latter part of their breeding period and are therefore flightless for 4 to 6 weeks (USFWS 2004a). These adults attain their flight feathers at about the same time as their goslings (USFWS 2004a). Consequently, such birds are more likely to be in flight within KWP II only when goslings have already fledged.

Indirect take to account for loss of dependent young will be assessed for adult Nēnē only when mortality occurs during the breeding season (August to April). Adults found during the months of October through March will be assumed to have had a 60 percent chance of having been actively breeding because 60 percent of the population has been recorded to breed in any given year (Banko et al. 1999). Adult Nēnē mortality that occurs outside the peak breeding season (April, August, and September) will be assumed to have had a 25 percent chance of breeding. Male and female Nēnē care for their young fairly equally, so indirect take would be assessed to the direct take of any adult Nēnē found during the breeding season. Because breeding Nēnē are not expected to collide with WTGs prior to the fledging of their young, it is assumed that the number of young possibly affected by loss

of an adult would be fewer than original clutch size (studies indicate that average number of fledglings produced per pair of Nēnē is 0.3).

Based on these assumptions, as indicated in Table 4.8 below, the amount of indirect take that would be assessed for each direct take of an adult Nēnē during the months of October through March is 0.09. Amount of indirect take assessed for each direct take of an adult bird during the remainder of the breeding season would be 0.04 based on life history data.

Table 4.8. Calculation of Indirect Take of Nēnē

Nēnē	*Season*	*No. fledglings per pair (A)*	*Likelihood of breeding (B)*	*Parental contribution (C)*	*Indirect (A*B*C)*
Adult, any gender	Oct-Mar	0.3	0.60	0.5	0.09
Adult, any gender	April, Aug, and Sep	0.3	0.25	0.5	0.04
Adult, any gender	May - July	--	0.00	--	0.00
Immature	All year	--	0.00	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.3.4 Population Level Impacts to Nēnē

The population of Nēnē statewide currently numbers at an estimated 1,300 individuals with 315 birds occurring on Maui (DOFAW unpub. data 2003). The proposed rate of take for Nēnē is not expected to cause a decline in the status of the species. The proposed mitigation program (see Section 4.7.4 and the HCP for the project) is expected to more than compensate for the estimated take level. Proposed mitigation measures will also contribute to the species' recovery by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the species' overall populations, and no significant cumulative impacts to the species, are anticipated.

4.7.2.4 Hawaiian Hoary Bat

4.7.2.4.1 Collision Risk and Other Potential Causes of Take at KWP II

The potential for take of the Hawaiian Hoary Bat is believed to be very low. This assessment is based on: (i) the surveys that have been conducted indicating low bat activity at the KWP I and KWP II project sites; (ii) the available information indicating low population numbers on West Maui; and (iii) the apparent relatively low susceptibility of resident (versus migrating) bats to collisions with wind turbines in general.

The occurrence of at least a few individuals in the project area has been documented, and one fatality has been recorded at the KWP I facility since it began operation. When adjustments for searcher efficiency and scavenging are applied, SWCA (2009) estimates that the observed annual fatality rate at KWP I during the first three years of operation has been 0.88 bats/year, which is well within the baseline take estimate for KWP I. This results in an annual fatality rate of 0.044 bats per turbine per year at KWP I. Applying this rate to all 14 turbines proposed for KWP II yields an average annual fatality rate of 0.6 bats per year.

The potential for bats to collide with met towers or cranes is considered to be negligible because they would be immobile and should be readily detectable by the bats through echolocation. This

conclusion is supported by field studies of 64 wind turbines at Mountaineer Wind Energy Center in the Appalachian plateau in West Virginia. During the period studied, bat fatalities were recorded at operating turbines, but not at a turbine in the wind energy complex that remained non-operational during the study period (Kerns et al. 2005).

4.7.2.4.2 Indirect Take

Hawaiian Hoary Bats are thought to move to higher elevations during the months of January through March (Menard 2001), and therefore may be less prevalent in the project area during those months. However given the lack of empirical data, it is conservatively assumed that levels of bat activity on-site remain constant throughout the year. Adult bats therefore are considered to have equal potential to collide with turbines throughout the year.

Hawaiian Hoary Bats breed between April and August (Menard 2001). Females are solely responsible for the care and feeding of young, and twin pups are typically born each year, although single pups sometimes occur. To date, no breeding records for Hawaiian Hoary Bat exist for Maui, however, any female bats directly taken from April through August will be examined and, if determined to be pregnant or lactating, indirect take will be assessed. No indirect take will be assessed for female bats found at other times of year, or for male or immature bats found at any time of year. The rate at which indirect take will be assessed for pregnant or lactating female bats found during the months of April through August is 1.8 juveniles per adult female as indicated in Table 4.9.

Table 4.9. Calculating Indirect Take for the Hawaiian Hoary Bat

	Season	***Average no. of juveniles per pair (A)***	***Likelihood of breeding (B)***	***Parental contribution (C)***	***Indirect take (A*B*C)***
Female	Apr-Aug Pregnant or lactating	1.8	1.0	1.00	1.80
Female	Sep-Mar	--	0.0	--	0.00
Male	All year	--	0.0	0.00	0.00
Immature	All year	--	0.0	--	0.00
Source: Draft KWP II HCP (SWCA 2009).					

4.7.2.4.3 Population Level Impacts on the Hawaiian Hoary Bat

As previously discussed, no recent population estimates exist for Hawaiian Hoary Bat. The Recovery Plan for the Hawaiian Hoary Bat (USFWS 1998) states "since no accurate population estimates exist for this subspecies and because historical information regarding its past distribution is scant, the decline of the bat has been largely inferred." Although overall numbers of Hawaiian Hoary Bats are believed to be low, they are thought to occur in the greatest numbers on the island of Hawai‘i and Kaua‘i (Menard 2001).

The identified baseline level of take is low and is unlikely to result in a significant impact on the overall population of the Hawaiian Hoary Bat. The proposed mitigation program described in Section 4.7.4 and in the HCP for the project will contribute to a greater understanding of the species' status on Maui, which in turn will help guide future management and recovery efforts. SWCA (2009) concludes that this should result in an overall net conservation benefit to the species.

4.7.3 MEASURES TO AVOID AND MINIMIZE TAKE OF PROTECTED SPECIES

The following sub-sections outline the measures that KWP II proposes to take to avoid, minimize, and mitigate anticipated impacts to protected species. These avoidance, minimization, and mitigation measures are described in greater detail in the Habitat Conservation Plan (HCP) that KWP II LLC has prepared for the project (SWCA 2009).

4.7.3.1 Site-Specific Project Design Considerations

The analysis of project design alternatives supports the conclusion that the proposed alternative is preferred when all impacts on the human and natural environment are considered. Because complete avoidance of risk to the four Covered Species is impossible under the preferred alternative, KWP II has sought to avoid and minimize the risk of collisions as much as possible by making the turbines less attractive, more visible, or more likely to be avoided by birds and bats.

These measures include:

- Employing relatively few turbines situated in two single rows, rather than a large number of staggered turbines or multiple rows.
- Using "monopole" steel tubular towers for the WTGs; these virtually eliminate perching and nesting opportunities. The tubular towers may also reduce collision risk because they are considerably more visible.
- Utilizing a rotor with a rotational speed (11 to 20 rpm) that makes the rotor visible during operation.
- Choosing a site in proximity to existing electrical transmission lines to eliminate the need for an overhead transmission line from the project to the interconnect location.
- Selecting a site in proximity to the existing KWP I facility so key infrastructure can be shared, thereby minimizing the need for new disturbance and development. Also, the considerable body of data that has been collected on endangered species at the KWP I site informs KWP II site selection and avoidance/minimization measures, as well as likely mitigation requirements.
- Placing all new power collection lines underground to eliminate the risk of collision with new wires.
- Designing and installing the site substation and interconnect to MECO's transmission lines using industry-standard measures to reduce the possibility of wildlife electrocutions.
- Marking guy wires on temporary and permanent meteorological monitoring towers with high-visibility bird diverters and other suitable marking devices designed to reduce bird strikes.
- Restricting construction activity to daylight hours as much as possible to avoid the use of nighttime lighting that could be an attraction.
- Requesting FAA endorsement of a minimal lighting plan to reduce the likelihood of attracting or disorienting seabirds.
- Having minimal on-site lighting at the operations and maintenance building and substation, using fixtures that will be shielded and/or directed downward and only utilized on infrequent occasions when workers are at the site at night (these three lighting measures will be taken not only as avoidance and minimization of wildlife impacts, but also to greatly reduce the visual impact for the resident and visitor population of Maui that is accustomed to or expects to see darkness in the West Maui mountains at night).
- Conducting pre-construction surveys for Nēnē and Nēnē nests prior to roadway and site clearing and construction, to identify and avoid harming or harassing (as defined under the ESA) any active

nests, eggs, young, or adults; the survey protocol that was developed and used for KWP I will be used for KWP II.

- Following the survey protocol should construction begin and Nēnē and/or a nest(s) is subsequently discovered.
- Notifying DLNR within 30 days in advance of any planned land management activity (e.g., construction or maintenance), which KWP II LLC reasonably anticipates will result in the incidental take of covered species on the enrolled property. KWP II LLC will also provide DLNR and USFWS, the opportunity to capture and/or relocate any potentially affected individuals of the Covered Species before the activity takes place.

4.7.3.2 USFWS Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines

While wind energy has been utilized for centuries, it has rapidly expanded relatively recently in the United States and worldwide with advances in technology and increased interest in renewable and alternative energy sources. In recognition of the growing wind energy industry in the United States, the United States Fish and Wildlife Service (USFWS) has prepared "Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines" (USFWS 2003) available through the USFWS website, http://www.fws.gov. The guidelines were published simultaneously with a Federal Register Notice of Availability and request for comments on the guidelines.

After reviewing the comments received, the Secretary of the Interior established a Wind Turbine Guidelines Advisory Committee to provide advice and recommendations to the Secretary of the Interior on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy facilities. To date, no updates to the Interim Guidelines have been released, and compliance with them is considered voluntary. Nonetheless, KWP II LLC believes that these guidelines provide several substantive recommendations that are relevant and applicable to the proposed wind energy generation facility.

Table 4.10 below lists the recommendations from the Interim Guidelines relating to site development and turbine design and operation and discusses how KWP II LLC plans to comply with these recommendations. It should be noted that these recommendations relate to all wildlife, whether or not they are protected under the Endangered Species Act or Migratory Bird Treaty Act.

4.7.4 MEASURES TO MITIGATE TAKE OF PROTECTED SPECIES

The proposed mitigation program for KWP II was influenced greatly by the approved mitigation program for KWP I and the data that has been collected by KWP I biologists since operations commenced. In coordination with biologists from DLNR and USFWS, KWP II LLC plans to either reproduce or expand the existing KWP II mitigation program to mitigate adverse impacts to protected species and provide a net conservation benefit to each species as required by State law.

General criteria that influenced the selection of preferred mitigation measures included the following:

- The level of mitigation should be commensurate with the currently anticipated take;
- Mitigation should be species-specific and, to the extent practicable, location or island-specific;
- Mitigation measures should be practicable and capable of being done given currently available technology and information;
- Mitigation measures should have measurable goals and objectives that allow success to be assessed;

Table 4.10. Consistency of the Proposed KWP II Facility with the USFWS Interim Voluntary Guidelines for Wind Projects (USFWS 2003).

USFWS Interim Voluntary Guidelines Site Development Recommendations	*Proposed KWP II Facility*
Avoid placing turbines in documented locations of any species of wildlife, fish, or plant protected under the Federal Endangered Species Act	There are no other locations on Maui that are both: (a) suitable for a financially viable wind energy generation facility and (b) unlikely to be visited by Covered Species. Data from the existing KWP I facility indicates that occurrence of Covered Species on the site is relatively low, and take is commensurately at or below the Baseline Level identified in the KWP I HCP. The proposed KWP II project minimizes habitat disturbance by sharing key infrastructure with KWP I and likewise incorporates measures to avoid and minimize risk to Covered Species as much as possible while still meeting the basic project purpose.
Avoid locating turbines in known local bird migration pathways or in areas where birds are highly concentrated, unless mortality risk is low (e.g., birds present rarely enter the rotor-swept area). Examples of high concentration areas for birds are wetlands, State or Federal refuges, private duck clubs, staging areas, rookeries, leks, roosts, riparian areas along streams, and landfills. Avoid known daily movement flyways (e.g., between roosting and feeding areas) and areas with a high incidence of fog, mist, low cloud ceilings, and low visibility.	This recommendation has been followed as much as practicable while still meeting the basic project purpose. Survey data collected to date has shown that the site is not a high concentration area for any of the Covered Species.
Avoid placing turbines near known bat hibernation, breeding, and maternity/nursery colonies, in migration corridors, or in flight paths between colonies and feeding areas.	This recommendation has been followed, based on the little information available on Hawaiian Hoary Bats. Hawaiian Hoary Bats are not known to hibernate or occur colonially. While a few bats have been confirmed to fly through the project area, there is no habitat considered suitable for roosting, or breeding nearby. The low numbers observed do not suggest that the project site lies within a bat migration corridor.
Configure turbine locations to avoid areas or features of the landscape known to attract raptors (hawks, falcons, eagles, owls). For example, Golden Eagles, hawks, and falcons use cliff/rim edges extensively; setbacks from these edges may reduce mortality. Other examples include not locating turbines in a dip or pass in a ridge, or in or near prairie dog colonies.	This recommendation has been followed, to the extent that it is applicable, by situating the turbines approximately away from Manawainui Gulch and Pāpalaua Gulch where most owl activity has been observed. Although owls have also been observed flying over the higher ground proposed for the wind farm, activity here is much lower than in the adjacent gulches.
Configure turbine arrays to avoid potential avian mortality where feasible. For example, group turbines rather than spreading them widely, and orient rows of turbines parallel to known bird movements, thereby decreasing the potential for bird strikes. Implement appropriate storm water management practices that do not create attractions for birds, and maintain contiguous habitat for area-sensitive species (e.g., Sage Grouse).	Turbines have been arranged as closely as feasible, given wind resource and terrain considerations, and in a linear fashion that is generally parallel to the direction of birds moving to and from the ocean. No potentially attractive water features will be constructed for the project.

USFWS Interim Voluntary Guidelines Site Development Recommendations	***Proposed KWP II Facility***
Avoid fragmenting large, contiguous tracts of wildlife habitat. Where practical, place turbines on lands already altered or cultivated, and away from areas of intact and healthy native habitats. If not practical, select fragmented or degraded habitats over relatively intact areas.	The majority of the natural environment in the project area has been previously disturbed by wildfires, pasturing and grazing uses. Existing areas of native cover types are fragmented and interspersed with disturbed, non-native dominated cover. Nēnē do utilize open areas and rock outcrops, and KWP II LLC has micro-sited the proposed WTGs so as not to disturb the features that are most attractive to Nēnē.
Avoid placing turbines in habitat known to be occupied by prairie grouse or other species that exhibit extreme avoidance of vertical features and/or structural fragmentation. In known prairie grouse habitat, avoid placing turbines within five miles of known leks (communal pair formation grounds).	Not applicable - no such species occur in the area.
Minimize roads, fences, and other infrastructure. All infrastructure should be capable of withstanding periodic burning of vegetation, as natural fires or controlled burns are necessary for maintaining most prairie habitats.	This recommendation will be followed. A Wild Land Fire Contingency Plan is in place for KWP I and will be administered at KWP II as well (note that controlled burn and prairie considerations are not applicable).
Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. For example, avoid attracting high densities of prey animals (rodents, rabbits, etc.) used by raptors.	This recommendation will be followed. Revegetation of disturbed areas and other habitat improvement measures will be coordinated with DLNR staff.
Reduce availability of carrion by practicing responsible animal husbandry (removing carcasses, fencing out cattle, etc.) to avoid attracting Golden Eagles and other raptors.	This recommendation is not applicable as Golden Eagles and other raptors are not a species of concern in the vicinity of the project.
Use tubular supports with pointed tops rather than lattice supports to minimize bird perching and nesting opportunities. Avoid placing external ladders and platforms on tubular towers to minimize perching and nesting. Avoid use of guy wires for turbine or meteorological tower supports. All existing guy wires should be marked with recommended bird deterrent devices (Avian Power Line Interaction Committee 1994).	This recommendation has been, and will continue to be followed. Tubular towers are being utilized; the towers will not have ladders or platforms; and guy wires will only be utilized over the long term on the two proposed permanent meteorological towers but will be appropriately marked.
If taller turbines (top of the rotor-swept area is >199 feet above ground level) require lights for aviation safety, the minimum amount of pilot warning and obstruction avoidance lighting specified by the Federal Aviation Administration (FAA) should be used. Unless otherwise requested by the FAA, only white strobe lights should be used at night, and these should be the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) allowable by the FAA. Solid red or pulsating red incandescent lights should not be used, as they appear to attract night-migrating birds at a much higher rate than white strobe lights.	KWP II LLC is working with the FAA to apply a minimal lighting scheme such as that which has been implemented at KWP I. Other on-site lighting will be minimal, shielded and used infrequently.

USFWS Interim Voluntary Guidelines Site Development Recommendations	***Proposed KWP II Facility***
Where the height of the rotor-swept area produces a high risk for wildlife, adjust tower height where feasible to reduce the risk of strikes.	This recommendation is generally not applicable in that the risk of strikes is not demonstrably related to the height of the rotor-swept area. However, the proposed 65-meter towers are the shortest that GE produces for its 1.5 MW machines.
Where feasible, place electric power lines underground or on the surface as insulated, shielded wire to avoid electrocution of birds. Use recommendations of the Avian Power Line Interaction Committee for any required aboveground lines, transformers, or conductors.	This recommendation is being followed; all new power lines will be placed underground where feasible.
High seasonal concentrations of birds may cause problems in some areas. If, however, power generation is critical in these areas, an average of three years monitoring data (e.g., acoustic, radar, infrared, or observational) should be collected and used to determine peak use dates for specific sites. Where feasible, turbines should be shut down during periods when birds are highly concentrated at those sites.	This recommendation is not applicable, as there is no documented seasonal concentration of birds. Though seabirds have been documented passing through the area, their numbers are low compared to other locations on Maui.
When upgrading or retrofitting turbines, follow the above guidelines as closely as possible. If studies indicate high mortality at specific older turbines, retrofitting or relocating is highly recommended.	This recommendation is not applicable to the current project, as it will be a new facility.
Source: Draft KWP II HCP (SWCA 2009).	

- Flexibility to adjust to changes in the level of take according to new information during project operation is desirable;
- Efforts that are consistent with or otherwise advance the strategies of the respective species' draft or approved recovery plans;
- Mitigation measures that serve to directly "replace" individuals that may be taken (e.g., by improving breeding success or adult and juvenile survival) are preferred, though efforts to improve the knowledge base for poorly documented species also have merit, particularly when the information to be gained can benefit future efforts to improve survival and productivity;
- Off-site mitigation measures to protect breeding or nesting areas for birds, and roosting areas for bats, located on otherwise unprotected private land are preferred over those on public land, and sites on State land are preferred by USFWS over those on federal land;
- Measures to decrease the level of take resulting from a private activity unrelated to the project are generally considered the responsibility of the other party and are not preferred as mitigation for the KWP II project (e.g., rescue/rehabilitation of downed seabirds outside the project area as a result of disorientation by outdoor lights not related to the proposed project); and
- Alternate or supplemental mitigation measures should be identified for future implementation if the level of take is found to be higher (or lower) as a result of monitoring.

The following sections provide details of the measures selected for each of the four protected species, and these are summarized in Table 4.11. These measures are as currently proposed in the Draft HCP submitted to the DLNR and USFWS. Final measures will be determined based upon review and approval by USFWS and DLNR. Further, once approved, all mitigation measures will be subject to review by DLNR and USFWS over the lifetime of the project and may be either discontinued, modified, or continued without modification.

4.7.4.1 Mitigation Measures for All Species

4.7.4.1.1 Wildlife Education and Observation Program

A wildlife education and observation program (WEOP) will be implemented for all regular on-site staff. The program will be long-term, on-going, and updated as necessary. Staff will be trained to identify listed and non-listed native species of birds and other wildlife that may be found on-site, to record observations of species protected by the ESA and/or MBTA, and to take appropriate steps when and if dead or downed wildlife is found. As part of their safety training, temporary employees, contractors, and any others that may drive project roads will be educated on speed limits, the possibility of downed wildlife being present on roads, and the possibility of Nēnē presence on the ground or flying low across roads. Personnel will be instructed to contact the Site Safety Officer immediately if they detect any downed wildlife on-site.

4.7.4.1.2 Downed Wildlife Monitoring Protocol

The protocol for the recovery, handling, and reporting of downed wildlife will follow that developed for the Draft KWP II HCP (KWP II LLC, 2009). This protocol was adapted from the protocol developed for KWP I in cooperation with DLNR and USFWS. All regular on-site staff will be trained in the protocol which will include prompt reporting and documenting of all observed mortalities or injury to wildlife.

Table 4.11. Proposed Baseline Mitigation Measures for Protected Species

Species	*Mitigation Measures*
Hawaiian Petrel	Predator removal at Makamakaʻole seabird colony in West Maui, search for additional colony mitigation opportunities in West Maui and explore colony enhancement measures.
Newell's Shearwater	Predator removal at Makamakaʻole seabird colony in West Maui, search for additional colony mitigation opportunities in West Maui and explore colony enhancement measures.
Nēnē	Fund the captive propagation of seven Nēnē goslings per year for the first 5 years of project operations for reintroduction at the Haleakalā Ranch Nēnē release site, regardless of take.
Hawaiian Hoary Bat	Provide funding to support collaborative research on population ecology and future management options throughout range.
Source: Draft KWP II HCP (SWCA 2009).	

USFWS and DLNR will be notified promptly upon discovery of an injured or dead protected species. Any protected species found dead or injured in the project area will immediately be reported to USFWS and DLNR and left as found for collection by USFWS or DLNR personnel. Until specimens are collected, they will be photo-documented and guarded against scavenging. Carcasses may also be collected by authorized field personnel if instructed by DLNR. Injured protected species will be photographed from a discreet distance and monitored until response measures are implemented. Non-protected species will also be collected if requested by USFWS or DLNR; collections will be made only by staff personnel permitted by USFWS and DLNR to handle and salvage wildlife. The HCP for the project identifies guidelines for handling injured individuals or carcasses.

4.7.4.2 Mitigation for Petrels and Shearwaters

Mitigation for the Hawaiian Petrel and Newell's Shearwater will follow the colony protection and productivity enhancement measures presently underway on behalf of both species at the Makamakaʻole seabird breeding colony in West Maui. This colony was discovered during surveys prescribed as part of the KWP I HCP. KWP I and KWP II will cooperate to fulfill the total mitigation obligation for both projects by sharing staff and resources.[42]

Mitigation for seabirds takes into account the expected annual rate of direct and indirect take. Replacement for take of both adults and juveniles will include replacement by either increased adult survival or increased fledging success. When replacement consists of fledglings, the rate of survival to adulthood will be taken into account to ensure that a sufficient number of fledglings reach adulthood to replace those adults incidentally taken. In addition, because Hawaiian Petrels and Newell's Shearwaters mature at age five and six years, respectively, mitigation also takes into account the loss of offspring that may have been produced by taken adults during the time that it takes

[42] As rates of take will likely vary between the two seabird species and mitigation efforts will likely be expended at a mixed breeding colony, the level of mitigation effort will be determined by the highest rate of take. This would be expected to result in the production of fledglings or increased adult survival for the other seabird species in excess of that which would otherwise be required. KWP II would be able to receive credit for such "extra" fledglings or adults that could then be used to compensate for take incurred in later years.

for replacement fledglings to reach sexual maturity. Juvenile survival rates to adulthood are assumed to be 30 percent for the Hawaiian Petrel (Simons and Hodges 1998) and 24 percent for Newell's Shearwater (Ainley et al 2001). The loss of productivity is assumed to be 0.45 fledglings/year/adult for the Hawaiian Petrel and 0.23 fledglings/year/adult for Newell' shearwater. Table 4.12 below lists the yearly number of fledglings required to be produced to offset the Baseline level of take anticipated at KWP II assuming same-year replacements.

Table 4.12. Baseline Mitigation Required for Hawaiian Petrel and Newell's Shearwater.

Species	Baseline take level			Average annual fledgling production requirement
Hawaiian Petrel	5-year take limit	Adults	5	
		Fledglings	2.5	
	Annual average	Adults	1	3.33
		Fledglings	0.5	0.5
	Loss of productivity			1.8
	Total fledglings required annually			**5.63**
Newell's Shearwater	5-year take limit	Adults	5	
		Fledglings	2.5	
	Annual average	Adults	1	4.17
		Fledglings	0.5	0.50
	Loss of productivity			1.15
	Total fledglings required annually			**5.82**
Source: Draft KWP II HCP (SWCA 2009).				

Predation has been shown to have significant negative effects on fledging success for the Hawaiian Petrel (Hodges 1994, Hu et al. 2001, Hodges and Nagata 2001, Telfer 1986). The dominant predator varies by location but predation mortality has been attributed to cats, mongooses, rats, and owls (Hu et al. 2001, Hodges and Nagata 2001). Hodges and Nagata (2001) identified predation as accounting for 41 percent of total terrestrial mortality (adults, fledglings, and eggs) in cases in which a cause of death could be determined. Human-related causes (road-kills, collapsed burrows, collision with structures) accounted for 49 percent of mortalities (23 percent of mortalities prior to 1987 were caused by the ungulate exclusion fence alone) and natural causes accounting for the remaining 10 percent. Data from Hodges (1994), Hu et al. (2001), and Hodges and Nagata (2001) show that predator control (trapping and fencing) generally results in an increase in Hawaiian Petrel nesting success as shown in Table 4.13.

In order to mitigate for the anticipated level of take by the proposed facilities, KWP II LLC will provide funding or in-kind support (in concert with the efforts already being undertaken by KWP I) at Makamaka'ole for three years of low-impact cat/mongoose/rat removal (trapping) to increase nesting success at the seabird colony. Ungulate exclusion fencing has already been constructed by DLNR around a portion of this breeding colony. Trapping would be conducted from February through November/December in each of the first three years following permit issuance. In addition, KWP II LLC will evaluate the present fencing systems, maintain and increase the present visibility enhancement measures implemented by KWP I biologists in 2008 using reflective poly-vinyl tape as necessary to minimize collision risk, and determine, in consultation with USFWS and DLNR, whether additional exclusion measures could be investigated to provide increased colony protection; if so, such measures will be implemented using the funding/in-kind services above.

Table 4.13. Comparison of Hawaiian Petrel Nesting Success with & without Predator Control.

Location	*Year(s)*	*Nesting success (%)*		*Reference*
		w/o predator control	*w/ predator control*	
Haleakala, Maui		42.0	57.0	Hodges 1994
Mauna Loa, Hawaii	1995-96	41.7	61.5	Hu et al 2001
Haleakala, Maui	1982	0.0	32.7	Hodges and Nagata 2001
Haleakala, Maui	1990	10.0	49.2	Hodges and Nagata 2001
Haleakala, Maui	1991	25.6	48.6	Hodges and Nagata 2001
Haleakala, Maui	1992	15.2	17.0	Hodges and Nagata 2001
Haleakala, Maui	1993	32.8	38.2	Hodges and Nagata 2001
Haleakala, Maui	1994	44.0	23.0	Hodges and Nagata 2001
Haleakala, Maui	1995	31.8	50.0	Hodges and Nagata 2001
Haleakala, Maui	1996	28.1	46.7	Hodges and Nagata 2001
Unweighted Average		27.1	42.4	
Source: Draft KWP II HCP (SWCA 2009).				

KWP II LLC will implement management and protection measures during the first three years of project operation as they are expected to more than offset the anticipated total take for both species, resulting in increases in fledgling production as summarized in Table 4.12. Colony protection and/or management measures will continue beyond Year 3 such that the ratio of birds protected to the adjusted take remains greater than 1 throughout the life of the project.

Radar and nocturnal visual surveys will be conducted in October in each of the first three years of project operation in an effort to quantify the number of Hawaiian Petrel and Newell shearwater fledglings departing the colony. Radar surveys will be performed during the spring and early summer when adult movement rates and activity levels at colonies are highest to ascertain overall abundance and to establish practical methods for estimating fledgling departure rates. These numbers will be used to inform the success of mitigation measures. Other measures will also be employed to monitor existing seabird populations, increase knowledge of species specific predation pressure on the seabird colony, and explore methods to further enhance the productivity of the colony. Measures proposed include:

- Collecting and analyzing predator scat from the Makamaka‘ole site adjacent to proposed trap lines and predator access points to determine species and composition of prey in samples;
- Increasing monitoring throughout the breeding season using surveillance radar at Lower Kahakuloa-Makamaka‘ole to evaluate movement patterns of petrels and shearwaters to establish a baseline for annual comparisons;
- Examining colony enhancement measures using social attraction mechanisms (vocalization playbacks) and nesting habitat improvement (artificial burrows).

4.7.4.3 Mitigation for Nēnē

KWP I biologists maintain an ongoing collaboration with biologists from DLNR and USFWS, as well as regional experts, to identify, select, and implement appropriate measures to mitigate for take of Nēnē under the terms of the KWP I HCP. Several provisions in the KWP I HCP guide mitigation for Nēnē. A similar approach is proposed for the KWP II project, with the intention of providing a net ecological benefit to the species in alignment with State and federal species recovery goals. KWP II LLC will provide support for Nēnē propagation and release, which may include translocation, intended to promote the recovery of the species through reintroduction and enhancement within portions of its historic range.

Mitigation for Nēnē will take into account the expected annual direct and indirect take of the species. Because mitigation for any direct take of adults and direct or indirect take of goslings will be provided through replacement by goslings (or possibly juveniles), it will also account for the survival rate of goslings to adulthood and for possible loss of production during the lag years between take of adult birds and the sexual maturity of released goslings.

Based on these assumptions, Table 6.4 identifies the number of goslings that will be required to be released annually to offset the Baseline level of take anticipated (assuming same-year replacements) for Nēnē during operation of the KWP II project.

While release of three goslings annually is expected to be sufficient to compensate for the Baseline level of take, the Baseline mitigation for Nēnē is proposed to consist initially of providing funding ($18,000 per year) to DLNR for the propagation and release of seven goslings annually for the first five years of project operation (35 goslings total) at the Haleakalā Ranch Nēnē release site soon to be active on Maui. Releases will be in addition to the reintroduction initiatives already stipulated in the KWP I HCP and those being performed by the State of Hawai‘i. A Safe Harbor Agreement with Haleakalā Ranch is pending approval that will enable a target population of at least 75 birds to be released under the combined scope of the management plan.

Table 4.14. Baseline Mitigation Required for Nēnē.

Species	***Baseline take level***			***Annual gosling release requirement***
Nēnē	5-year take limit	Adults	6	
		Goslings	3	
	Annual average	Adults	1.2	2.34
		Goslings	0.6	0.60
Adjustment for loss of productivity				0.09
Total goslings to be released annually				**3.03 (rounded to 3.00)**
Source: Draft KWP II HCP (SWCA 2009).				

If the combined releases from KWP I and KWP II reach the target number of releases at Haleakalā Ranch before the end of the proposed initial five-year KWP II Nēnē release effort, or if circumstances change and gosling release at the Haleakalā Ranch no longer is a viable option, KWP II has committed to provide funding (not to exceed $50,000) for the construction of a second Nēnē release pen on Maui, Moloka‘i, or Hawai‘i as determined in consultation with DLNR and USFWS. The remainder of the set of 35 goslings proposed to be released over the initial five-year period would then be released at the new location.

If take of Nēnē at the KWP II facility occur at Baseline level over the 20-year life of the project, this would require release of approximately 60 goslings as compensation, or three goslings per year on average. Releases over the first five years would initially result in a “surplus” of released goslings, which is desirable both to guard against the possibility of take occurring at higher rates than

anticipated, and to "jump-start" the Haleakalā Ranch population by allowing for a greater number of birds to reach adulthood at an earlier time.

Following the initial release of 35 goslings over the first 5 years of operation, funding would be provided to DLNR for the continued propagation and release of goslings on an annual basis. The number of goslings released in subsequent years (from Year 6 onward) would at a minimum meet the number required to compensate for the adjusted take identified from the previous year. This would retain the "surplus" developed over the first five years of project operation. When the point is reached that it appears the surplus of goslings released is capable of compensating for take incurred through the end of the 20-year project life, annual releases of goslings will cease, with mitigation for subsequent take, plus a net benefit, to be provided by the surplus. Post-construction monitoring will continue so that actual take can continue to be measured. If the take that occurs subsequent to the termination of gosling releases is of a high enough level to cause the surplus to be insufficient to compensate for that take, the KWP II LLC will provide funding to DLNR sufficient to propagate and release the number of goslings needed to compensate for the measured take plus a net benefit. As the previously identified release sites may be at capacity by that time, these goslings would be released at an appropriate site as identified through consultation with the DLNR and USFWS.

In addition to these measures, KWP II LLC will also provide funding for the following:

- $9,000 toward the purchase of a truck or all-terrain vehicle to support maintenance and predator control efforts at the Haleakalā Ranch facility;
- $15,000 toward staffing operations and maintenance personnel at the Haleakalā Ranch facility during its first year of operation; and
- $1,000 toward use of a helicopter to carry the first year's set of goslings to the release site.

In addition to the above, as part of mitigation for baseline levels of take, a wildlife biologist will make systematic visual observations of Nēnē activity from representative locations within the KWP II project area during the first year of project operation. The observation program will provide additional insights into the way Nēnē activity and behavior responds to the turbines. These observations will contribute to a better interpretation of the risk WTGs present to Nēnē and will facilitate minimization initiatives intended to reduce impacts.

4.7.4.4 Hawaiian Hoary Bat

Because of the lack of life history information on the Hawaiian Hoary Bat, research is identified as one of the key components in achieving the recovery of this subspecies. The Recovery Plan for the Hawaiian Hoary Bat (USFWS 1998) states:

> *"…Research is the key to reaching the ultimate goal of delisting the Hawaiian Hoary Bat because currently available information is so limited that even the most basic management actions cannot be undertaken with the certainty that such actions will benefit the subspecies…"*

Gorresen et al. (2008) recently identified the following key areas of research required to improve knowledge of Hawaiian Hoary Bat life history:

- Determining bat occupancy rates in different habitat types;
- Determining bat distribution across seasons on a local and regional scale;
- Determining seasonal and daily peak bat activity periods; and
- Monitoring population trends.

Development and implementation of a survey and monitoring program remains a high priority and a key recovery objective for the Hawaiian Hoary Bat (Gorresen et al 2008, USFWS 1998).

As part of the mitigation program for bats under its approved HCP, KWP I has contributed funding for the U.S. Geological Survey (USGS) Hawaiian Hoary Bat Research Project. This has allowed the agency to purchase equipment and to monitor bat activity at over 20 locations during the past two years. KWP II proposes to mitigate for the effects that its facilities may have on the Hawaiian Hoary Bat by supporting research that will survey and monitor for Hawaiian Hoary Bats in different habitat types or collect basic life history information needed to identify resource needs (such as foraging and roosting areas) and threats (USFWS 1998).

The proposed mitigation for the Baseline level of take consists of the following:

- Contributing $40,000 to an appropriate program to support bat research such as the Hawai‘i Bat Research Cooperative (HBRC) as determined by DLNR and USFWS.
- Surveying for bat activity on the project site for at least the first 12 consecutive months of operation and documenting the results. This will be done using acoustic bat detectors placed in the areas within and around the turbine locations and, possibly, thermal imaging or night vision technology.
- Making bat observations an incidental part of the seabird colony monitoring efforts.
- Incidental on-site observations of bats by KWP II staff will be reported under the WEOP.

KWP II believes this in-house research will advance the scientific understanding for developing effective avoidance and minimization strategies at wind facilities for the Hawaiian hoary bat in Hawai‘i and elsewhere.

4.8 NOISE IMPACTS

The following discussion is divided into three main parts.

- Section 4.8.1 summarizes applicable noise standards. It also defines two key terms used in the analysis.
- Section 4.8.2 describes the effects that operation of the proposed facilities would have on noise levels.
- Section 4.8.3 describes construction-related noise impacts.

4.8.1 APPLICABLE NOISE CONTROL STANDARDS

As discussed in Section **Error! Reference source not found.**, Hawaii Administrative Rules (HAR) Title 11, Chapter 46, Section 4 (§11-46-4) defines the maximum permissible community sound levels in dBA. These differ according to the kind of land uses that are involved (as defined by zoning districts) and time of day (daytime or nighttime). They are as shown in Table 3.7.

Definitions of two technical terms used in this 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.[43] 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

[43] The sound pressure level in decibels is equal to twenty times the logarithm to the base ten of the ratio of the pressure of the sound measured to a reference pressure of 20 micropascals, or 0.0002 dynes per square centimeter.

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.

The maximum permissible sound levels specified in HAR §11-46-4(b) do not apply to any particular distance from a source (such as a WTG). Instead, they apply to sound levels at the parcel boundary. Because of this, a source that is allowable if it set well back from the property line of the parcel in which it is located can be much louder than one set close to the property line and still be consistent with the standard. Thus, even though the parcel on which Kaheawa Pastures is located and the adjoining parcels fall into the Class A (most restrictive) category, the fact that they are set back from the property line by a substantial amount means that this need not be a problem.

4.8.2 SOUND FROM OPERATIONS

4.8.2.1 Source Sound Level Estimates

In order to determine if the proposed WTGs could be operated in a way that is consistent with the limits established in §11-46-4(b), D.L. Adams Associates, Ltd. (January 9, 2009) began with the manufacturer's sound level performance specifications for the GE 1.5sle wind turbine.[44] These specifications represent the wind turbine as a point source at the hub (rotor center) and were determined in accordance with IEC International Standard 61400-11, Wind Turbine Generator Systems – Acoustic Noise Measurement Techniques.

The specifications indicate that the maximum sound *power* level for the 1.5sle wind turbine is 104 dBA. Because the sound *pressure* level at 50 feet is approximately 32 dBA less than the sound power level of a point source[45], this is equivalent to a sound pressure level of 72 dBA at 50 feet. The GE 1.5sle reaches its maximum sound power level (the level used in this impact analysis) at an electric power output of approximately 60 percent of full generating capacity. This level of operation is achieved with a wind speed of 9 meters per second (20.1 mph) at the hub height of the wind turbine. Although not used in our analysis, sound levels can decrease by up to 8 dB or more for lower wind speeds.

4.8.2.2 Sound Propagation Model

D.L. Adams & Associates used the DataKustik CadnaA (version 3.7.123) software program to model sound propagation from the WTGs.[46] The model is conservative (i.e., the actual sound levels due to turbine sound propagation should be equal to or less than the predicted levels). The conservatism stems from the incorporation of several assumptions.

- It assumes that meteorological conditions are favorable for sound propagation. That is, every receiver is assumed to be downwind in the presence of a well developed temperature inversion. In reality, every receiver cannot be downwind simultaneously so this provides a somewhat worst case scenario, which is consistent with ISO 9613-2.
- The model assumes an average temperature of 70° Fahrenheit and relative humidity of 65 percent, based on available climate information for the area. It also assumes that the receiver (i.e., listener) is 1.5 meters (~5 feet) above ground; this is the height at which testing for compliance with the Community Noise Control Rule is normally done.

[44] The 20 existing wind turbines are GE Model 1.5se turbines with 55 meter hub heights and 70.5 meter diameter three-blade rotors. The 14 proposed wind turbines are identical except that the hub height is 65 meters. The actual sound power level data for the GE 1.5se turbines is GE's proprietary information.

[45] From attenuation due to hemispherical radiation = 10 log ($2pR^2$) where R is the distance in meters.

[46] The software program uses the calculation procedures of International Standard ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

- The modeling assumed a ground attenuation coefficient of 0.0. The coefficient can range from 0.0 to 1.0. A ground attenuation coefficient of 1.0 indicates an acoustically absorptive surface such as dense foliage or fresh powder snow; a coefficient of 0.0 indicates an acoustically reflective surface such as still water or concrete. Based on the terrain in the area, a realistic average ground absorption coefficient is probably between 0.2 and 0.4. Hence, using a coefficient of 0.0 leads to "worst-case" results for this factor.[47]

4.8.2.3 Compliance with Noise Limits

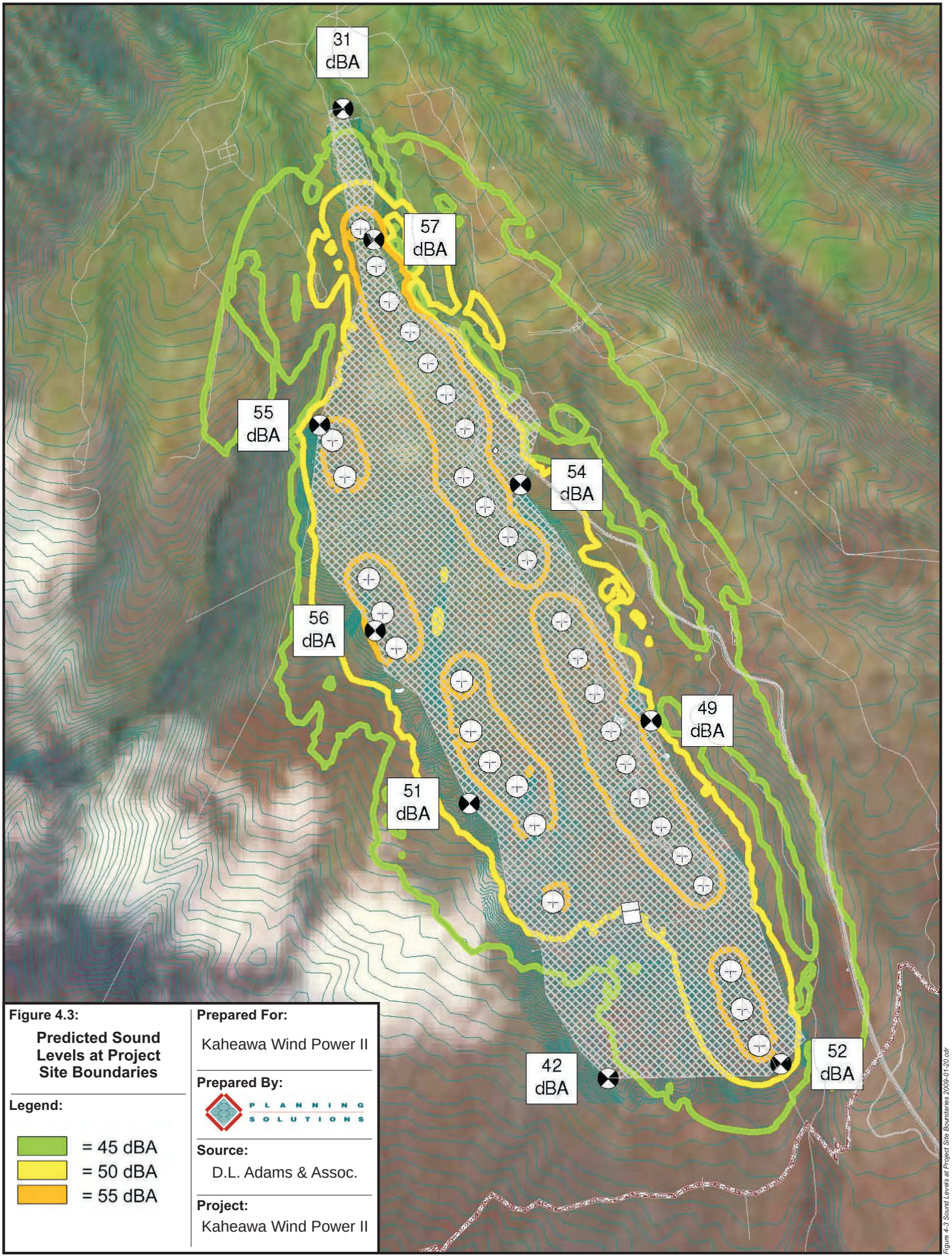
Figure 4.3 shows the predicted sound level contours and sound levels for 45 dBA and higher at locations along the KWP II site property lines. Based on the predicted sound levels shown in Figure 4.3, KWP II may exceed the Community Noise Rule, Class A nighttime property line sound level limit of 45 dBA. It would be in general compliance with the 55 dBA daytime limit.[48] It is unlikely that a noise abatement package for the wind turbines would reduce the sound levels sufficiently to meet the property line limit fully.

The areas near the project site are uninhabited. Hence, the only persons who would be in a position to hear the wind turbines are (i) individuals working on the project site, (ii) persons using the existing road to access the forest and conservation land above Kaheawa Pastures, and (iii) individuals and groups using the Lahaina Pali Trail. The first two categories of people are engaged in activities that would not be adversely affected by the forecast sound levels, either because they are present as part of their work on the wind farm itself or are simply briefly transiting the area. In view of this, it is unlikely that there would be a complaint due to sound at the property line. If KWP II LLC wished to be in full compliance with the standard, it could request a variance from the State of Hawai'i Department of Health as provided for in HAR §11-46-8.

During preparation of this report, special attention was paid to the effect that project-related sound might have on third category of individuals, users of the Lahaina Pali Trail. Figure 4.4 shows the predicted sound level area contours and sound levels at selected locations along the Lahaina Pali Trail. The model results indicate that sound from the wind turbines may be audible along parts of the trail that are closest to the turbines but that project-related impacts on trail users would be low. Not surprisingly, sound would be most noticeable (41 to 44 dBA) on the stretch of trail closest to the existing access road. However, even there the predicted sound levels are lower than the 45 dBA limit that applies to conservation and preservation lands during the nighttime hours (10:00 PM to 7:00 AM). Even then, however, it would be below this most restrictive limit and below the ambient levels experienced during all but the calmest wind conditions. Hence, it should not interfere substantially with enjoyment of the trail.

[47] The ground attenuation coefficient has only a modest effect on the model predictions. For example, using a ground absorption coefficient of 1.0 instead of 0.0 reduces the predicted sound levels on the Lahaina Pali Trail by 0-1dB at most locations, and 1-3 dB at the locations nearest the site.

[48] There are 0ne or two short property line segments where the model suggests the sound levels could be slightly higher. In no case is the exceedance greater than 2 dB, an amount that is within the range of error of the model.


31 dBA
57 dBA
55 dBA
54 dBA
56 dBA
49 dBA
51 dBA
42 dBA
52 dBA
Figure 4.3:
Predicted Sound Levels at Project Site Boundaries
Legend:
= 45 dBA
= 50 dBA
= 55 dBA
Prepared For:
Kaheawa Wind Power II
Prepared By:
PLANNING SOLUTIONS
Source:
D.L. Adams & Assoc.
Project:
Kaheawa Wind Power II
Figure 4-3 Sound Levels at Project Site Boundaries 2009-01-20.cdr

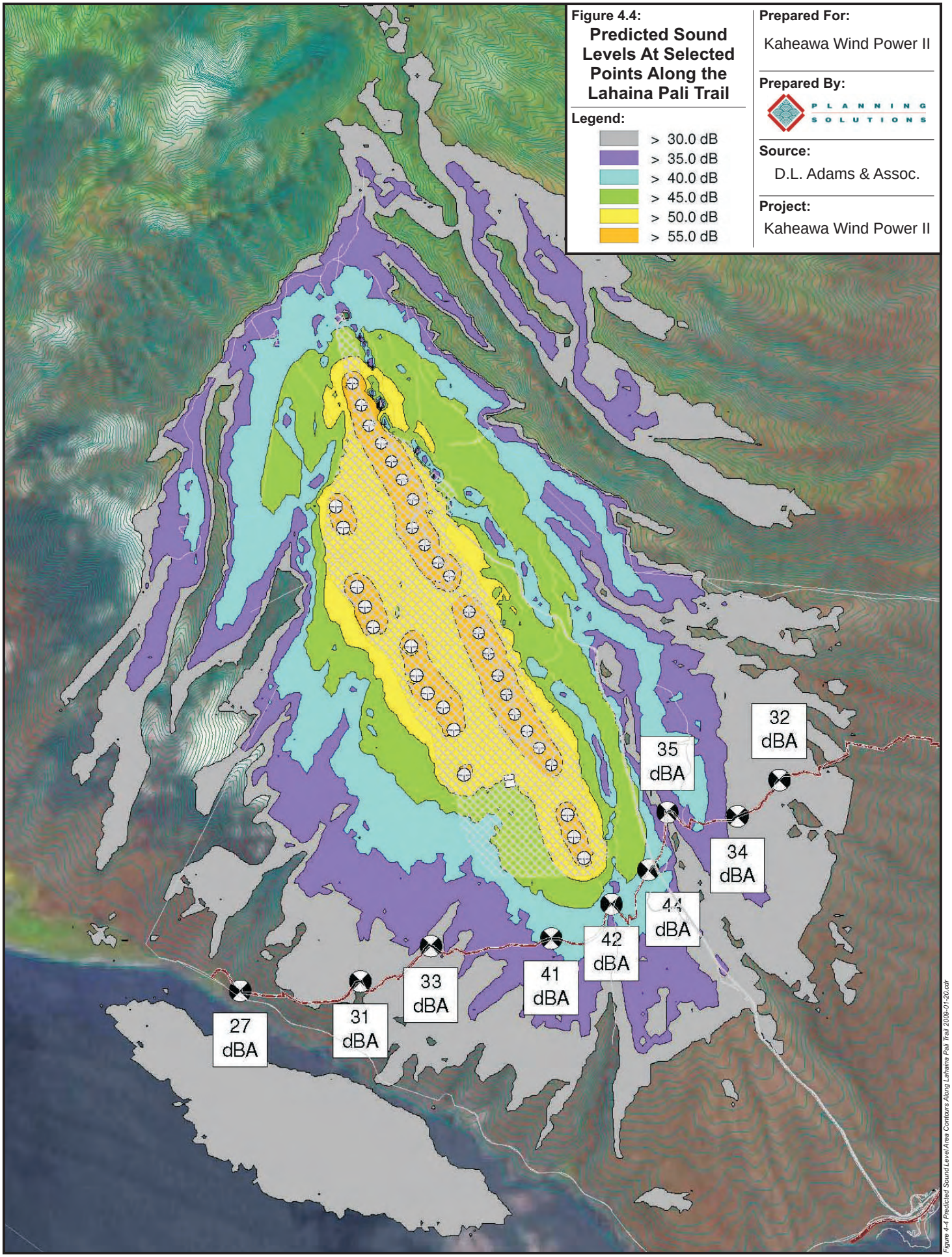


Figure 4-4 Predicted Sound Level Area Contours Along Lahaina Pali Trail 2009-01-20.cdr

4.8.3 NOISE FROM CONSTRUCTION

Construction of KWP II will involve the use of graders, excavators, bulldozers, cranes, cement trucks, haul trucks, and other heavy equipment. Some of the construction equipment and activities are inherently noisy. Earthmoving equipment, *e.g.*, bulldozers and diesel-powered trucks, would probably be the loudest equipment used during construction. In cases where construction noise exceeds, or is expected to exceed, the SDOH's "maximum permissible" property line noise levels, a permit must be obtained from the SDOH to allow the operation of construction equipment, power tools, etc., which emit noise levels in excess of "maximum permissible" levels. The DOH noise permit does not limit the sound level generated at the construction site, but rather the times at which noisy construction can take place.

While no detailed construction noise analysis was conducted for this report, the results of the sound modeling done for the WTGs suggest that development of a few areas of the site (e.g., the uppermost WTGs) may involve work so close to the property line that a contractor may wish to obtain a State DOH construction noise permit. This will require it to submit an application to the Department describing the construction activities and requesting a variance.

The State DOH may require action by the Contractor to incorporate noise mitigation into the construction plan and/or it may require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. However, because of the isolated location of the proposed work, the Department may deem this unnecessary. If a construction noise permit is granted, the contractor will be required to use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. If construction noise in excess of the standards is allowed, it will be limited to between 7:00 a.m. and 6:00 p.m., Monday through Friday and to between 9:00 a.m. and 6:00 p.m. on Saturday.

4.9 IMPACTS TO ARCHAEOLOGICAL/ HISTORIC/ CULTURAL RESOURCES

Section 3.9 describes the historic, cultural, and archaeological resources present in the KWP II project area. The majority of these (the exceptions are the *heiau* and the Lahaina Pali Trail to the south of the lease area) have been subject to data collection by qualified archaeologists and have been recommended for no further work or preservation.

4.9.1 POTENTIAL IMPACTS TO ARCHAEOLOGICAL AND HISTORIC SITES

Construction of the proposed facilities has the potential to affect historic and archaeological resources directly if it physically disturbs remains at or near the ground surface. Indirect impacts are possible if construction or operation of the facilities adversely affect the ambience of remains or the context within which they are seen or used. Similarly, direct effects on cultural resources could occur if cultural uses of an area are displaced or disturbed by the proposed facilities.

The information available from all of the studies conducted in the project area, as well as the fact that no artifacts or burials were encountered during construction of KWP I, indicates that the probability of encountering subsurface remains during construction is relatively low. However, it does not eliminate the potential entirely. In order to minimize the potential for KWP II construction to affect the existing *heiau* or other inadvertent archaeological finds, KWP II LLC proposes the measures described below.

- Contracting for Archaeological Monitoring of Construction. Prior to commencing construction, KWP II LLC will contract with a qualified archaeologist for on-site/on-call monitoring of construction work. The construction contract will make the contractor responsible for halting work and reporting any archaeological or cultural materials encountered to the archaeological monitor. The monitoring contract will provide for on-call monitoring. The proposed program of

archaeological monitoring will be conducted in accordance with Chapter 279: Rules Governing Minimal Standards for Archaeological Monitoring Studies and Reports; Hawai‘i Administrative Rules; Title 13, Department of Land and Natural Resources; Subtitle 13, State Historic Preservation Division (adopted December 2003). The proposed monitoring plan will be submitted to the SHPD for review and approval prior to beginning work, unless otherwise agreed to by the SHPD.

- Pre-Construction Conference. Before work commences on the project, the consulting archaeologist will meet with the construction supervisors and all regular members of the construction crew to identify the location of the *heiau*, review guidelines for working in the vicinity of it, and explain what other kinds of cultural or archaeological materials might be encountered and the procedures they are to follow in the event they are uncovered during the course of construction. The archaeologist will also explain his/her role and that the monitoring archaeologist will have the authority to halt construction in the immediate area of any find.
- Treatment of Finds: If cultural deposits are discovered during monitoring, appropriate data will be collected. This would include recording their geographic location on project area maps, general written descriptions, sampling, and section drawings, plan views, and photographs as appropriate. For traditional Hawaiian deposits, this may include analysis of recovered artifacts and midden and possible radiocarbon dating of samples from cultural contexts. If historic deposits are located (e.g. older than 50 years) then analysis of associated historic artifacts may be required. If any findings are deemed significant, and if the deposit is likely to be further impacted by construction activities, the archaeologist will halt work in the immediate affected area and will develop an appropriate mitigation strategy in consultation with SHPD. All cultural and historic remains other than burials will be treated in accordance with the current requirements and specifications contained in the SHPD Hawai‘i Administrative Rules (HAR) §13-280 (Rules Governing General Procedures for Inadvertent Discoveries of Historic Properties During a Project Covered by the Historic Preservation Review Process; effective December 11, 2003).

  Any human skeletal remains would be treated in accordance with the current requirements and specifications contained in the SHPD Hawai‘i Administrative Rules (HAR) §13-300:40 (Rules of Practice and Procedure Relating to Burial Sites and Human Remains: Inadvertent discovery of human remains; effective September 1996), and HRS 6E-43.6.

In the event that burials are encountered during the course of construction of the facilities, KWP II LLC will also adhere to the laws cited above relating to the inadvertent discovery of human remains. Once in operation, the project will have virtually no potential to negatively impact archaeological or historic sites so long as the *Heiau Preservation Plan* continues to be complied with.

4.9.2 POTENTIAL IMPACTS ON TRADITIONAL HAWAIIAN CULTURAL RESOURCES AND PRACTICES

No on-going cultural practices have been identified for the project area. However, prior archaeological studies have documented one significant archaeological site meriting preservation and the cultural impact assessment has identified two potential traditional cultural properties. The following subsections outline the framework for the evaluation, discuss potential effects, and outline the mitigation measures that KWP II will take.

4.9.2.1 Evaluation Framework

The OEQC “Guidelines for Assessing Cultural Impact” referred to in Section 3.9.3 identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are nature features

of the landscape and historic sites, including traditional cultural properties.[49] "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary. With one important exception, they are subject to the same kind of evaluation as any other historic resource; the exception stems from the fact that, by definition, the significance of traditional cultural properties is determined by the community that values them.

As the OEQC guidelines do not contain specific criteria for assessing the significance of traditional cultural properties, the CIA adopts the State's criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. Thus, to be significant the traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A. Be associated with events that have made an important contribution to the broad patterns of our history;

B. Be associated with the lives of persons important in our past;

C. Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D. Have yielded, or is likely to yield, information important for research on prehistory or history;

E. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

It is DLNR-SHPD's practice to consider most historic properties significant under Criterion D at a minimum; by definition, traditional cultural properties are also significant under Criterion E.

A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the State of Hawaiʻi Supreme Court's decision in the Ka Paʻakai O Kaʻāina v Land Use Commission court case. That decision established a three-step process for evaluating potential impacts:

(1) identify whether any valued cultural, historical, or natural resources are present the extent to which any traditional and customary native Hawaiian rights are exercised;

(2) identify the extent to which those resources and rights will be affected or impaired; and

(3) specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

4.9.2.2 Anticipated Cultural Impacts

As a noted above in Section 4.9.1, one site was identified that had the potential to be impacted by the KWP II. SIHP Site 5232 is an upland heiau located in the east-central portion of the KWP II area along the western edge of the existing wind farm. Oral-historical information gathered during the current study indicates that this heiau is named Hikiʻi; and it is suggested by both the archaeological studies and the oral-historical information that Hikiʻi Heiau was linked to navigational activities, perhaps associated with travel between Maui and Kahoʻolawe. Site 5232 is considered significant under Criterion D because of its important research potential and under Criterion E because of its important traditional cultural value. This site was recommended for preservation (Athens 2002; Clark

[49] The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service.

and Rechtman 2006), and a site preservation plan has already been prepared, approved, and partially implemented (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, KWP II will ensure that an archaeological monitor will be present during any development activities (e.g., grading) that occur within 500 feet of the heiau.

Archival research and oral-historical information indicate that there are two potential traditional cultural properties associated with the KWP II project area. The exposed red dirt Honua‘ula Ridge is considered to have function as a visual marker, or ko‘a, associated with local navigational practices. While the WTGs are quite noticeable, they do not obscure this natural navigation aid; hence, their impact can be considered negligible in that the ability to use this landscape feature is not diminished by their presence.

The second potential traditional cultural property is more general in nature and includes the greater project area and beyond, identifying it as a kulamanu, a place where birds (namely Nēnē, pueo, and ‘ua‘u) have historically gathered (and continue to gather) before moving in flocks to other part of Maui and to Kaho‘olawe. The US Fish and Wildlife Service has recognized this area as a significant bird habitat resources and have directed KWP II LLC to abide by a habitat conservation plan in an effort to protect and perpetuate indigenous and endangered avian species.

4.9.2.3 Mitigation Measures

The CIA makes three recommendations with respect to maintaining an on-going commitment to the preservation and enhancement of cultural properties and practices.

- Limit additional WTGs and related development to areas below (i.e., lower in elevation) the existing facilities. This will ensure that they do not intrude into what is culturally considered wao akua, or divine space.
- KWP II LLC should continue and expand upon the education outreach programs conducted by the operators of the existing wind farm. In particular, resources should be devoted to malama ‘āina (land and resource management), ho‘okele wa‘a (navigation and voyaging), and papahulilani (Hawaiian study of atmosphere).
- KWP II LLC should work with cultural practitioners and genealogical descendants of the area to establish a Kupa ‘Āina Council as an advisory group for the project area to help with educational and resource conservation planning as well as community outreach.

KWP II LLC has agreed to implement these measures.

4.10 LAND USE & SOCIOECONOMIC EFFECTS

4.10.1 LAND USE IMPACTS

The proposed KWP II facility would be located in open meadows and adjacent to existing roadways on a remote ridge. It is close to the existing KWP I wind-generating facility. There are no existing uses of the pasture area other than wind generation. Discussions with DLNR staff have indicated that the proposed KWP II project will not interfere with other existing or potential uses of the State land that the proposed facilities would encumber (via the proposed lease). The presence of the WTGs, site access roads, substation, and related facilities would not limit access to other land served by the existing access road.[50] As discussed elsewhere in this report, the proposed facilities will not degrade the usefulness of the upland area as habitat for Nēnē or other important avian species.

The parcels in which the proposed project and existing access road are situated, are designated as Section(b) Ceded Lands. These lands belonged to the Hawaiian Kingdom at the time of the 1893 overthrow and later transferred ("ceded") by the United States government to the State of Hawai‘i upon statehood. Today, the State holds the Ceded Lands corpus in trust for Native Hawaiians and the general public. OHA receives a portion of all revenues generated on these lands and will, therefore, receive a portion of the amount that KWP II LLC pays to the Department of Land and Natural Resources for the lease of the 333-acre project site.

The presence of the proposed facilities will not interfere with continuing recreational use of the Lahaina Pali trail, although it will be quite visible from portions of it (see Section 4.11.4.1). The proposed KWP II facilities would be visible from only a few other areas, none of which is proposed for land uses that might be particularly sensitive to the presence of the WTGs and/or related facilities. Hence, the construction and operation of the proposed facilities will not interfere with any existing or likely future land uses.

4.10.2 SOCIO-ECONOMIC IMPACTS

Construction and operation of the proposed facilities will have a number of socio-economic impacts. Direct socio-economic effects of the proposed facilities include: (1) construction employment and business activity; (2) ongoing employment of facility staff (which would be relatively limited); and (3) ongoing expenditures for materials and outside services; and (4) State revenues in the form of excise taxes, lease revenues, and other taxes. These are discussed below. Additional benefits are discussed in Section 1.2.

4.10.2.1 Construction Employment and Expenditures

As reported in Section 2.4, the total estimated cost for construction is $68 million. In order to estimate the effect that these expenditures would have on the Maui and State economy, KWP II LLC first split each of the construction cost line items in Table 2.4 between those that would be spent in-state and those that would be spent out-of-state. Those estimates indicate two-thirds of the expenditures are allocated for equipment and materials that would be purchased out of Hawai‘i; the remaining one-third would be spent in-state.

[50] Note that the State restricts use of the existing access road at the present time and will continue to do so in the future. It must grant permission to those who wish to use it and allow them entrance through the locked gate that is at the intersection of the access road and Honoapi‘ilani Highway.

Table 4.15. Allocation of Construction Costs Between Out-of-State and in Hawai‘i.

Item	*Order-of Magnitude Cost (in million 2006$)*	*Location of Expenditures (% of Total)*		*Expenditures (in million $) by Location)*	
		Out of State	*Hawai‘i*	*Out of State*	*Hawai‘i*
Access Road/Site Development	$4.0	0%	100%	$0	$4.0
Wind Turbine Equipment	$31.0	100%	0%	$31.0	$0.0
Wind Turbine Installation/Balance of Plant	$8.0	40%	60%	$3.2	$4.8
Transportation and Logistics	$6.0	50%	50%	$3.0	$3.0
Electrical Substation, Collection Lines, & Interconnect	$18.0	70%	30%	$12.6	$5.4
Operation and Maintenance Facility	$1.0	0%	100%	$0	$1.0
TOTAL	**$68**	**66%**	**34%**	**$49.8**	**$18.2**

Source: Compiled by Planning Solutions Inc. based percentage and cost on estimates by KWP II LLC.

The State of Hawai‘i Department of Business, Economic Development, and Tourism (DBEDT) has developed an econometric model that allows it to estimate the impact that construction expenditures such as those shown in Table 4.15 have on the State and County economies (see Figure 4.5).[51] The figure shows how money spent in construction expenditures creates *indirect* economic activity in addition to the *direct* economic activity in the construction industry itself. The figure shows that, on average, a dollar in *direct* construction spending actually generates, nearly $1.27 of total output in the economy.[52]

A module of the State Input-Output model refines the statewide figures and allows the model to produce estimates of the effect that construction expenditures in individual Counties will have on the overall level of business output, earnings, and employment. The multipliers in that model were applied to the $18.2 million dollar in-state direct expenditure estimate to calculate the direct, indirect and induced output effects (in dollars) and jobs (in person-years of employment) that are shown in Table 4.16.

The lower boxes in Figure 4.5 provide a rough indication of the way in which this economic activity is likely to be distributed among the key industries that provide inputs into the construction sector. They show that most of the output, jobs, and income from construction spending generated is in the construction industry itself.[53]

4.10.2.2 Operational Employment

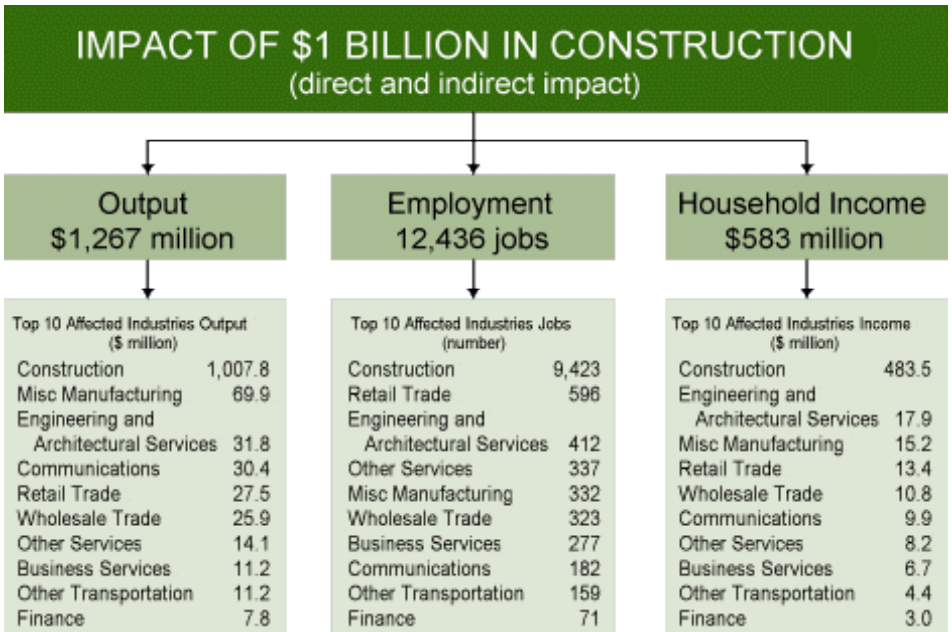
KWP II estimates that 10-12 workers will be present at the proposed facility once the project is completely operational. The team of employees will consist of 1-2 biologists, a plant manager, contractor, road maintenance worker, and a crew of 6 people from General Electric. Not all of these will be on-site at one time.

[51] The estimates are the product of the State of Hawai‘i Department of Business, Economic Development and Tourism (DBEDT, 2002) Hawai‘i Input-Output Model. This input-output model, which is based on historical economic data in Hawai‘i, estimates the extent to which the direct economic inputs from various activities lead to indirect economic effects.

[52] The output is defined as the value of sales for most industries and "trade margins" for a few industries such as retail and wholesale trade, which do not actually make the goods they sell.

[53] Note, that this more detailed breakdown applies at a statewide level and should not be compared directly with the estimates from the County-level model.

Figure 4.5 Impact of Construction Expenditures on Hawaii Economy.



Source: Department of Business, Economic Development, and Tourism.

Table 4.16. Impact of Project-Related Expenditures on Economic Output, Earnings, and Employment in Hawai‘i.

Parameter	*Type 1 (Direct & Indirect*		*Induced*		*Total (Type 2)*	
	Multiplier	*Amount*	*Multiplier*	*Amount*	*Multiplier*	*Amount*
Output	1.42	$25.8 million	0.54	$9.8 million	1.96	$35.7 million
Earnings	0.45	$8.2 million	0.14	$2.5 million	0.59	$10.7 million
Jobs	13.00	237 Person-yr	5.30	96 Person-yr	18.30	333 Person-yr

Source: Compiled by Planning Solutions, Inc. using Expenditures from Table 4.16 and factors from State of Hawai‘i Department of Business, Economic Development and Tourism (DBEDT, 2007) Hawai‘i Input-Output Model (Maui Inter-County module).

4.10.3 STATE REVENUES

KWP II LLC will lease the property on which the proposed facilities would be constructed from the State of Hawai‘i. The exact terms of the lease have not yet been negotiated, but based on the precedent set for KWP II, it expects that the amount will be based, in part, on the amount of power that the facilities produce and the terms of the power purchase agreement that KWP II LLC is able to negotiate with MECO. Assuming that those are as described elsewhere in this report, the State would receive approximately $6 million dollars per year. The State would also derive tax revenues from in-state purchases of equipment and supplies and from taxes on workers' and businesses' incomes.

4.11 SCENIC AND AESTHETIC RESOURCES

This section discusses the effect that construction and operation of the proposed facilities would have on scenic and aesthetic resources. It is divided into four main parts.

- Section 4.11.1 identifies the project-related structures and activities that have the potential to affect these resources.
- Section 4.11.2 describes the methodology that was used to identify and evaluate these effects.
- Sections 4.11.3 and 4.11.4 discusses the anticipated visual effects of the proposed facility from various public vantage points.

4.11.1 PROJECT COMPONENTS WITH POTENTIAL TO IMPACT SCENIC & AESTHETIC RESOURCES

Some of the proposed structures (e.g. the operations and maintenance building, the electrical substation, the warehouse-type structure housing the BESS system, etc.) are relatively low and resemble other structures that are present in remote upland parts of the West Maui Mountains. They would not be visible/barely visible from the lowland areas where most people are present. Even from the Lahaina Pali Trail, the one public right-of-way that passes close to the KWP II site, these facilities would be relatively unobtrusive.

The proposed WTGs, on the other hand, are much taller and bulkier. Hence, even though they are the same size, shape, and color as the immediately adjacent KWP I WTGs, they still have a much greater potential to affect views and other aspects of the visual environment.[54]

Once constructed, the KWP II facility will produce no visible airborne emissions and likely will result in a decrease of visible emissions in the region by decreasing the amount of fossil fuel that must be burned at the Mā‘alaea Generating Station. The visible impact to air quality therefore will be limited to the construction period, where some dust and smoke produced in the construction process may be temporarily generated (see Section 4.3.1).

4.11.2 VISUAL IMPACT ASSESSMENT METHODOLOGY

The visual impact assessment methodology involved two major parts. The first was aimed at identifying locations on the island from which the proposed facilities would be visible and providing a quantitative measure of the extent to which they might be obtrusive. The second step was designed to produce photo-renderings that illustrate the appearance of the hillside from selected vantage points with and without the proposed project. The methodologies used for each of these are summarized in the following subsections.

[54] Because of their height, the two permanent meteorological monitoring towers and the communications tower that are proposed would also be visible, but they are much less bulky than the WTGs. That, and the fact that their final siting has not yet been completed, has led us to omit them the graphics.

4.11.2.1 Methodology Used to Identify Areas from which the Facilities Would be Visible

The following methodology was used to identify areas on the island from which the proposed facilities would be visible and providing a quantitative measure of their visibility.

- Creating a computer model of the terrain to graphically depict the viewshed. This was done using elevation data downloaded from the USGS National Elevation Dataset (URL: http://seamless. usgs.gov/website/ seamless/ viewer.htm).
- Geo-referencing the turbine locations. This was done using X-Y (latitude-longitude) coordinates from First Wind for each of the WTGs.
- Adding a Z (height) value to each of the WTG locations. This was done using information on the proposed tower height (212 feet above ground level, or agl), the height of the tips of the blades (328 feet agl), and the height of the observer (6.5 feet agl).
- Mapping the Areas from Which the Proposed WTGs Could be Seen. This was done using ESRI® ArcView® Spatial Analysis Extension software together with the terrain model and information on the WTGs described above.[55] The Spatial Analysis software provided digital rasters with pixel sizes of 0.00028 degrees latitude and longitude, which represents approximately 10,000 ft.$^{2.}$
- Graphically Depicting and Tabulating the Model Results. The ESRI software produced maps showing areas from which the proposed (i.e., KWP II) WTGs could (and could not) be seen.
- Depicting the Extent of Change in WTG Visibility. The ESRI software also produced maps and tables showing the extent to which proposed additional Kaheawa WTGs would increase the area from which Kaheawa WTGs would be visible. Two viewsheds were considered in producing the tabulations; one that consists only of the land area of the island of Maui; the other included the entire available digital elevation data set encompassing surrounding waters and islands like Molokini and the northern exposure of Kahoʻolawe. This viewshed analysis revealed the locations on and offshore of the Island of Maui from which the proposed KWP II facility would be most visible.

4.11.2.2 Methodology Used to Produce Photo-Renderings

The methodology used to produce photo-renderings that illustrate the appearance of the hillside from selected vantage points with and without the proposed project as follows.

- Identifying the critical vantage points to consider. Previous studies and environmental impact evaluations of the existing KWP I wind generation facilities were reviewed to determine which types of vantage points are of greatest concern to the people and businesses that would see them. Comment letters on the EIS for the existing KWP I facility were helpful in this regard.
- Selecting Four Vantage Points for Detailed Analysis. These vantage points included: (1) the Lahaina Pali Trail; (2) Olowalu; (3) Māʻalaea Bay/Kīhei Town; and (4) Wailea. Initially it was thought that we would also depict the effect on views from up-country on Haleakala, but a site visit to that area confirmed that the proposed KWP II facilities are too far from that region and from the closest point on the National Park to have a measurable effect on views from that area.[56]
- Creating a Computer Simulation of Views from the Selected Vantage Points. ESRI® ArcView® Spatial Analysis Extension software was used with the terrain and facility information to create a 3-

[55] The facility would also be visible from some locations offshore or above Maui (i.e., boats or aircraft flying overhead). These were not mapped.

[56] The proposed KWP II WTG array may be visible on clear days from certain vantage points on the slopes of Haleakalā. With a distance of over 15 miles to Makawao, and 20 miles to the summit of the volcano, it is unlikely that many people at these viewpoints would notice the wind turbines unless they were specifically looking for them or were using magnification apparatus like a telescope, binoculars or a telephoto lens and only in the clearest possible weather and visibility conditions. Also, because of the intervening Kealaloloa Ridge, most areas on Haleakalā would have limited line of sight to the proposed facilities.

dimensional computer model that allowed the appearance of the proposed facilities to be represented from the selected vantage points.

- Converting the Computer Simulation into a Photo-Simulation. In order to make the graphical representation of the proposed project's appearance as realistic as possible, actual photographs of the terrain taken from the selected vantage points were combined with photographs of GE 1.5 MW WTGs of the type that are proposed to create a photo-simulation of the project as seen from each of the selected locations. The computer model allowed the graphical representations of the WTGs to be sized accurately.

4.11.3 ISLANDWIDE VISIBILITY

As shown by the viewshed analysis maps in Appendix C, the proposed new turbines would be substantially less visible from the most populous areas of the island than are the existing WTGs that make up KWP I. People in most of the areas from which the new WTGs would be visible can already see the existing turbines, and in general the existing turbines are more visible than the proposed new array. The area that would experience the greatest visual change as a result of the additional WTGs is Olowalu and the shoreline immediately east of that. Even there, the change is modest (see Section 4.11.4.2 for a detailed discussion).

4.11.4 VISUAL IMPACT ANALYSIS BY LOCATION

Wind turbine generators are, by their nature and design, conspicuous, and for many observers represent an intrusion on views of the existing landscape. Because of this, KWP II LLC paid considerable attention to the siting of the machines, choosing an area close to the existing wind farm (to avoid creating an entirely new visual object) but in an area that is least visible from developed areas and important viewpoints. The remainder of this section uses real photographs and the visual simulation methodology described in Section 4.11.2.2 to depict the changes that the proposed project will make to views from the selected vantage points that were previously discussed.

4.11.4.1 Lahaina Pali Trail

The Na Ala Hele website describes the Lahaina Pali Trail as follows:

> *"Trail runs from a point near Mā'alaea Harbor with refreshment stands and restrooms, over a ridge and down to a long, sandy beach with snorkeling, surfing and picnicking facilities. Ranging in elevation from 100 to 1,600 feet, the trail offers excellent scenic vistas of Kaho'olawe and Lāna'i islands. Whales can be observed during the winter months. Scrub vegetation at the lower elevations gives way to endemic dry-land plants as the trail climbs. The Old Lahaina Trail is part of the historic around-the-island trail system on Maui."*

Many of the existing WTGs are visible from the trail (see the turbines toward the right-hand side of Figure 4.6. The additional WTGs that are proposed would both increase the number that can be seen and cause persons using the trail to pass closer to them. Hikers along the Kaheawa Pastures section of the trail would have a clear view of these turbine arrays, with little natural vegetation to screen them from their presence. Two factors help limit the significance of the impact. First, the turbine nearest the trail would still be more than 900 feet away and would only be closely visible as hikers traverse the project site (which constitutes a small segment of the overall trail). Second, the fact that the additional WTGs are nearly identical in appearance to the existing WTGs means that the fundamental nature of the views will not significantly change. Nonetheless, it is evident that the proposed new turbines will have a more commanding appearance when seen from the trail than do the existing WTGs, even though the latter are more numerous.

4.11.4.2 Olowalu

Terrain makes the existing wind farm and the KWP II site invisible from Lahaina and other urbanized areas on West Maui. Hence, the facilities are only visible from the West as one reaches and passes the small town of Olowalu. Even from there, the effect is limited. None of the existing WTGs at Kaheawa Pastures are visible from the developed areas of Olowalu at the present time. This is due to the effect of intervening terrain and existing vegetation. There are some points along the shoreline in the Olowalu area from which a few of the existing WTGs are visible, but the fact that most of the structures are obscured by the terrain and the considerable intervening distance mean that they are a minor part of the landscape.

As can be seen by the photo-simulation reproduced as Figure 4.7, construction of the proposed project will place a few more WTGs within eyesight of people along the shoreline when there is no intervening vegetation. However, because of the distance that is involved (approximately 4.3 miles from the point where the picture was taken to the closest turbine), the proposed new WTGs and other facilities will not significantly alter views even from the few locations where they would be visible.

4.11.4.3 Māʻalaea Bay

This vantage point is situated along the shoreline of Māʻalaea Bay near the western end of Kealia Pond. Views from this location are representative of those from other shoreline segments at a similar distance from the KWP II site. The views are also available (in slightly modified form) to persons in the upper floors of buildings further east in Kīhei and to drivers and passengers in cars on Honoapiʻilani Highway. Residents of low-rise buildings and people in cars on Kīhei Road generally cannot see Kaheawa Pastures because of intervening vegetation and buildings.

Most of the WTGs that can be seen along the ridgeline from this vantage point in the photo-simulation reproduced as Figure 4.8 belong to KWP I. Only four proposed WTGs (the ones on the far left) are fully visible; the very tops of a few other KWP II machines can be seen intermingled with the existing turbines. The distance (3.7 miles and 3.8 miles to the closest proposed and closest existing, respectively) makes all of them appear relatively small, but they are still an obvious presence on the otherwise undeveloped West Maui Mountain. Nonetheless, the presence of the existing turbines means that the proposed addition will not alter the situation significantly. In this regard it is worth noting that as discussed in Section 2.5.2.1 of this report, the “upwind siting area” that was being considered at the time the EISPN for the project was issued was eliminated from further consideration in part because of its greater visibility from central Maui.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Original Photo taken April 22, 2008)

Note: This rendering does not show the proposed new access road or substation.

Figure 4.6:

Simulated View of KWP II Turbines from Lahaina Pali Trail

Kaheawa Wind Power II

Figure 4-6 Simulated View of KWP II from Lahaina Pali Trail 2009-01-20.cdr

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Photo taken April 22, 2008)

Figure 4.7:

Simulated View of KWP II from Olowalu

Kaheawa Wind Power II

Figure 4-7 Simulated View of KWP II from Olowalu 2009-01-20.cdr

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Photo taken April 22, 2008)

Figure 4.8:

Simulated View of KWP II from Ma`alaea Bay

Kaheawa Wind Power II

Figure 4-8 Simulated View of KWP II from Ma`alaea Bay 2009-01-20.cdr

4.11.4.4 Wailea

As indicated by the photograph to the right (which was taken from the shoreline near Wailea), as one moves farther from the West Maui Mountains all of the features become indistinct. Because of this, there is no potential for the project to have a significant impact on views from this area. Nonetheless, because views from residences are a particular concern, we prepared a visual simulation of views from existing development at Wailea (which is a little less than 10 miles from Kaheawa Pastures) as a means of illustrating the changes that would occur if the proposed project is approved and constructed. Figure 4.9 shows the results of that simulation. [Please note that because the WTGs would have been indistinct if they were portrayed at the size they would actually appear to the human eye, the scene had to be magnified (i.e., made larger than they would actually appear to the unaided eye). This means that the photo-simulation overstates the visibility of the wind farm.]

The existing WTGs are the ones on the right hand side of the figure; the proposed new turbines are on the left. The closest of the three proposed WTGs are in the down-string siting area; the eleven that are behind those are in the downwind siting area. Because the viewpoint is elevated (the ground elevation is approximately 160 feet above sea level), it is possible to see virtually all of the machines, not just the top portions as is the case from some of the closer vantage points.

Because the proposed WTGs are joining ones that are already present, they do not represent an entirely new feature on the mountainside. Instead, they add to the cluster that is already visible. For viewers who have grown accustomed to the existing wind farm and have positive attitudes toward renewable energy, the addition will tend to go largely unnoticed. For those who are already bothered by the intrusion of large structures into an area that is otherwise natural, KWP II will be an imposition.

4.12 HAZARDOUS MATERIALS

Construction and operation of the proposed KWP II project will involve the use of small amounts of several hazardous materials that require special handling and storage. These may include such materials as waste aerosols, gel-cell batteries, combustible liquid materials, chemicals and paint. Operation of the facility will require on-site storage of cleaning products and mineral, hydraulic and lubricating oils for maintenance of the substation and WTG equipment. As noted previously, the batteries that are part of the BESS system do not contain hazardous materials.

These will be identified, along with measures for containment and spill prevention, in a SPCC Plan for the KWP II facility. The plan will comply with applicable federal, State, and local regulations that govern the use of hazardous materials and the disposal of hazardous wastes. The following sections summarize the possible hazmat issues and the types of containment, spill prevention and cleanup measures that KWP II will include in its SPCC.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

Planning Solutions, Inc.
(Photo taken April 22, 2008)

Figure 4.9:

Simulated View of KWP II from Wailea

Kaheawa Wind Power II

Figure 4-9 Simulated View of KWP II from Wailea 2009-01-20.cdr

4.12.1 CONSTRUCTION PERIOD RISKS

Releases or spills of hazardous materials during construction could occur during transport of construction materials to the site, temporary storage and staging, or during grading or construction of the proposed WTGs, substation, and associated structures. Petroleum products used to power and lubricate the construction equipment are by far the most likely of the potential contaminants. The risk of harm will be minimized by requiring the contractor to follow best management practices, including proper containment of staging and stockpiling areas, provision of spill kits, regular waste collection and disposal, frequent equipment inspection, and off-site refueling and vehicle washing at an approved location.

4.12.2 OPERATIONAL PERIOD RISKS

Operational releases of hazardous materials would most likely emanate from one of the areas where they will be stored. These storage areas will include: 1) the Operations and Maintenance (O&M) building; 2) the WTG sites; and 3) the substation and BESS enclosure. Each of these is discussed in further detail below.

Operations and Maintenance Building. The O&M building will contain products/materials needed for routine O&M which includes mineral oil (~55 gallons), hydraulic oil (~5 gallons), grease tubes (5 to 6 cases), a waste oil container (~55 gallons), and cleaner/degreaser (~20 gallons). These items will be stored on a spill retentive skid or absorbent sheets. Diesel fuel will be stored in small containers (i.e., 5 gallon capacity) outside the O&M building.

Wind Turbine Generators. Each wind turbine site will include two storage containers: (1) a gear box; and (2) a step-up transformer. The gear box stores 64 gallons of hydraulic and lubricating oils and is contained within the nacelle, which is located on top of the WTG tower. Nacelles have catch basins capable of containing small oil spills. Larger spills would overflow into the tower and be contained at the tower's base, which is sealed at the foundation. A pad-mounted step-up transformer is located adjacent to the base of each wind turbine. Each transformer contains approximately 522 gallons of mineral oil. There is no secondary containment in place.

Electrical Substation. The new substation that would be constructed for KWP II will contain a large transformer, a distribution step-up transformer and a grounding transformer. Together, these will cumulatively store approximately 4,000 gallons of mineral oil. The main transformer will be surrounded by a containment dike. The distribution transformer will be pad-mounted and surrounded by six inches of ¾-inch washed gravel, and the grounding transformer will be mounted on an aerial platform and also surrounded by 6 inches of ¾-inch washed gravel.

4.12.3 CONTAINMENT, SPILL PREVENTION & CONTROL MEASURES

The SPCC Plan that KWP II LLC will prepare for the KWP II facility will include emergency contacts, an emergency action plan, organizational roles and responsibilities, site-specific contingency plans, information on hazards analysis, response functions, public information and community relations, as well as information on spill containment and cleanup. It will likely closely follow the existing SPCC for the KWP I facility. The SPCC will include (but will not be limited to) the following types of prevention and control measures:

- *Personnel Training:* As required by 40 CFR 112.7(f)(1) and (3), oil handling personnel will be trained to prevent discharges. KWP II personnel will participate in periodic training for oil spill prevention and cleanup. This training will include familiarization with oil pollution prevention measures at the site, the Spill Prevention, Control, and Countermeasure Plan, and available spill cleanup supplies. Contractors and other transient personnel will be advised of applicable spill prevention measures upon entering the site.

- *Security:* The project is located in a remote area on State Conservation lands above McGregor Point in the West Maui Mountains. Access to the state lands is controlled by a locked gate and signage warning that the road is closed to the public. The Lahaina Pali Trail runs across the access road about 3,000 feet to the south of the southernmost existing WTG. Signage is in place to warn hikers that the access road is closed to the public and to stay on the trail. The gear boxes are located within the nacelle and require no additional security. The step-up transformers at the individual wind turbine sites are located on access roads that are closed to the public. These transformers have pad-locked and wrenched locked cabinets which prevent access to the level gauges and valves that could result in oil discharge. Security fencing and gates are installed around the substation where the largest oil containing transformers are located. These factors ensure that vandalism is a low risk. The O&M building is kept locked. The 5 gallon diesel containers are stored outside and in an area that is not easily seen while approaching the building.
- *Inspection Protocols and Recording:* Facility inspections will be conducted monthly for wind turbine sites, the substation, all containment structures, and all storage containers. The results will be documented and the records retained in accordance with 40 CFR 112.7(e).
- *Spill Response, Reporting and Cleanup:* KWP II LLC will develop "Spill Response and Reporting Procedures" for the proposed facility. The procedures will specify the clean-up and reporting requirements for small spills (less than 5 gallons) and larger spills (equal to or greater than 5 gallons). If the spill or release cannot be contained, the Maui Fire Department will be contacted. Spill reporting may include notifications to the National Response Center (NRC), US EPA, and the State Department of Land and Natural Resources.
- *Transformer Inspections.* The large transformer in the substation will be inspected for rainwater monthly. If there is no sheen present, the rainwater will be pumped out of the concrete pit. If sheen is present, a spill response contractor or facility personnel will provide clean-up.
- *Containment Measures:* The SPCC regulations in 40 CFR 112.8(b) require facilities to prevent potential discharges from un-diked areas (such as the land containing the step-up transformers located at the base of each wind turbine) by designing facility drainage systems to flow into catchment basins or lagoons. Many of these areas are located such that a spill would not reach navigable waters or cause a violation of water quality standards due to the existing topography and/or the distance to wetlands or surface water. KWP II LLC will conduct a site visit and analysis to determine which, if any, of the WTG sites are situated so that a spill could potentially reach navigable waters. At these turbines, KWP II LLC will identify appropriate secondary containment measures.
- *Spill Prevention Procedures:* No fuel will be transported to or stored at the KWP II facility with the exception of a very small quantity of diesel fuel (~5 gallons). When transferring hazardous product to or from a storage container, personnel will be instructed to load or unload in approved locations only, verify the remaining volume of the receiving container, allow sufficient volume (approximately 10 percent of the total capacity) in the container for thermal expansion, and visually inspect all valves for leakage when transfer is complete.

4.13 PUBLIC INFRASTRUCTURE AND SERVICES

The proposed KWP II project has little potential to affect public infrastructure and services adversely.[57] It would consume only small amounts of electrical power, and this would be delivered through the substation and power distribution equipment that are being installed as part of the project. All of the water needed for the facility would be trucked up to the site; no new potable water service

[57] The need for public agencies to respond in the event of an accident is an exception to this general rule. However, this responsibility already exists and would minimally alter any of the action alternatives being considered.

would be required. Similarly, no significant impacts on transportation, telecommunications, or other utilities are anticipated.

4.13.1 TRANSPORTATION FACILITIES

This section describes the effects that the proposed project would have on transportation facilities in the region. While the focus is principally on land transportation facilities (i.e., roads and highways), the discussion also covers air and water transportation.

4.13.1.1 Vehicular Traffic & Roadways

All of the equipment, employees, and materials needed for construction and operation of the WTGs and related facilities would access the site from and the existing roadway serving KWP I. Honoapiʻilani Highway is the main highway serving West Maui, and it is designed and constructed to accommodate heavy vehicular traffic. The existing Kaheawa Pastures access road is owned by the State of Hawaiʻi and was upgraded in conjunction with the development of KWP I. Access is controlled by DLNR, which shares responsibility for the road's upkeep with KWP I LLC. As indicated in Section 3.13.1, existing traffic on Honoapiʻilani Highway is moderately high during the day, but there is remaining capacity.

4.13.1.1.1 Construction-Phase Trip Generation

Construction of the proposed facilities would generate vehicle traffic on area roadways throughout the construction period. Most of these trips would be associated with employee commute trips to and from working areas and with the delivery of construction materials to staging areas. No work is planned in existing highway rights-of-ways under the preferred alternative, however the transport of large pieces of equipment may cause temporary traffic delays and will require traffic control measures to minimize disruption. Those measures are outlined in Section 4.13.1.1.3.

Employee Work Trips. Compared with large-scale development projects, construction of the proposed facilities involves relatively few employees. During much of the time on-site employment is expected to range between 30 and 60 workers; it could reach as many as 100 workers for a few weeks during the busiest period. Because of the limitations of the access road and the need to give first priority to construction materials and equipment, it is expected that most employees will car pool. In some cases this will be from company baseyards located in Kīhei, Kahului, or elsewhere; in others the workers will rendezvous in the parking area situated adjacent to the intersection of the access road and Honoapiʻilani Highway.

When all factors are considered, we estimate that employees will average at least two persons per vehicle and will, therefore, generate an average of 30 to 60 one-way vehicle trips per day to and from the highway/access road intersection. Nearly all of these are expected to be to and from Central Maui, although a few may be to and from West Maui. During its busiest week, this might rise to 100 one-way-vehicle-trips per day. Assuming typical work schedules, most of the "to-work" trips would be between 6:30 and 7:00 a.m.; most of the "from-work" trips would be between 3:30 and 4:00 p.m.

Equipment Delivery Trips. Construction of KWP II will involve the importation of several relatively large pieces of equipment.[58] These include the WTGs, transformers, and substation equipment. Many smaller pieces of equipment will be needed as well. Figure 4.10 contains photographs of some of this equipment. These will have to be imported to the Island. Most of the larger pieces of equipment are presently being stored in Kīhei and would be trucked from there to the project site as needed.

[58] The WTG support poles will be brought to the area in sections and assembled there, limiting the size of the pieces that must be transported over public roadways.

A. Harbor unloading of WTG segment.

B. Trucking of WTG tower segment.

C. Truck transport of WTG blade.

D. Truck transport of WTG nacelle.

Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Source:

First Wind

Figure 4.10:

WTG Equipment Transport Photographs

Kaheawa Wind Power II

Figure 4-10 WTG Equipment Transport Photographs 2009-01-20.cdr

Each WTG tower is made up of four oversize pieces. The rotors are also comprised of four large pieces (the hub three blades). Each of those, together with the nacelle (which contains the generator and gearbox), must be transported individually to the project site and trucked up the mountain to their final positions. While the total number of delivery trips needed for this equipment will be low (8*14=126), with fewer than 4 to six occurring on even the busiest day, the oversize vehicles that are needed for the deliveries slow traffic from the posted speed limit to about 25 miles per hour.

Concrete and Steel for Foundations. Substantial amounts of steel and concrete are required for each of the WTG foundations. While the exact amount will not be determined after final geotechnical and structural analyses are completed, it is expected that each foundation will require 300 to 400 cubic yards of concrete. Assuming the 11-cubic yard-capacity concrete mixer trucks that would be used can be filled to no more than 80 percent of their capacity because of the steepness of the grade of the roadway access to the site and the need for one large truckload of reinforcing steel, each foundation would require 35 to 50 round-trips by heavy vehicles. Because concrete must be poured within 90 to 120 minutes of the time it is placed in the mixer trucks and the pour must be continuous (i.e., all of the concrete must be placed without interruption), the pours concentrate these concrete truck-trips over a period of a number of hours.

Excavated Material and Select Fill. The plans for the project call for a balancing of cut and fill during the civil works portion of construction. Hence, only select material (mostly gravel) must be brought to the site by truck; the remainder will simply be used from one place to another within the overall site. The majority of select fill would be used on the access road, but some would also be used for the WTG pads, the substation site, and other purposes.

Current estimates are that a total of approximately 20-30 truckloads of material will need to be delivered to the site over a period of about 12 weeks (amounting to 2 or 3 truckloads per week). Because this road work cannot readily take place on days when the access road must be used for other purposes, this component of traffic generally does not overlap other project-related traffic.

Total Construction Period Trip-Generation. As can be seen from the preceding discussion of trip generation by various components of the project, project-related vehicle-traffic will vary greatly over the course of construction with respect to the number and timing of trips made each day and the kinds of vehicles that will be involved.

- On most days, employee vehicle trips (made mostly in passenger cars, light trucks, and vans) will be the predominant type of travel, and the bulk of this will occur from 6 to 7 a.m. (arriving) and from 3:00 to 4:00 pm (departing) Monday through Saturday. Little other project-related traffic will be generated during these hours. Hence, the proposed project will generally add from 30 to 50 vehicle-trips to the existing highway traffic during these hours.
- The concrete pours, which will generate the most intense volume of project-related truck traffic, will occur on only fourteen days (one for each of the WTG tower foundations). Because the trips will be spread over a number of hours during the work day, the total vehicle-trips produced by this component in any given hour will be substantially less than the number of trips during the morning and afternoon commute period.
- Transportation of the large pieces of equipment that make up the project will generally occur during off-peak hours. This is outside the hours during which other construction is underway and will not, therefore, have a cumulative effect on traffic. Hence, it is the large size of the transport vehicles and the need for them to move carefully and slowly when turning into and out of the access road that is of greatest concern here.

4.13.1.1.2 Operational Phase Vehicle-Trip Generation

The majority of the vehicular-traffic associated with the proposed facilities would be employees reporting to or leaving the facility; service trips by MECO maintenance personnel would add a few additional vehicle-trips to this. The number of trips that this would generate is summarized in Table

4.17. The compilation, which is for the initial years of operation when the facility is likely to demand the greatest staffing, makes it clear that operation of the project would not place significant numbers of vehicles on area roadways.

Table 4.17. Anticipated Vehicle Trips During Operation of KWP II.

Time Period		*In-Bound Vehicle-Trips*	*Outbound Vehicle-Trips*	*Total Vehicle-Trips*
5:00 am to 9:00 am	Employee	5	1	6
	Other	0	0	0
9:00 am to 3:00 pm	Employee	1	2	3
	Other	2	2	4
3:00 pm to 11:00 pm	Employee	2	5	7
	Other	0	0	0
Note: Periodic inspections and maintenance activities would bring a few additional personnel to the facility for at most a few days each year. These might increase the number of round-trip employee commute trips by 5-10 per day for up to a week.				
Source: Compiled by Planning Solutions, Inc. using employee estimates by KWP II LLC.				

4.13.1.1.3 Traffic Impact Mitigation Measures

As discussed above, project-related construction and operation traffic will not significantly increase the number of vehicles traveling on Honoapiʻilani Highway. However, two aspects of the construction period vehicle-trips do require particular attention and mitigation. The first is the large size of the trucks needed to transport components of the WTGs to the access road. The second is the intense movement of concrete mixer trucks to and from the site when the foundations for the WTGs are being poured.

These issues were dealt with successfully during work on the KWP I project, and the measures take to accomplish that will be used during construction of the facilities that are proposed for KWP II as well. Those measures include the following:

- *Police Escort*. The trucking company that will transport the large WTG pieces now being stored in Kīhei to the intersection of the site access road and Honoapiʻilani Highway will arrange for a police escort. The escort will ride ahead of the truck warning other traffic of the oncoming load and stopping other vehicles for the few turns that are required.
- *Traffic Control at Honoapiʻilani Highway/Access Road Intersection*. The entrance to the access road will be manned by two people during construction working hours. They will work as flagmen to stop other traffic for the 1-2 minutes that are needed for the large trucks to turn into and out of the site access road.
- *Traffic Control on Site Access Road*. Different trucks are used to carry heavy equipment up the hill than are used to deliver it to the staging area at the bottom. Trucks regularly using the road are equipped with radio communication equipment so that they can be contacted while on-route, and turn-out areas are provided along the side of the road so that passing can be coordinated.

4.13.1.2 Impacts to Airports & Air Traffic

The proposed project would not generate significant amounts of passenger or cargo traffic at Maui's airports. Consequently, the only mechanism through which it could affect air transport is by obstructing the airspace used by the aircraft that provide this service.

The proposed wind turbines are of a height that requires KWP II to submit a construction Notice of Intent to the Federal Aviation Administration. This was done for the existing WTGs, and the FAA determined that so long as they were properly lighted they would not constitute a hazard to air navigation.

KWP II LLC is presently preparing a notification to the FAA that describes the proposed new structures. It anticipates that the FAA will determine that the structures would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. It further expects that the FAA will determine that the structure would not be a hazard to air navigation provided the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 K Change 2, Obstruction Marking and Lighting. This is the same condition included in the FAA's determination for KWP I.

The FAA reviewed and approved the neighboring KWP I facility, which is closer to the ridgeline facing central Maui. Hence, while the FAA has not yet made a determination on the project, KWP II LLC anticipates that the proposed facilities will be determined not to adversely affect navigable airspace so long as they are properly marked and lighted.

4.13.1.3 Impacts to Harbors & Ocean Navigation

All of the major pieces needed to erect the WTGs have already been landed on Maui. Additional equipment for the electrical collector lines, substation, and BESS will need to be imported. However, only a limited amount of this will be needed and the individual pieces are of a size and nature that allows them to be handled as general containerized cargo. Hence, they will not place an unusual demand on the harbor facilities.

4.13.2 UTILITIES & PUBLIC SERVICES

4.13.2.1 Water Supply

As discussed in Section 2.2.7, water for the proposed facilities will be stored in a 60,000-gallon tank at the base of the access road for emergency purposes and for irrigating native plants that are being reestablished in the area. KWP II LLC estimates that daily water usage from the tank during normal operation will amount to about 250-450 gallons. The small bottled potable water and eye wash station that will be provided in the operations building do not constitute significant uses of water. Consequently, the facility is not expected to be a burden on Maui's municipal water supply.

4.13.2.2 Wastewater Collection, Treatment, and Disposal

As discussed in Section 2.2.7, only a few people will work on site and, in accordance with the methods used for KWP I, they will use portable toilets situated outside the O&M building or restrooms served by a septic tank. The waste that accumulates in the portable toilets or septic tank will be collected by a private contractor and transported to the Kīhei Wastewater Treatment Facility or other approved location for disposal. The small amount of sanitary wastewater that this represents can easily be accommodated in the existing treatment and disposal facilities.

4.13.2.3 Telecommunications

Telecommunications provided by Hawaiian Telcom exist at the KWP I site, and these will be extended to the proposed O&M building at KWP II. A fiber optic cable will be installed to connect the new substation with the facility and MECO control systems. These additions will not substantially increase the burden on Hawaiian Telcom's system.

4.13.2.4 Police and Fire Service and Public Safety

The proposed facility would be accessed through a locked gate. The facility has 24-hour on-site security staff and a video monitoring system at the gate. KWP II would not place substantial additional demands upon the existing police service in the area. Similarly, as described in Section 4.5.4, the facility design includes fire water storage and other fire protection facilities, thus reducing

the potential for additional burden on the Fire Department. All facilities will comply with the National Fire Protection Association's (NFPA) recommendations, local codes, and other applicable fire protection regulations.

4.13.2.5 Health Care Facilities

The nearest hospital to the proposed KWP II site is the Maui Memorial Hospital in Wailuku. In case of emergencies, paramedic/ambulance services are available from the Wailuku and Kīhei areas, both of which are approximately 20-25 minutes drive from the facility.

4.13.2.6 Solid Waste

The wind energy generating facility as proposed in the preferred alternative would produce very small amounts of municipal solid waste. While no exact estimate is available, installations of the type proposed typically maintain a small dumpster on-site that is emptied once per week. KWP II LLC will contract with a private solid waste management company for the collection and disposal of this refuse. The contractor would pick up the refuse once each week and haul it to a permitted landfill for disposal. No hazardous material is present in this waste stream.

5.0 NO ACTION ALTERNATIVE

5.1 INTRODUCTION

Section 2.5.1 of this EIS sets the framework for the consideration of Alternatives and Section 2.2 describes the action alternative whose potential effects are evaluated in detail in this report. Chapter 2 also describes a number of other alternatives that KWP II LLC considered but eliminated when it became clear that they would not satisfy the objectives of the proposed action.

This chapter discusses the potential effects of the "No Action" alternative as required by HAR §11-200-17(f) (1). "No Action" consists of foregoing the installation of additional wind generating capacity at Kaheawa Pastures and hence the opportunity to add additional renewable energy generating capacity to Maui's grid at this location. While other currently proposed or future renewable energy projects could provide some or all of the renewable energy generating capacity that would be foregone if this alternative were selected, KWP II LLC believes the existing infrastructure at Kaheawa Pasture, the excellent proven wind resource at that location, and the progress that it has made on obtaining the approvals and permits needed to implement its project make "no action" undesirable from environmental and economic standpoints.

As discussed in Chapter 4 of this report, the environmental impacts that would be avoided by choosing this alternative are limited. KWP II believes they are far outweighed by the benefits that 21 MW of clean energy would bring in energy security, quality of life and improved air quality for Maui's residents. Further, the environmental impacts of the KWP II project are likely to be significantly less than those associated with a "green fields" renewable energy project where no infrastructure (e.g., roads, transmission lines, interconnection facilities, etc.) presently exists.

It cannot be emphasized too strongly that this alternative would not meet the objectives of the proposed action listed in Section 1.3. "No Action" is included to fulfill the requirements of Chapter 343, Hawai‘i Revised Statutes.

If additional generating capacity is not installed at Kaheawa Pastures, the island of Maui will be faced with two choices. The first is to obtain a larger proportion of its electrical energy through the combustion of fossil fuels than it would if the proposed project is placed in operation. The second is to obtain an equivalent amount of electrical energy from other alternative renewable sources (either different technologies or wind power development in other locations on the island).[59] The remainder of this chapter briefly discusses the probable effects of each of these two possibilities [60]

5.2 IMPACTS OF CONTINUED RELIANCE ON FOSSIL FUELS

KWP II LLC estimates that the electrical energy that would be produced by the proposed project would allow MECO to forego the combustion of approximately 138,000 barrels per year of fossil fuel. If the "no action" alternative leads MECO to continue to obtain this amount of electrical energy by burning fossil fuel, this will have substantial environmental and economic effects.

5.2.1 ENVIRONMENTAL EFFECTS OF FOSSIL FUEL ALTERNATIVE

If the unavailability of wind or other renewable energy sources forces MECO to continue to rely on its existing or future fossil fuel-fired units, they will release a substantial volume of pollutants into the

[59] It is theoretically possible for wind energy generated elsewhere in Hawai‘i (e.g., on Lāna‘i or on Moloka‘i to be transmitted to Maui for use there, but at the present time neither of the two large-scale wind power projects that are proposed for those two islands plan an interconnection with Maui.

[60] Note that while it is always desirable, energy conservation (i.e., using less energy than is anticipated) is not an alternative as the reduction is unlikely to reduce the level of electrical energy use to the point where the megawatt hours produced by KWP II could not be used.

atmosphere. The exact amount will depend upon the exact way in which the units are operated, something which it is not possible to specify at this time. However, an order-of-magnitude sense of the emissions can be obtained by considering what the emissions would be from the most efficient type of units in MECO's system when they are run in their most efficient (and least-polluting) mode.

The *Final Environmental Impact Statement for the Waena Generating Station* estimates potential emissions from the use of diesel fuel in the 58 megawatt capacity Dual-Train, Combined-Cycle Combustion Turbines (DTCC) that would be used at the Waena Generating Station when it is placed in operation sometime during the next decade. These are the same types of units that MECO now operates at its Mā'alaea Generating Station. The report estimates tons per year emissions of key pollutants assuming the units operate at 100 percent of their capacity throughout the year.

This information can be used to approximate the emissions that would occur if fossil-fired energy were to be used in lieu of energy from the KWP II project. In using it, the following assumptions were made:

- The capacity of the proposed wind farm (21 megawatts) represents only 36 percent of the capacity of the 58 MW DTCC units for which the *FEIS* estimated annual emissions.
- Because WTGs are dependent upon wind that is not always present, they have an estimated net capacity factor of about 0.4.[61]

Combining these two factors means that if the WTGs that are proposed as part of KWP II project are not installed, then MECO's air emissions will be higher by the amounts shown in Table 5.1.[62]

Table 5.1. Air Emissions if Electricity from Fossil Fuel Substitutes for Electricity from KWP II.

Pollutant	***Emissions (in tons per year)***
Nitrogen Oxide	53
Sulfur Dioxide	139
Carbon Monoxide	34
Volatile Organic Compounds	5
Particulate Matter	25
Particulate Matter less than 10 microns	25
Sulfuric Acid Mist	7
Beryllium	.0000504
Mercury	.0001728
Lead	.018864
Fluoride	.002592
Note: Emission estimates are based on 14.6% of amounts reported for continuous operation of 58 MW DTCC generating unit proposed for the Waena Generating Station.	
Source: Maui Electric Company Ltd, November 1997.	

[61] "Net capacity factor = the actual amount of power produced over time/the power that would have been produced if the turbine operated at maximum output 100% of the time, net losses due to operating constraints and limitations.

[62] Those amounts are equivalent to between 14 and 15 percent of the amount reported in the FEIS for one of the DTCC units that is has proposed for the Waena site.

Similarly, use of fossil fuel-fired units to provide electrical energy rather than obtaining that same amount of energy from the proposed KWP II project will entail a range of other environmental effects (e.g., noise, water consumption, traffic related to fuel transport, wastewater generation, etc.). While none of these is likely to be significant, being able to forego them is beneficial to the natural environment.[63]

5.2.2 ECONOMIC EFFECTS OF FOSSIL FUEL ALTERNATIVE

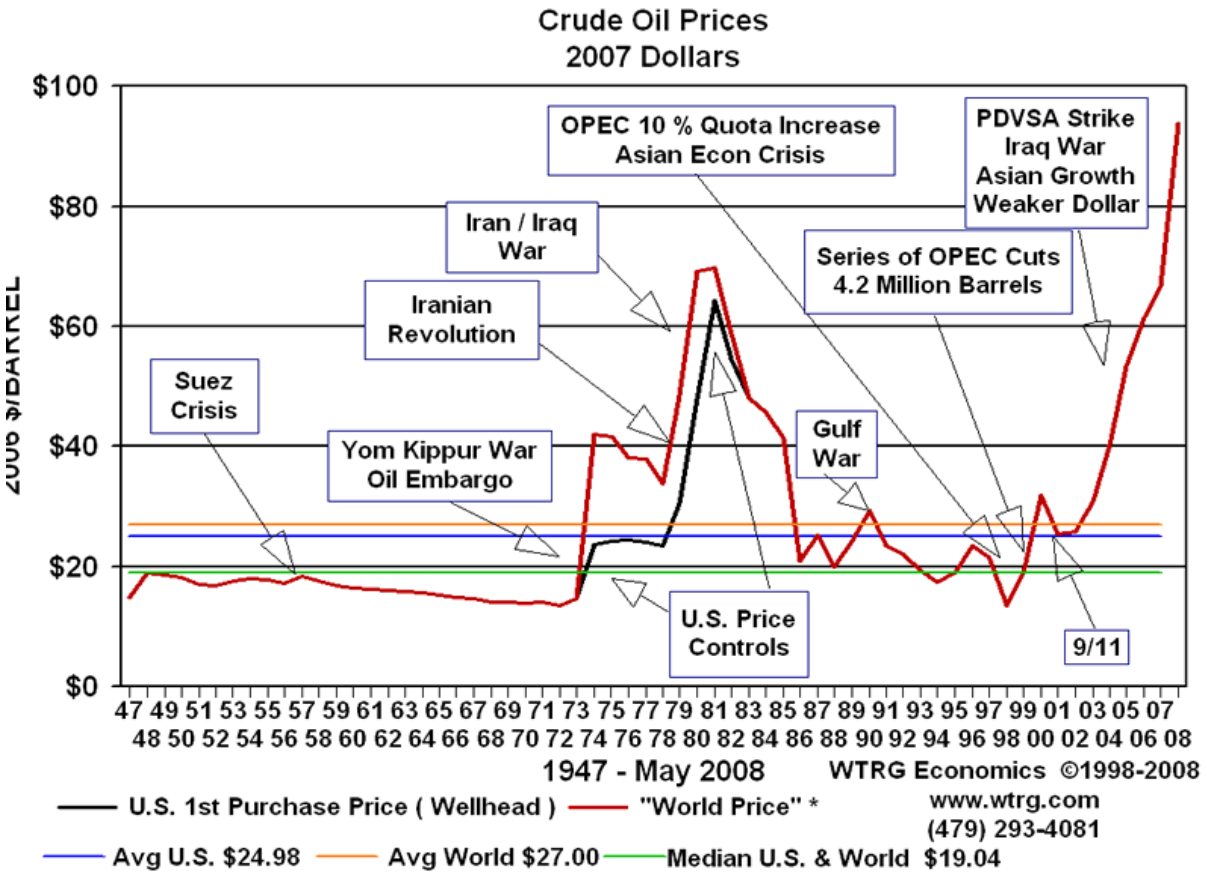
Conservatively assuming that the U.S. market value crude oil averages $80 per barrel over the life of the project, the amount of oil that KWP II would replace over its 20-year life is worth about $100 million. This is roughly 50 percent more than the estimated construction cost of the proposed wind generation facilities. Moreover, virtually all of the dollars spent on fossil fuel are spent off-island and out-of-state. Hence, they have little beneficial effect on the local economy. In contrast, once it is operating, most of the expenditures on KWP II will be spent locally and will support Maui and Hawai‘i’s economy.

It is also worth noting that many forecasts of fuel prices suggest that prices are likely to be much higher than $80 dollars per gallon and few forecasts are for less than that amount. Hence, the dollar value of the wind-generated electricity is likely to be greater than that shown. Moreover, fossil fuel pricing has not only increased markedly over time, it has been volatile, as well, and the volatility makes long-range planning and capital investment decisions difficult. Both the trend toward higher price and the volatility can be seen by comparing the price on July 11, 2008 ($147.27 per barrel) with the price at the beginning of 2007 (just over $60/barrel (see Figure 5.1).

By reducing the island’s dependence on imported fossil fuels, KWP II will help decouple electricity prices from the cost of imported fuels, thereby reducing price volatility. Moreover, because the power purchase contract with MECO will link the price paid for power from the proposed facility to the overall rate of inflation rather than to the cost of imported oil (which is expected to increase at a faster rate), it could allow island residents and businesses to pay less for electrical energy than they are likely to have to pay without it.

[63] Because the KWP project will not provide firm power, MECO must still provide fossil fuel-fired capacity for use during periods when there is insufficient wind energy. Hence, the development-related effects of conventional power plant development will remain.

Figure 5.1. Crude Oil Prices 1947-May 2008



Source: http://www.wtrg.com/oil_graphs/oilprice1947.gif

5.3 IMPACTS OF OTHER PROPOSED RENEWABLE ENERGY DEVELOPMENT

With the enactment of the Renewable Portfolio Standards, the establishment of the Hawai‘i Clean Energy Initiative, and the passing of legislation designed to encourage and facilitate the development of renewable energy projects in Hawai‘i, it is clear the State is committed to encouraging renewable energy projects to provide a sizable portion of Hawai‘i’s energy supply into the future.[64] Several renewable energy projects are currently being proposed for Maui County, and more are likely to arise in response to these incentives.

It is possible that one or more of these wind energy projects could alone or in combination provide the additional renewable energy that the State and County have targeted for development. It is beyond the scope of this report to analyze each active or hypothetical proposal in detail, and indeed there is no way to know at this stage which if any of the projects that have been proposed might eventually be approved and constructed. None are as far along in the approval process as KWP II, however, and none are located adjacent to an operating wind farm. Hence, any renewable energy project that might be implemented if the KWP II project does not move forward would have to be a

[64] "Renewable energy" means energy generated or produced utilizing the following sources: (1) Wind; (2) The sun; (3) Falling water; (4) Biogas, including landfill and sewage-based digester gas; (5) Geothermal; (6) Ocean water, currents and waves; (7) Biomass, including biomass crops, agricultural and animal residues and wastes, and municipal solid waste; (8) Biofuels; and (9) Hydrogen produced from renewable energy sources (HRS §269-91).

"green field" development that lacks the combination of existing transmission, roads, and proximity to an operating wind farm. In short, there is nothing about an alternative location that suggests it would have lesser environmental effects than KWP II. To the extent that an off-island project is considered, the costs and potential impacts of an undersea cable to Maui would have to be considered. There is to our knowledge currently no proposal to make such a connection. .

Other renewable energy projects are being discussed that could provide renewable energy to the island of Maui. These include solar, biomass waste-to-energy, biofuels, OTEC, wave energy, and hydroelectric. However, none of these are as advanced as the proposed WTGs that make up the KWP II project, and so none are likely to come to fruition within the same time frame, if at all. Moreover, none of these has the immediate potential to provide the level of energy as the proposed project.

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6.0 CONSISTENCY WITH EXISTING POLICIES, CONTROLS, & LAND USE PLANS

In accordance with the requirements of HAR §11-200-17 (h), this chapter discusses the relationship of the proposed action to land use plans, policies, and controls for the area that would be affected by the proposed KWP II project. Table 6.1 lists the permits and approvals required for the project and provides the current status of each. The subsequent discussion identifies the extent to which the proposed action 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 the jurisdiction (County, State, or Federal) and then by specific ordinance, regulation, or law.

6.1 REQUIRED PERMITS AND APPROVALS

Table 6.1 lists the potential permits and approvals required for the project. The remainder of the chapter discusses the compliance and compatibility of the proposed improvements with pertinent plans, policies, and regulations at County, State, and Federal levels.

Table 6.1. Status of Required Permits and Approvals

Permit or Approval	*Issuing Agency*	*Status*
Endangered Species Act Section 10 Incidental Take Permit	U.S. Fish and Wildlife Service	Draft HCP/Permit Application to be Submitted Q1, 2009
"Notice of Proposed Construction or Alteration"	Federal Aviation Administration	Not Started
State Endangered Species Incidental Take License	Department of Land and Natural Resources	Draft HCP Submitted to ESRC
Conservation District Use Permit	Department of Land and Natural Resources	Not Started
NPDES Construction Permit	Clean Water Branch, State Department of Health (DOH)	Not Started
PUC Approval	Public Utilities Commission	Not Started
Source: Compiled by Planning Solutions, Inc.		

6.2 MAUI COUNTY

6.2.1 MAUI COUNTY GENERAL PLAN

The Maui County General Plan establishes a vision and a set of long-range guiding principles, goals, objectives, policies and maps to guide the growth and development of the island. The Plan is the principal tool for the County and its citizens to use when evaluating public and private projects and their impacts on land use, the economy, environment, infrastructure, and cultural resources.

The General Plan of the County of Maui (1990) was adopted by Ordinance No. 2039 on September 27, 1991 and was amended on April 23, 1993 by Ordinance No. 2234. An update of the Plan is underway, and a Draft General Plan outlining the County's development policies up to the year 2030 was circulated for comment in January 2008. Public review of the Draft General Plan is continuing, and in the fourth quarter of 2008 the Maui County Council extended the deadline for the Maui County

General Plan Advisory Committee to complete its review of the Plan by March 1, 2009. In view of the current pace of review, it appears likely that the existing General Plan will remain in effect through most or all of 2009.

The *Draft 2030 General Plan* consists of a series of planning documents organized into three tiers[1]:

- ***The Countywide Policy Plan*** acts as an over-arching values statement and is an umbrella policy document for the Island and Community Plans.
- ***The Maui Island Plan*** will function as a regional plan and address the unique problems and needs of the Island of Maui and establish specific policies relating to regional systems such as transportation, utilities, and growth management for the Island of Maui.
- ***The Community Plans*** will reflect the unique characteristics of each Community Plan area and enable residents and stakeholders within those areas to address location specific challenges. A total of nine community plans are in place on Maui.

The following sub-sections discuss the project's consistency with each of these planning documents.

6.2.1.1 Draft Countywide Policy Plan

The Draft Countywide Policy Plan provides the policy framework for the development of the Maui Island Plan and the nine community plans that will address the unique character of each of the islands within the County. It outlines Goals, Objectives, and Policies related to 11 topics:

A. Protect the Natural Environment

B. Preserve Local Culture and Traditions

C. Improve Education

D. Strengthen Social and Health Care Services

E. Expand Housing Opportunities for Residents

F. Strengthen the Local Economy

G. Improve Parks and Public Facilities

H. Diversify Transportation Options

I. Improve Physical Infrastructure

J. Promote Sustainable Land Use & Growth Management

K. Strive for Good Governance

The following section lists the topics, goals, and policies most relevant to the proposed project and discusses it's consistency with them. Text from the draft Countywide Policy Plan is reproduced prior to each response.

[1] In 2002 the County Council adopted Ordinance 3166 (Bill 84 now MCC 2.80B) which revised the process for updating the Maui County General Plan. 2.80B requires that the General Plan identify and describe the major problems and opportunities regarding the needs and the development of the county as well as the social, economic and environmental effects of development. In addition, MCC 2.80B mandates that the General Plan set forth the desired sequence, patterns and characteristics of future development. 2.80B stipulates that a Countywide Policy Plan be prepared first, followed by a Maui Island Plan and the nine Community Plans.

A. PROTECT THE NATURAL ENVIRONMENT

Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed, and cared for in perpetuity.

- *Objective 1: Improve the opportunity to experience the natural beauty and native bio-diversity of the islands for present and future generations.*

  Policies:

  a. Perpetuate native Hawaiian bio-diversity by preventing the introduction of invasive species, containing or eliminating existing noxious pests, and protecting critical habitat areas.

  g. Identify, preserve, and provide ongoing care for important scenic vistas, view planes, landscapes, and open space resources.

- *Objective 3: Improve the stewardship of the natural environment.*

  Policies:

  b. Protect flora and fauna communities.

  h. Reduce air, noise, light, land, and water pollution and reduce Maui county's contribution to global climate change.

Discussion: As discussed in Section 4.6.2, development of the proposed facilities would occur in areas dominated by non-native species. In selecting the proposed layout KWP II LLC specifically ruled out areas to the north with higher concentrations of native plants. Section 4.6.2.1 describes the measures KWP II LLC is proposing to prevent the introduction and spread of invasive species at the project site. These measures will complement and add to the efforts made by KWP I and other resource management groups at the existing facility.

KWP II LLC considered a number of factors in selecting the proposed layout, including visual impacts. The proposed facility would not significantly change views from Central and East Maui, where most of the population lives. The views that will be most affected are aerial views and views from the ocean, and in either case the character of the proposed facility is not significantly different from the existing KWP I facility.

B. PRESERVE LOCAL CULTURES AND TRADITIONS

Goal: Maui County will foster a spirit of pono and protect, perpetuate and reinvigorate its multi-cultural values and traditions to ensure that current and future generations will enjoy the benefits of their rich island heritage.

- *Objective 1. Perpetuate the Hawaiian culture as a vital force in the lives of residents.*

  Policies:

  b. Foster partnerships to identify and preserve or revitalize historic and cultural sites.

  c. Identify and prohibit inappropriate development of cultural lands and sites which are important for traditional Hawaiian cultural practices and establish mandates for the special protection of these lands in perpetuity.

- *Objective 4. Preserve and restore significant historic architecture, structures, cultural sites, cultural districts and cultural landscapes.*

  Policies:

  a. Support the development of an island-wide historic, archaeological, and cultural resources inventory.

  d. Protect and preserve lands that are cultural or historically significance [sic].

Discussion: Archaeological inventory and cultural resource surveys were conducted for the entire KWP II project area. Results of these surveys are discussed in detail in Section 3.9.2 and 3.9.3. None of the features identified were recommended for further preservation by the archaeologists, and SHPD concurred with this recommendation. Although it is not on the proposed project site, KWP II LLC will comply with the preservation plan that is in place for the *heiau* on the KWP I site and will notify contractors of its presence.

F. STRENGTHEN THE LOCAL ECONOMY

Goal: Maui County's economy will be diverse, sustainable, and support community values.

- *Objective 4: Expand economic sectors that increase living wage job choices and are compatible with community values.*

  Policies:

  a. Support emerging industries, including but not limited to the:

  Renewable energy industry.

Discussion: Maui County has identified renewable energy as an important emerging industry. As discussed throughout this document, the project is expected to result in significant environmental, economic, and community benefits by providing a clean renewable energy source, generating tax and lease revenue, and contributing to Maui's energy independence.

I. IMPROVE PHYSICAL INFRASTRUCTURE

Goal: Maui County's physical infrastructure will be maintained in optimum condition and will provide for and effectively serve the needs of the County through clean and sustainable technologies.

- *Objective 3. Utilize renewable and green technologies to promote energy efficiency and energy self-sufficiency.*

  Policies:

  a. Encourage the use of locally renewable energy sources and reward energy efficiency.

  b. Provide tax incentives and credits for the development of sustainable and renewable energy sources.

  d. Encourage small scale energy generation which utilizes wind, sun, water, biowaste, and other renewable sources of energy.

  e. Expand potential renewable energy production capabilities.

  f. Develop public-private partnerships to ensure the use of renewable energy and increase energy efficiency.

  k. Reduce Maui County's dependence on fossil fuels and energy imports.

Discussion: The goals and objectives outlined in the Countywide Policy Plan confirm that renewable energy will remain a priority for the County well into the future. KWP II is an example of the type of public-private partnership that the County seeks to encourage in expanding its renewable energy portfolio.

6.2.1.2 Draft Maui Island Plan

The Draft Maui Island Plan provides a guide for the future growth of the island to the year 2030. The Maui Island Plan establishes a vision and a set of long-range guiding principles, goals, objectives, policies and maps to guide the growth and development of the island.

Renewable energy is given significant attention in the Plan's Economic Development section in Volume I, which notes that:

> *Renewable energy development will be critical in helping the State of Hawaii and Maui County reduce energy costs, avoid the negative economic effects of volatile oil prices, reduce overdependence on oil, and increase energy security by reducing imports. Renewable energy can grow new local industries, provide jobs and income for the people of Maui County, and protect the environment, which is also the basis of Maui's economy***.**

The Plan also acknowledges KWP I's contribution to renewable energy on Maui and notes that additional wind generating capacity is under consideration at the site.

Challenges and opportunities for wind energy development on Maui are discussed as well:

> *Maui has significant potential for wind energy development. View impacts and physical access present challenges to wind energy development on Maui, since many viable sites lie on high ridges. Wind energy may encounter fewer land use and zoning barriers than other types of renewable energy development. Zoning ordinances allow for wind energy development in State and County Agricultural districts, and barring conflicting land uses, wind energy is likely to be allowable in rural districts.*

Volume II of the Plan outlines specific goals and policies to match the topics covered in Volume I. Those policies most relevant to the proposed KWP II project are reproduced below, followed by a discussion of the project's consistency with each.

ECONOMIC DEVELOPMENT

EMERGING INDUSTRIES – HIGH TECHNOLOGY & RENEWABLE ENERGY GOAL & POLICIES

3.4 Goal: Maui's high technology and renewable energy industries will be contributing significantly to the island's economy.

3.4.3 Increase the economic contribution of the renewable energy industry on Maui, including solar, wind power and biofuel technologies, and include the protection of an adequate supply of land for these industries.

Discussion: The proposed KWP II project will contribute an additional 21MW of renewable energy to Maui's grid. The economic and environmental benefits associated with the project are significant, as discussed elsewhere in this report.

HERITAGE RESOURCES

CULTURAL RESOURCES - GOAL & POLICIES

2.1 Goal: Maui will have preserved a rich inventory of historic and archaeological sites and artifacts that represent living examples of the island's diverse history.

2.1.5 Require development within Heritage Areas to be compatible with and supportive of cultural landscapes, native Hawaiian cultural practices, and resident lifestyle.

Discussion: As discussed in Section 4.8.3, the project is expected to be compatible with existing historic, cultural, and archaeological resources. It will not impact resources recommended for preservation and will follow all applicable laws and guidelines to ensure the protection of existing significant resources (i.e., the *heiau* on the KWP I site, the Lahaina Pali Trail).

HERITAGE RESOURCES

SCENIC RESOURCES - GOAL & POLICIES

2.2 Goal: Maui County's natural environment and distinctive open spaces will be preserved, managed and cared for in perpetuity.

2.2.3 Protect public views of Haleakala, Iao Valley, the West Maui Mountains, the Pacific Ocean and other significant water features, ridgelines and landforms.

2.2.4 Promote the siting and design of telecommunication facilities and infrastructure to avoid visual impacts on the landscape.

2.2.5 Establish limits for development on the slopes of the West Maui Mountains.

Discussion: As discussed in Section 4.11, the proposed layout was selected with concern for minimizing visual impacts to Maui residents and visitors. The wind generating facility will be nearly identical in character to the existing facility, and locating it next to the existing facility will reduce the need for additional road and facility development. The proposed KWP II turbines will be less visible to populated areas of Central and Eastern Maui than the existing facility. Thus, the proposed facility is consistent with the Draft Maui Island Plan's objectives.

6.2.1.3 West Maui Community Plan

The West Maui Community Plan provides specific recommendations to address goals, objectives and policies in the General Plan, while recognizing the values and unique attributes of the West Maui region. The West Maui Plan was last updated in 1996 and identifies planning goals, objectives, policies and implementation considerations to guide decision-making in the region through the year 2010. Several of the opportunities, objectives, and policies identified in the West Maui Community Plan are relevant to the proposed KWP II project. These are reproduced below, followed by discussions of the project's consistency with them.

Part II - Description of the Region and its Problems and Opportunities

Opportunity 2 (Stability of the Economic Base) in Section B (Identification of Major Problems and Opportunities):

> *...It is therefore important to maintain a stable economic base by encouraging the upgrading of existing visitor facilities; pursuing diversified economic opportunities; insuring responsible and sustainable growth to provide a range of job opportunities so that the young people can remain in or return to the community;* ***encouraging alternate energy production (i.e., solar, wind and biomass)****; identifying potential uses of federal, state and county lands to benefit the community; and in general, creating opportunities for more self-sufficiency.* (emphasis added)

Discussion: The bold portion of the quoted text reiterate's Maui County's commitment to renewable energy development and recognition of the potential economic benefits of renewable energy projects.

Part III - Policy Recommendations, Implementing Actions, & Standards for the West Maui Region, Section B. Goals, Objectives, Policies and Implementing Actions:

Land Use:

> *2. Preserve and enhance the mountain and coastal scenic vistas and the open space areas of the region.*
>
> *5. Preserve the current State Conservation District and the current State Agriculture District boundaries in the planning region, in accordance with this Community Plan and its land use map. Lands north of Kapalua and south of Puamana to the region's district boundaries should ensure the preservation of traditional lifestyles, historic sites, agriculture, recreational activities and open space.*

Discussion: The proposed project is located in the Conservation District in an area characterized by open space and sweeping mountain vistas. As discussed in detail in Section 4.11, the facility was designed with sensitivity to its appearance from populated areas of Maui, and is not expected to detract significantly from existing views or uses in the area. The project design also takes into account existing uses and sensitive resources in the area, with attention to avoiding or minimizing adverse impacts. Approval of the project will not affect Conservation District boundaries.

Cultural Resources:

> *6. Ensure that new projects or developments address potential impacts on archaeological, historical, and cultural resources and identify all cultural resources located within the*

project area as part of initial project studies. Further require that all proposed activity adequately mitigate potential adverse impacts on cultural resources.

Discussion: The Plan identifies the Lahaina Pali Trail among significant cultural resources to be preserved. None of the other cultural resources mentioned in the Plan are near the KWP II project site. Sections 4.9 and 4.11.4.1 discuss the project's potential impacts on the Lahaina Pali Trail and the measures KWP II LLC has proposed in order to minimize or mitigate impacts to users of the trail.

***Energy*:**

3. *Promote the environmentally sensitive use of renewable energy resources, such as biomass, wind, and solar.*

Discussion: KWP II LLC is working with resource agencies at the State and Federal level to ensure that the proposed facility is constructed and operated with minimal impact to valued environmental resources. Consequently, it is compatible with the intent of this statement.

6.2.1.4 Kīhei-Mākena Community Plan

The Kīhei-Mākena Community Plan was last updated in 1997 and identifies planning goals, objectives, policies and implementation considerations to guide decision-making in the region through the year 2010. The area covered by the Plan includes parts of the lower slopes and foothills of the West Maui Mountains, as well as the community of Mā'alaea. The portions of the plan relevant to the proposed project closely parallel (or are in some cases identical to) those in the West Maui Community Plan discussed above. Consequently, they are not discussed separately here. Nothing in the Kīhei-Mākena Community Plan suggests that the proposed KWP II project will conflict with existing or planned land uses in the area.

6.2.2 COUNTY ZONING

Title 19 of the Maui County Code defines zoning districts and regulates development within them. The proposed KWP II project is within the State Conservation District and is, therefore, exempt from the Maui County zoning code. Consequently, County zoning regulations are not applicable to the proposed facility.

6.3 STATE OF HAWAI'I

6.3.1 HAWAI'I STATE PLAN

The *Hawaii State Plan* is intended to guide the long-range development of the State of Hawai'i 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 KWP II 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 action's consistency with them is discussed.

§226-18 (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;

Discussion: As discussed elsewhere in this document, the proposed project is cost-competitive with traditional fossil-fueled electrical generation and has the associated environmental and economic benefits of reduced air pollutant emissions and enhanced energy independence. The proposed battery storage will significantly enhance the facility's reliability as well. Consequently, it is consistent with this objective.

(2) Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;

Discussion: The proposed KWP II project would help to increase the ratio of indigenous to imported energy on Maui by harnessing the naturally high winds in the West Maui mountains.

(3) Greater energy security in the face of threats to Hawaii's energy supplies and systems.

Discussion: The proposed facility would reduce Maui's dependence on imported fossil fuels significantly, as discussed in Section 1.2.2.2. The fixed cost of the project will also help buffer the local economy from the fluctuating costs of energy during its lifespan.

(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.

Discussion: Section 4.3.2 quantifies the reduction in greenhouse gas emissions that is expected to result from the project. Because wind energy generates little to no emissions, these reductions are significant and in accordance with this objective.

§226-18 (b) To achieve the energy objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable energy services to accommodate demand.

Discussion: As previously discussed, the proposed facility will provide clean, cost-competitive electricity to Maui's consumers, and its reliability will be bolstered by the battery storage technology KWP II LLC is proposing. Consequently, the project is consistent with this objective.

6.3.2 CHAPTER 205, HAWAIʻI REVISED STATUTES - LAND USE LAW

Chapter 205, Hawaii 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 proposed KWP II project site is entirely within the General Subzone of the State Conservation District and is owned by the State of Hawaiʻi. The existing State Land Use District boundaries within the project area are shown in Figure 3.6.

The State Department of Land and Natural Resources (DLNR) is responsible for regulating land uses within the Conservation District. Hawaiʻi Administrative Rules §13-5-22(P-6) identifies *"energy generation facilities utilizing the renewable resources of the area (e.g., hydroelectric or wind farms)"* as a "Public Purpose Use". This type of land use is permitted in the General Subzone with the

issuance of a Conservation District Use Permit (CDUP) approved by the Board of Land and Natural Resources (BLNR). This EIS will be submitted in support of KWP II LLC's Conservation District Use Application (CDUA) for the project.

The criteria that DLNR and the Board will use in evaluating the project are outlined in Hawai'i Administrative Rules, §13-5-30(c). Each criterion, followed by a discussion of how the proposed lagoon restoration project fulfills it, is reproduced in italics below.

(1) The proposed land use is consistent with the purpose of the conservation district;

Discussion: The purpose of the Conservation District is to conserve, protect, and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public's health, safety, and welfare (HAR §13-5-1). As discussed throughout this document, the proposed project will help reduce the Island of Maui's dependence on imported fossil fuels for electricity, thereby contributing to improved air quality and enhanced energy security and independence. Thus, it is in keeping with the purpose of the Conservation District.

(2) The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

Discussion: The KWP II project site is in the General (G) subzone of the Conservation District. The objective of this subzone is to designate open space where specific conservation uses may not be defined, but where urban use would be premature (HAR §13-5-14(a)). The proposed wind energy generation facility is compatible with existing land uses in the area, and was designed with sensitivity to visual impacts. It is not significantly different in size or character from the existing KWP I facility, and its construction and operation will not preclude future uses of the site for conservation purposes. Consequently, it is consistent with the intent of the General subzone.

(3) The proposed land use complies with provisions and guidelines contained in chapter 205A, HRS, entitled "Coastal Zone Management," where applicable;

Discussion: The discussion in Section 6.3.4 below confirms the consistency of the project with the Coastal Zone Management Act and the objectives outlined in Chapter 205A, HRS.

(4) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;

Discussion: As discussed in Chapter 4, substantial adverse environmental impacts are not expected to result from the proposed project. Unavoidable impacts will be minimized and mitigated through coordination with various resource agencies.

(5) The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;

Discussion: The area adjacent to the project site is already used for wind energy generation, and the facilities being proposed are very similar to the existing ones. Other uses in the area have coexisted with the existing project and this is expected to continue during construction and operation of KWP II. The existing facility also avoids the need to construct substantial new roads and infrastructure on the generally steep slopes of the West Maui Mountains.

(6) The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;

Discussion: While the facility will have unavoidable visual impacts, these will be minimized by situating it adjacent to an existing wind energy facility, and locating it further west where it will be less visible to populous areas of central and east Maui. In general, wind energy facilities have been shown to be compatible with other open space uses and scenery, and KWP II is expected to be no exception.

(7) Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district;

Discussion: No property subdivision is needed for the proposed project. KWP II LLC is working with DLNR to negotiate a lease for the project site.

(8) The proposed land use will not be materially detrimental to the public health, safety and welfare.

Discussion: The project will not be detrimental to public health, safety, or welfare. It is located well away from residences and other sensitive uses that might be affected by noise or construction-related air pollutants, and once in operation the project will not be a source of emissions. If anything, the project will improve public health and safety by significantly reducing greenhouse gas emissions on Maui.

6.3.3 NA ALA HELE TRAILS & ACCESS PROGRAM

The State of Hawai‘i established the Na Ala Hele Trails and Access Program in 1988 by adopting Act 236 (Chapter 198D, HRS). Program responsibility, assigned to DLNR, includes planning, developing, acquiring, constructing and coordinating a statewide trail and access system. The program intent is to ensure adequate public access to coastal and mountain areas consistent with sound conservation principles. The program’s vision statement calls for the State to develop, via the Na Ala Hele Program, a trail and access network and management system which:

- Provides a broad range of recreational, cultural, religious, and subsistence opportunities for all of Hawai‘i’s people, and
- Helps to conserve Hawai‘i’s cultural heritage and environment.

The Lahaina Pali Trail has been designated a demonstration trail on the Na Ala Hele Trails and Access Program and is the first trail so-designated on Maui. The trail, which is 7.2km (4.5mi) long, starts near the County of Maui’s Ukumehame Beach Park and ends near Pu‘u Hele. It traverses the Kaheawa Pastures below the lower end of the existing KWP I turbines. The trail joins the access road just before the road crosses the Malalowaiaole Gulch at an elevation of about 500m (1,600ft) above sea level.

KWP I LLC consulted with the State’s Na Ala Hele Trails and Access Program in conjunction with the development of the existing KWP I facility and used the input it received to guide the placement of several WTGs so as to reduce the visual impact of the facility to trail users.

The proposed KWP II facility would add 14 additional WTGs to the hillside, 3 of which are closer to the trail than the existing KWP I WTGs. As illustrated by the visual simulation presented in Figure 4.6, this will increase the visual impacts to users of the trail. The proposed additional WTGs will be virtually the same as the existing ones, and the new turbine closest to the Trail would still be over 900

feet away from it. Siting constraints made it impossible to find locations further from the trail that still met the stringent siting requirements for the WTGs. The only other alternative was to /or reducing the number to below economic This, combined with the anticipated environmental and economic benefits of the proposed facility has led KWP II LLC to the conclusion that the proposed wind energy generating facility would not compromise the ability of the trail to meet the objectives of the Na Ala Hele Trails and Access program.

6.3.4 COASTAL ZONE MANAGEMENT PROGRAM

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, including the 12-mile U.S. territorial sea and all archipelagic waters.

The Hawai‘i Coastal Zone Management Program focuses on ten policy objectives:

- Recreational Resources. To provide coastal recreational opportunities accessible to the public and protect coastal resources uniquely suited for recreational activities that cannot be provided elsewhere.
- Historic Resources. To protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.
- Scenic and Open Space Resources. To protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.
- Coastal Ecosystems. To protect valuable coastal ecosystems, including reefs, from disruption and to minimize adverse impacts on all coastal ecosystems.
- Economic Uses. To provide public or private facilities and improvements important to the state's economy in suitable locations; and ensure that coastal dependent development such as harbors and ports, energy facilities, and visitor facilities, are located, designed, and constructed to minimize adverse impacts in the coastal zone area.
- Coastal Hazards. To reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.
- Managing Development. To improve the development review process, communication, and public participation in the management of coastal resources and hazards.
- Public Participation. To stimulate public awareness, education, and participation in coastal management; and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZM program.
- Beach Protection. To protect beaches for public use and recreation; locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion.
- Marine Resources. To implement the state's ocean resources management plan.

Other key areas of the CZM program include: a permit system to control development within a Special Management Area (SMA) managed by the Counties and the Office of Planning; a Shoreline Setback Area which serves as a buffer against coastal hazards and erosion, and protects view-planes; and the Marine and Coastal Affairs. Finally, a Federal Consistency provision requires that federal activities, permits and financial assistance be consistent with the Hawai‘i CZM program.

The proposed project is located more than a mile from the coastline. It does not involve the placement, erection, or removal of materials near the coastline. As documented in this EIS, the type and scale of the activities that it involves do not have the potential to affect coastal resources significantly, and thus the project does not require a CZM Federal consistency determination. However, it is consistent with the CZM objectives that are relevant to a project of this sort. A copy of this *Draft EIS* was sent to the Office of Coastal Zone Management at the State of Hawai‘i Department of Business, Economic Development, and Tourism, and the *Final EIS* will contain a response to any comments that are received.

6.3.5 ARCHEOLOGICAL AND HISTORIC PRESERVATION ACT (16 U.S.C. § 469A-1) & NATIONAL HISTORIC PRESERVATION ACT (16 U.S.C. § 470(F))

Section 4.8.3 documents the proposed project’s compliance with the provisions of the Archaeological and Historic Preservation Act and National Historic Preservation Act. SHPD will be provided a copy of this *DEIS* and their comments, if any, will be included in the *Final EIS*.

6.3.6 CLEAN AIR ACT (42 U.S.C. § 7506(C))

Section 0 documents that the project as proposed would comply with all applicable standards at the county, State, and federal level. Thus, it is compliant with the Clean Air Act.

6.3.7 CLEAN WATER ACT (CWA)

The CWA (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. Under Section 401 of the CWA, projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards. The State of Hawai‘i Department of Health implements the Section 401 certification program. Section 404 of the law authorizes a permit program for the disposal of dredged or fill material into navigable waters. The U.S. Army Corps of Engineers (USACE) administers the program. KWP II LLC has consulted with USACE and with the State Department of Health and confirmed that the project will not affect navigable waters. Thus, Section 401 and 404 permits will not be required.

6.3.8 ENDANGERED SPECIES ACT (16 U.S.C. 1536(A)(2) AND (4))

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

Section 0 of this EA discusses existing fauna on and near the project site. The discussion documents that several threatened and endangered species are known to occur in the project area, including Nēnē, Hawaiian Hoary Bats, Hawaiian Petrels, and Newell’s Shearwaters. As discussed in detail in Section 4.7.2, KPW II LLC is working with USFWS to obtain an incidental take permit under ESA Section 10 for any “take” of listed species associated with KWP II. This process includes preparation of a Habitat Conservation Plan (HCP) and execution of an Implementation Agreement with USFWS. Copies of the DEIS have been provided to the USFWS for review and comment, and any new information that the Service provides will be incorporated into the Final EIS (FEIS). KWP II anticipates that the USFWS will use the FEIS in preparing its National Environmental Policy Act documentation for the HCP and Section 10 permit.

6.3.9 RESOURCE CONSERVATION AND RECOVERY ACT (42 U.S.C. 6962)

The Resource Conservation and Recovery Act (RCRA) regulates solid and hazardous waste. Its goals are: (i) to protect human health and the environment from the hazards posed by waste disposal; (ii) to conserve energy and natural resources through waste recycling and recovery; (iii) to reduce or eliminate, as expeditiously as possible, the amount of waste generated, including hazardous waste; and (iv) to ensure that wastes are managed in a manner that is protective of human health and the environment.

As discussed in Section 4.12, the facility will not utilize or generate significant hazardous waste. A RCRA permit is not required.

7.0 OTHER CHAPTER 343 TOPICS

Hawai‘i Administrative Rules §11-200-17 establishes the content requirements for environmental impact statements. Most of these topics have been dealt with in the preceding sections of this report. This chapter addresses the few that do not fit neatly into any of the previously defined categories.

7.1 SECONDARY AND CUMULATIVE IMPACTS

The proposed facility is not directly or indirectly related to other actions planned by KWP II LLC. The proposed project’s secondary effects (such as those related to the direct expenditure of construction dollars on Maui) are discussed in the appropriate impact sections of the report. Notwithstanding the environmental and economic benefits associated with increased renewable energy capacity, the project would not lead to significant growth or changes in the character of economic activity on Maui (e.g., the opening of new industries not previously practical) that might have secondary impacts. Likewise, the project will not generate significant new employment opportunities. Hence, it does not have the ability to cause significant secondary impacts.

The additional WTGs would add to the risk to avian fauna transiting the area, and the potential for that cumulative effect (as well as the measures that would be taken to avoid and/or mitigate them) are discussed in Chapter 4 and are being addressed in the HCP that has been submitted to State and Federal agencies. Other arenas in which there could be cumulative effects (such as the job and business activity multiplier that will increase the economic stimulus the direct construction expenditures provide) are discussed in that chapter as well. The only other wind project that is currently proposed is tens of miles away on the slope of Haleakalā, and there is little likelihood that birds affected by the proposed KWP II project would be exposed to the same threats as might affect them. Hence, there is little likelihood of cumulative effect on that front.

7.2 SHORT-TERM USES VS. LONG-TERM PRODUCTIVITY

Constructing and operating the proposed wind energy generation facility would provide renewable energy to Maui’s grid, thereby helping to reduce pressures on the existing grid and alleviate some of the island’s dependence on imported fossil fuels. The facility would not preclude other uses of the property that might be more productive over the long term, nor does it preclude the use and development of other energy sources.

7.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS

The construction of the proposed facility does not irrevocably commit any party to the continued use of the site for wind energy generation or to the continued use of wind energy to add power to MECO’s grid.

Construction of the project does require some non-renewable resources (e.g., construction materials, fuel for vehicles, etc.). However, at the end of the estimated project lifetime of 20 years the land lease and power purchase agreements can be renegotiated or be terminated, and upon removal of the facilities the land can be allowed to return largely to its prior state (with the exception of some of the topography affected by grading for access roads and pads).

7.4 UNRESOLVED ISSUES

At present, there are no known unresolved issues. However, several permits and approvals must still be obtained, and it is possible that issues may arise as applications for these are prepared and processed.

7.5 RATIONALE FOR PROCEEDING

Chapter 4 describes the environmental effects that could result from construction and operation of the proposed wind power generating facility. KWP II LLC is committed to avoiding or mitigating adverse effects to the greatest extent practical. KWP II LLC does not believe that there are alternatives, including those described in this report, which would achieve the same goals with fewer environmental effects. Consequently, it proposed to proceed with construction and operation of the project.

8.0 GLOSSARY AND LIST OF ACRONYMS

Alien	Introduced to Hawai‘i by humans
AOS	Adequacy of Supply
ahupua‘a	A traditional unit of land in ancient Hawai‘i that usually includes a region between two bounding ridges, from the ocean to the mountain peaks
BMP	Best Management Practice
CERCLA	Comprehensive Environmental Response, Compensation, & Reliability Act
CFR	Code of Federal Regulations
Crepuscular	Active at twilight hours (dawn and dusk)
CWRM	Commission on Water Resource Management, State of Hawai‘i
Cycling units	Generating units that are started up before the morning peak and shut down daily after the evening peak.
CZM	Coastal Zone Management
CZMP	Coastal Zone Management Program
dB	Decibel, the basic, logarithmic unit of sound level measurement
dBA	A-weighted sound level: Sound level measurement weighted to be most sensitive to the frequencies audible to the human ear
DBEDT	Department of Business, Economic Development and Tourism, State of Hawai‘i
DC	Direct Costs
DEM	Digital Elevation Model
DLNR	Department of Land and Natural Resources, State of Hawai‘i
DNL	Day-Night Average Sound Level (also expressed as Ldn)
DOH	Department of Health, State of Hawai‘i
Domesticated	Feral species, not considered established in the wild on the Island of O‘ahu
DPP	Department of Planning and Permitting, City & County of Honolulu
EA	Environmental Assessment
EIS	Environmental Impact Statement (DEIS = Draft EIS; FEIS = Final EIS)
EISPN	Environmental Impact Statement Preparation Notice
Endangered	Listed and protected under the Endangered Species Act as an endangered species
Endemic	Native and unique to the Hawaiian Islands
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act of 1973, as amended
◦F	Fahrenheit degrees
FEMA	Federal Emergency Management Agency, U.S. Federal Government
FIRM	Flood Insurance Rate Map

GIS	Geographic Information System
HAR	Hawai‘i Administrative Rules
HRS	Hawai‘i Revised Statutes
Hz	Hertz, the basic unit of frequency, cycles per second
IBC	International Building Code
Indigenous	Native to the Hawaiian Islands, but also found elsewhere naturally
IPP	Independent Power Producer
IRS	Interconnection Requirement Study
IRP	Integrated Resource Plan
kV	Kilovolt
kWh	Kilowatt hour
Ldn	Day-Night Average Sound Level (also expressed as DNL)
LM	Load management
makai	Towards the ocean
mauka	Inland; towards the mountains
MECO	Maui Electric Company
MGD	Millions of Gallons per Day flow
moku	District; a Hawaiian land division within an *ahupua‘a*
MPH	Miles per hour
MPRM	Meteorological Processor for Regulatory Models
MSL	Mean sea level
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NE	Northeast
NLT	No later than
NOAA	National Oceanic and Atmospheric Administration, Department of Commerce, U.S. Federal Government
Nocturnal	Active at night-time, after dark
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service, Department of the Interior, U.S. Federal Government
NW	Northwest
OEQC	Office of Environmental Quality Control, Department of Health, State of Hawai‘i
OSHA	Federal Occupational Safety & Health Administration
pH	Measure of acidity; the negative logarithm (Base 10) of the effective molar concentration of hydronium ions in water

PPA	Power Purchase Agreement
PUC	Public Utilities Commission
ROW	Right-of-Way
RPS	Renewable Portfolio Standard
S	South
SAAQS	State Ambient Air Quality Standards
SCS	Soil Conservation Service, US Department of Agriculture (now the Natural Resource Conservation Service)
SEC	State Energy Corridor, State of Hawai‘i
SHPD	State Historical Preservation Division, Department of Land and Natural Resources, State of Hawai‘i
SLUC	State Land Use Commission, State of Hawai‘i
SMA	Special Management Area
SMP	Special Management Area Permit
SPCC	Spill Prevention, Countermeasure, and Control
SPL	Sound Pressure Level (SPL or Lp)
SWL	Sound Power Level (other abbreviations are PWL or L_w).
Threatened	Listed and protected under the ESA as a threatened species
TMK	Tax Map Key
tpy	Tons per year (air pollutant emissions unit)
UBC	Uniform Building Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USN	United States Navy
VOC	Volatile Organic Compounds
WERC	Wind Engineering Research Council
WTA	Willingness to Accept
WTP	Willingness to Pay
µS/cm	Micro-Siemens per centimeter, the standard unit for measuring specific conductance (which is generally directly proportional to salinity in natural waters)
z_o	Surface roughness length unit

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9.0 BIBLIOGRAPHY

Adams, D.L. & Associates, Ltd. (January 9, 2009). *Environmental Noise Assessment Report Kaheawa Wind Power Phase II Ukumehame, Maui, Hawai‘i*. DLAA Project No. 08-55. Prepared for: First Wind Energy, LLC. Honolulu, Hawaii

Adams, Josh (2008). “Petrels in the Pacific: Tracking the Far-ranging Movements of Endangered ‘Ua‘u (Hawaiian Petrel)”, US Geological Survey, Western Ecological Research Center. www.microwavetelemetry.com/ newsletters/spring_2007 Page 4.pdf.

Ainley, D.G., L. DeForest, N. Nur, R. Podolsky, G. Spencer, and T.C. Telfer (1995). Status of the threatened Newell’s Shearwater on Kaua‘i: Will the population soon be endangered?

Ainley, D. G., R. Podolsky, L. DeForest, G. Spencer, and N. Nur (2001). “The status and population trends of Newell’s Shearwater on Kaua‘i: insights from modeling.” *Studies in Avian Biology* No. 22: 108-123.

Ainley, D. G., T. C. Telfer, and M. H. Reynolds (1997). Townsend’s and Newell’s Shearwater *Pufinus auricularis*. In *The Birds of North America*, No. 297. (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

American Ornithologists’ Union. (1998). *Check-list of North American birds*. 7th ed. American Ornithologists’ Union, Washington, DC. 829 pp.

Armstrong, R. W. (ed.) (1983). *Atlas of Hawaii*. (2nd. ed.) University of Hawaii Press.

Arnett, Edward B., W. Kent Brown, Wallace P. Erickson, Jenny K. Fiedler, Brenda L. Hamilton, Travis H. Henry, Aaftab Jain, Gregory D. Johnson, Jessica Kerns, Rolf R. Koford, Charles P. ..... Nicholson, Timothy J. O’connell, Martin D. Piorkowski, Roger D. Tankersley, Jr. (2008). ..“Patterns of Bat Fatalities at Wind Energy Facilities in North America”. *Journal of Wildlife Management* 72(1):61–78.

Arnett, E. B. and M. D. Tuttle (2004). “Cooperative Efforts to assess the impacts of wind turbines on bats.” *National Wind Coordinating Committee, Onshore Wildlife Interactions with wind Developments: Research Meeting V*, November 3-4, 2004, Landsdowne, VA. Resolve,Inc., Washington, D.C.

Athens, J. (2004). *Supplemental Archaeological Survey for Access Road, Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua‘a, Maui* (TMK 4-8-001:001 & 3-6-001:014). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

––– (2002). *An Upland Heiau Site.* Ukumehame Ahupua‘a, Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for GE Wind Energy, LLC, Tehachapi, California.

Baldwin, P.H. (1950). “Occurrence and behavior of the Hawaiian bat.” *J. Mammalogy* 31:455-456.

Banko, P.C. (1992). “Constraints on productivity of wild Nēnē or Hawaiian Geese *Branta sandvicensis*.” *Wildfowl* 43: 99–106.

––– (1988). Breeding biology and conservation of the Nēnē, Hawaiian goose (Nesochen sandvicensis). Ph.D. dissertation, Univ. Washington, Seattle. 255pp.

Banko, P. C., J. M. Black, and W. E. Banko (1999). Hawaiian Goose (Nēnē) (Branta sandvicensis). In *The Birds of North America*, No. 434 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Banko, W. E. (1980). Part I. Population histories—species accounts. Sea birds: Newell Shearwater ('A'o). Cooperative National Park Resources Studies Unit, University of Hawaii at Manoa, Honolulu, HI. CPSU/UH Avian History Report 5B: History of Endemic Hawaiian Birds. 35 pp.

Bellwood, J.J. and J.H. Fullard (1984). "Echolocation and Foraging Behaviour in the Hawaiian Hoary Bat, *Lasiurus cinereus semotus*." *Canadian Journal of Zoology* 62:2113-2120.

Bird Studies Canada (2003). *Wind Turbines and Birds: A Guidance Document for Environmental .. Assessment, Draft* December 2003. Prepared by Kingsley, A. and B. Whittam, Bird Studies Canada, for Canadian Wildlife Service, Environment Canada, Gatineau, Quebec.

Bonaccorso, F. (2008). Annual Summary Report: Hawaiian Hoary Bat Occupancy in Hakalau Forest National Wildlife Refuge. Special Use Permit: 12516-07008.

Brandt, C. A., J. K. Parrish, and C. N. Hodges. (1995). "Predictive approaches to habitat ..... quantification: Dark-rumped Petrels on Haleakalā, Maui." *Auk* 112: 571–579.

CFR (Code of Federal Regulations 1986). Title 36, Part 800: *Protection of Historic Properties*. (Including Part 800.9: Criteria of effect and adverse effect.)

––– (Code of Federal Regulations,1981). Title 36 Part 60: *National Register of Historic Places*. (Including Part 60.4: Criteria for evaluation.)

Clark, M. & R. Rechtman (2006). An Archaeological Survey of 333 Acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK (2) 4-8-001:001). Ukumehame Ahupuaʻa, Lahaina District, Island of Maui. Prepared for Kaheawa Wind Power II, LLC.

Conant, S. (1980). "Recent records of the 'Ua'u (Dark-rumped Petrel) and the 'A'o (Newell's Shearwater) in Hawaii." *'Elepaio* 41: 11–13.

––– (2005). An Archaeological Survey of the Proposed Kaheawa Wind Farm Project Area (Portions of TMK (2) 3-6-001:014 & (2) 4-8-001:001), Ukumehame Ahupuaʻa, Lahaina and Wailuku Districts, Island of Maui. Rechtman Consulting LLC Report RC-0328. Prepared for Kaheawa Wind Power LLC, Makawao, HI.

Cooper, Brian A. and Robert H. Day (July 7, 2008). *Modeling Annual Seabird Fatality At Wind Turbines At The Proposed KWP II Wind Energy Facility, Maui Island, Hawaiʻi*. Prepared by ABR, Inc. for First Wind. Author: Fairbanks, AK 99708-0410.

––– (2003). "Movement of Hawaiian Petrels to inland breeding sites on Maui Island, Hawaiʻi." *Waterbirds* 26:62–71.

––– (1998). "Summer behavior and mortality of Dark-rumped Petrels and Newell's Shearwaters at power lines on Kauaʻi." *Colonial Waterbirds* 21: 11–19.

Cooper, Brian A. & Robert H. Day, ABR, Inc. (2004a). Results of Endangered Bird and Bat Surveys at the Proposed Kaheawa Pastures Wind Energy Facility on Maui Island, Hawaii. Prepared for Kaheawa Windpower LLC.

––– (2004b). Modeling Annual Seabird Use and Fatality at the Proposed Kaheawa Pastures Wind Energy Facility, Maui Island, Hawaii. Prepared for Kaheawa Wind power LLC.

Cowie, R. H., Evenhuis, N. L. & Christensen, C. C. 1995. *Catalog of the Native Land and Freshwater Molluscs of the Hawaiian Islands*, Backhuys Publishers, Leiden, The Netherlands: vi + 248 pp.

Day, Robert H., and Brian A. Cooper (2002). *Petrel and shearwater surveys near Kalaupapa, Molokai Island, June 2002*. Unpublished report prepared for National Park Service, Hawaii National Park, HI, by ABR, Inc.—Environmental Research & Services,Fairbanks, AK, and Forest Grove, OR. 17 pp.

––– (2001). *Results of petrel and shearwater surveys on Kauaʻi, June 2001*. Unpublished report prepared for U. S. Fish and Wildlife Service, Honolulu, HI, by ABR, Inc., Fairbanks, AK, and Forest Grove, OR. 21 pp.

––– (1999). Results of Endangered Bird and Bat Surveys at the .....Proposed Kaheawa Pastures Windfarm on Maui Island, Hawai‘i, Summer 1999. Prepared by ABR, Inc., Forest Grove, OR and Fairbanks, AK for Zond Pacific, Wailuku, HI. 26 pp.

––– (1995). "Patterns of movement of Dark-rumped Petrels and Newell's Shearwaters on Kaua‘i." *Condor* 97: 1011–1027.

Day, R.H., B.A. Cooper, and T.C. Telfer (2003a). "Decline of Townsend's (Newell's) Shearwaters(Puffinus auricularis newelli) on Kauai, Hawaii." *Auk* 120:669-679.

Del Hoyo, J., A. Elliott and J. Sargatal. (1992). *The Handbook of the Birds of the World, Volume I.* Ostrich to Ducks. Lynx Edicions, Barcelona.

Department of Business, Economic Development and Tourism, State of Hawai‘i. (2006a). State *of Hawai‘i 2005 Data Book.*

––– (2006b). 2005 Annual Visitor Research Report.

Devereux, T., I. Masterson, M. Heidel, V. Creed, L. Pyle, H. Hammatt (1999). *Archaeological Inventory Survey and Subsurface Testing of a 440 Acre Parcel*. Ahupua`a of Ukamehame, District of Lahaina, Island of Maui (TMK 4-8-02:09). Cultural Surveys Hawaii. Prepared for Sugar Way Ltd.

Dirksen, S., A. L. Spaans and J. Winden (1998). "Nocturnal collision risks with wind turbines in tidal and semi-offshore areas." *Wind Energy and Landscape. Proceedings of the 2nd European and African Conference on Wind Engineering, 1997.* pp. 99-108.

DOFAW (Hawai‘i Division of Forestry and Wildlife). (2005a). http://www.dofaw.net/fbrp/projects.php?id=00064.

––– (2005b). Hawai‘i's Species of Greatest Conservation Need (July 27, 2005 Draft). http://www.state.hi.us/dlnr/ dofaw/cwcs/Conservation_ need.htm.

––– (2000). "Survey of the Nēnē population on Maui." *‘Elepaio* 60:25-28.

DOH (State of Hawai‘i Department of Health, Air Quality Branch), (2005). *Hawai‘i 2005 Air Quality Data Book.*

Electric Power Monthly (Sept 2006). http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum .html

Erickson, W.P. (2003). "Updated information regarding bird and bat mortality and risk at new generation wind projects in the west and Midwest." *National Wind Coordinating Committee, ... Wildlife Workgroup Meeting*, November 18, 2003. Resolve, Inc., Washington, D.C. http: //www.nationalwind. org/events/wildlife/2003 -2/presentations/erickson.pdf

Erickson, W. P., G. D. Johnson, D. P. Young, Jr., M. D. Strickland, R. E. Good, M. Bourassa, K. Bay (2002). Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical Report prepared for Bonneville Power Administration, Portland, Oregon.

Erickson, W.P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka and R.E. Good. (2001). Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee Publication. http://www.nationalwind.org/pubs/default.htm

Evans, W. R. (2003). "An assessment of the potential hazard to migrant birds from a wind farm proposed by Equinox Wind Partners, LLC on Little Equinox Mountain, Manchester, VT." Prepared for Vermont Fish and Wildlife Department. In *Bird Studies Canada 2003. Wind Turbines and Birds: A Guidance Document for Environmental Assessment*, Draft. Prepared by

Kingsley, A. and B. Whittam, Bird Studies Canada, for Canadian Wildlife Service, Environment Canada, Gatineau, Quebec.

Federal Register (1999a). Department of the Interior, Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants*. 50CFR 17:11 and 17:12 – December 3, 1999

––– (1999b). Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates or Proposed for Listing as Endangered or Threatened. Annual Notice of Findings on Recycled Petitions, and Annual Description of Progress on Listing Actions. Federal Register, 64 No. 205 (Monday, October 25, (1999): 57534-57547.

First Wind and Kaheawa Wind Power (2008). Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan Year 2 HCP Implementation. 82pp.

––– (2007a). Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan 2006 Annual Report Part 1. 43pp.

––– (2007b). Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan 2006 Annual Report Part 2. 52pp.

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 Lāna'i, 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.

Fujioka, K. K., and S. M. Gon III (1988). "Observations of the Hawaiian Bat (Lasiurus cinereus semotus) in the districts of Ka'u and South Kona, island of Hawai'i." *Journal of Mammalogy* 69: 369–371.

Fullard, J.H. (2001). "Auditory Sensitivity of Hawaiian Moths (Lepidoptera: Noctuidae) and Selective Predation by the Hawaiian Hoary Bat (*Chiroptera: Lasiurus cinereus semotus*)." *Proceedings of the Royal Society of London B.* 268:1375-1380.

Gill, J.P., M. Townsley, and G.P. Mudge (1996). "Review of the impacts of wind farms and other aerial structures upon birds." *Scottish Natural Heritage Review*. No. 21.

Gorresen, P. Marcos, Adam C. Miles, Christopher M. Todd, Frank J. Bonaccorso, and Theodore J.Weller (2008). "Assessing Bat Detectability and Occupancy with Multiple Automated Echolocation Detectors." *Journal of Mammalogy*, 89(1):11–17, 2008.

Guillemette, M., J. Larsen, and I. Clausager. 1999. Assessing the impact of the Tunø Knob wind park on sea ducks: the influence of food resources. NERI Technical Report No. 263.

––– (1998). *Impact assessment of an offshore wind park on sea ducks*. NERI Technical Report 227. National Environmental Research Institute, Kalø.

Hammatt, H., I. Masterson and T. Devereaux. (1996). *Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69kV Transmission Line Corridor.* Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric Co.

Handy, E.S.C., E.G. Handy and M. Pukui (1991). *Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69V Transmission Line Corridor*. Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric. Co.

Harrison, C. (1990). *Seabirds of Hawaii*. Natural History and Conservation. Cornell University Press, Ithaca.

Hawai'i Natural Heritage Program (1999). *Natural Diversity Database.* December 16, 1999.

Hays, W.S.T. and S. Conant (2007). "Biology and Impacts of Pacific Island Invasive Species. 1. A Worldwide Review of Effects of the Small Indian Mongoose, *Herpestes javanicus* (*Carnivora :Herpestidae*)." *Pacific Science* 61(1):3-16.

Hirai, L.T. (1978). "Possible dark-rumped petrel colony on Lanaʻi, Hawaiʻi." *ʻElepaio* 38:71-72.

Hobdy, Robert W. Environmental Consultant (2006). Botanical Resources Survey For The Kaheawa Pastures Wind Energy Project II Ukumehame, Maui, Hawaiʻi. Prepared for Kaheawa Windpower, LLC.

–––(2004a). Botanical Resources Survey for the Kaheawa Pastures Wind Energy Project Access Road – Primary Route. Ukumehame, Maui, Hawaii. Prepared for Kaheawa Wind Power, LLC. 18 pp.

––– (2004b). Botanical Resources Survey for the Kaheawa Pastures Wind Energy Project Access Road – Alternate Route Section. Ukumehame, Maui, Hawaii. Prepared for Kaheawa Windpower, LLC.

Hodges, C. S. (1994). Effects of introduced predators on the survival and fledging success of the ...endangered Hawaiian Dark-rumped Petrel (Pterodroma phaeo -pygia sandwichensis). M.S. thesis, Univ. of Washington, Seattle.

Hodges, C.S.N. and R.J. Nagata (2001). "Effects of Predator Control on the Survival and Breeding Success of the Endangered Hawaiian Dark-rumped Petrel." *Studies in Avian Biology* 22: 308-318.

Horn, J.W., E.B. Arnett, and T.H. Kunz (2008). "Behavioral Responses of Bats to Operating Wind Turbines." *Journal of Wildlife Management* 72(1):123-132.

Hoshide, H.M., A. J. Price, L. Katahira (1990). "A progress report on Nēnē Branta sandvicensis in Hawaiʻi Volcanoes National Park from 1974-89." *Wildfowl* 41: 152–155.

Hu, D. E. (1998). *Causes of endangerment and extinction in Hawaiian birds.* Ph.D. diss., Univ. of California, Davis.

Hu, D., C. Glidden, J. S. Lippert, L. Schnell, J. S. MacIvor, and J. Meisler (2001). "Habitat use and limiting factors in a population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i." Pages 234-242 in J. M. Scott, S. Conant, and C. van Riper III, eds. *Ecology, conservation, and management of endemic Hawaiian birds: A vanishing avifauna. Studies in Avian Biology* volume 22.

International Standard ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of Calculation.

Jacobs, D.S. (1994). "Distribution and abundance of the endangered Hawaiian Hoary Bat, Lasiurus cinereus simotus." *Pacific Science* 48:193-200.

––– (1993). *Character release in the endangered Hawaiian Hoary Bat, Lasiurus cinereus simotus.* Final report to U.S. Fish and Wildlife Services (Grant 14-48- 0001-92570). 6pp.

James, R.D. (2003). "Bird observations at the Pickering wind turbine." *Ontario Birds*, August 2003.

Johnson, G. D. (2005). "A review of bat mortality at wind-energy developments in the United States." *Bat Research News* 46:45–49.

Johnson, G.D., W.P. Erickson, M.D Strickland (2003a). Mortality of Bats at a Large-scale Wind Power Development at Buffalo Ridge, Minnesota. American Midland Naturalist 150(2):332-342. Johnson, G.D., W.P. Erickson, and M.D. Strickland. 2003b.

Johnson, G. D., W. P. Erickson, and M. D. Strickland (2003b). "What is known and not known about bat collision mortality at windplants?" In R. L. Carlton (ed.), *Proc. Workshop on Avian*

Interactions at Wind Turbines, 16-17 October, 2002, Jackson Hole, WY. Electric Power Research Inst., Palo Alto, CA.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd and D. A. Shepherd (2000). *Final report, avian monitoring studies at the Buffalo Ridge, Minnesota wind resource area: results of a 4-year study*. Prepared for Northern States Power Company, Minneapolis, by Western Ecosystems Technology, Inc.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo (2002). "Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota." *Wildlife Society Bulletin* 30:879-887.

Kaheawa Wind Power, LLC (2008). *KWP I and KWP II Acoustic Monitoring of Bat Activity*. Unpublished report.

Kaheawa Wind Power, LLC. (2006). Kaheawa Pastures Wind Energy Generation Facility Habitat Conservation Plan (TMK Nos. 4-8-001:001 and 3-6-001:014), Ukumehame, Maui, Hawai'i.

Kaheawa Wind Power, LLC. (2004). Kaheawa Pastures Wind Energy Generation Facility Final Environmental Assessment.

Kear, J. and A. J. Berger 1980. *The Hawaiian goose: an experiment in conservation*. Buteo Books, vermillion, SD.

Kepler, C. B., and J. M. Scott. 1990. "Notes on distribution and behavior of the endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus), 1964–1983." '*Elepaio* 50: 59–64.

Kerlinger, P. 2005. Bird studies: what we know and what has been done? 2nd Wind Power .Siting Workshop: Siting Wind Power Projects in the Eastern U. S. Sponsored by the American Wind Energy Association, www.awea.org.

Kerns, J., W. P. Erickson, and E. B. Arnett. 2005. Bat and Bird Fatality at Wind Energy Facilities in Pennsylvania and West Virginia. Pages 24–95 In: Arnett, E.B., editor. Relationships Between Bats and Wind Turbines in Pennsylvania and West Virginia: An ... Assessment of Bat Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. A Final Report Submitted to the Bats and Wind Energy . Cooperative. Bat Conservation International, Austin, Texas, USA. http://www.batcon.org/windliterature.. Accessed 1 Sep 2007.

Kingsley, A., and B. Whittam. (2007). *Wind Turbines and Birds: A Background Review for Environmental Assessment, Draft*. Canadian Wildlife Service, Environment Canada, Gatineau, Quebec.

Kramer, R. J. (1971). *Hawaiian Land Mammals*. Charles E. Tuttle, Rutland, VT. 347 pp.

Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak (2007). "Assessing Impacts of Wind-energy Development on Nocturnally Active Birds and Bats: A Guidance Document." *Journal of Wildlife Management* 71: 2449–2486.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, I. Davidson, L.Dickson, N. Edelson, R. Elliot, R.M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl (2002). *Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas*, Washington, DC.

Larsen, J. K., and J. Madsen (2000). "Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective." *Landscape Ecology* 15: 755-764.

Larsson, A. K. 1994. "The environmental impact from an offshore plant." *Wind Engineering* 18: 213-219.

Macdonald, G.A., A.T. Abbott, and F.L. Peterson. (1983). *Volcanoes in the Sea: The Geology of Hawai'i.* 2nd Edition. Honolulu: University Press, 517 p.

Magnuson, C.M. (2003). *Supplemental archaeological survey of turbine pad alignments, Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui.* Prepared for Hawaii Wind Energy, LLC, Honolulu. International Archaeological Research Institute, Inc., Honolulu.

Malama Environmental, LLC (2007). Phase 1 Environmental Site Assessment. Preliminary Summary for the Property Located at the Kaheawa Wind Farm, West Maui Mountains, Maui, HI. TMK(2) 4-8-01:001 (portion), MEV Project No. 0708-0066.

MECO, 1994. As cited in WSB-Hawai'i, Final Kaheawa Pastures 20 MW Windfarm, Maui, Hawai'i Environmental Impact Statement, August 26, 1999.

Medeiros, Arthur C. (1998). Botanical Survey of Proposed Road Construction Corridor, SE West Maui. Prepared for Zond Energy Systems, Inc.

––– (1996). A botanical survey of six proposed wind testing sites on leeward West Maui. Prepared for Zond Pacific, Inc.

Menard, T. (2001). Activity Patterns of the Hawaiian Hoary Bat (Lasiurus cinereus semotus) in Relation to Reproductive Time Periods. Masters thesis, Univ. of Hawai'i, Hawai'i.

Miller, A. H. (1937). "Structural modifications in the Hawaiian goose (*Nesochen sandvicensis*): a study in adaptive evolution." *University of California Publications in Zoology* 42(1):1-80.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung (2005). *Hawaii's Comprehensive Wildlife Conservation Strategy*. Department of Land and Natural Resources. Honolulu, HI. Available at: http://www.state.hi.us/dlnr/dofaw/cwcs/index.html. Accessed August 21, 2008.

Mossop, D. H. (1998). *Five years of monitoring bird strike potential at a mountain-top wind turbine, Yukon Territory*. Prepared for CANMET Energy Technology Centre, Natural Resources Canada.

Nishibayashi, E. (1998). *Native bird activity at proposed access road*. Prepared for Zond Pacific, Inc., Wailuku, HI, by Eric Nishibayashi Biological Consulting, Kahului, HI.

––– (1997). *Downed wildlife survey at six leeward West Maui wind monitoring towers*. Prepared for Zond Pacific, Inc., Wailuku, HI, by Eric Nishibayashi Biological Consulting, Kahului, HI.

OEQC (Office of Environmental Quality Control, State of Hawai'i 1997). *Guidelines for Assessing Cultural Impacts*. Adopted by the Environmental Council; November 19, 1997.

Parker, P.L., and T.F. King (1990). "Guidelines for Evaluating and Documenting Traditional Cultural Properties." *National Register Bulletin No. 38*. Washington, D.C.: U.S. Dept. Interior, National Park Service.

Percival, S. M. (2001). *Assessment of the effects of offshore wind farms on birds*. Report ETSU W/13/00565/REP, DTI/Pub URN 01/1434.

Pitman, R. L. (1986). *Atlas of Seabird Distribution and Relative Abundance in the Eastern Tropical Pacific.* La Jolla, California: NOAA, NMFS, Southwest Fisheries Center Administrative Report LJ-86-02C.

Podolsky, R. (2005). *Peer Review and Avian Risk of Collision Model, Kaheawa Pastures Wind Farm, Maui, HI*. Prepared by The Louis Berger Groyup, Rockport, ME for UPC Wind Management, LLC.

––– (2004). Avian Risk of Collision (ARC) model. National Wind Coordinating Committee, Onshore Wildlife Interactions with Wind Developments: Research Meeting V, ... November 3-4, 2004, Landsdowne, VA. Resolve, Inc., Washington, D.C.

Podolsky, R., D. G. Ainley, G. Spencer, L. DeForest, and N. Nur. (1998). "Mortality of Newell's Shearwaters caused by collisions with urban structures on Kaua'i." *Colonial Waterbirds* 21: 20–34.

Pratt, T. K. (1988). "Recent observations, March–May 1988." *'Elepaio* 48: 65–66.

Pratt, H.D., P.L. Bruner, and D.G. Berrett (1987). *The Birds of Hawaii and the Tropical Pacific*. Princeton University Press, Princeton, NJ.

Pukui, M. K., S. H. Elbert, and E. T. Mookini (1976). *Place Names of Hawai'i*. University of Hawai'i Press. Honolulu, Hawai'i. 289 pp.

Pyle, R. L. (1983). "Hawaiian Islands Region (1 June–31 July 1983)." *American Birds* 37: 1028–1029.

Rasmussen, C. (2005a). Supplemental Archaeological Reconnaissance Survey of the Southern Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 3-6-001:014). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

––– (2005b). Supplemental Archaeological Reconnaissance Survey within the SMA Zone for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 3-6-001:014). Draft. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

RESOLVE, Inc., Susan Savitt Schwartz, ed., Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts. Washington, DC. May 18-19, 2004, September 2004.

Reynolds, M. H., B. A. Cooper, and R. H. Day. 1997. "Radar study of seabirds and bats on windward Hawai'i." *Pacific Science* 51:97–106.

Reynolds, M.H. and G.L. Ritchotte. 1997. "Evidence of Newell's Shearwater Breeding in Puna District, Hawaii." *Journal of Field Ornithology* 68(10): 26-32

Richardson, F. and D.H. Woodside. 1954. "Rediscovery of the nesting of the Dark-rumped Petrel in the Hawaiian Islands." *Condor* 56: 323-327.

Ridge Energy Storage & Grid Services L.P. (June 27, 2005). *The Economic Impact of CAES on Wind in TX, OK, and NM: Final Report*. Prepared for the Texas State Energy Conservation Office. Houston, Texas.

Robins, J., W. Folk, & H. Hammatt. (1994). An Archaeological Inventory Survey of an Approximately 14.7 Mile Proposed Transmission Line from Ma'alaea to Lahaina, Maui, Hawai'i, Cultural Surveys Hawaii, Kailua, HI. Original 1991, Revised 1994.

Sanzenbacher P.M. and B.A. Cooper. (2009) Radar and Visual Studies of Seabirds at the Proposed KWP II Wind Energy Facility, Maui Island, Hawaii: Use of 2008 Data to Model Annual Collision Fatalities at Proposed Wind Turbines. Prepared for First Wind, Newton Massachusetts, 28 pp.

Severns, Mike R. (January 2009). An Assessment of Hawaiian Native Molluscan Fauna Kaheawa Pastures, West Maui, Hawai'i. Prepared for First Wind. Kihei, Hawai'i.

Severns, Mike R. In press. *An illustrated Catalog of the Shelled Molluscan Fauna of the Hawaiian Islands, Marine, Freshwater and Land*, Conchbooks Publishers. Maizer Str. 25, D-55546, Hackenheim, Germany. Estimated 800 pp.

Simons, T. R. (1985). "Biology and behavior of the endangered Hawaiian Dark-rumped Petrel." *Condor* 87: 229-245.

––– (1984). "A population model of the endangered Hawaiian dark-rumped petrel." *J. Wildl. Mgmt.* 48(4) 1065-1076.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (Pterodroma phaeopygia). In The Birds of North America, No. 345 (A. Poole and F. Gill, eds.). The Birds of North America, ...Inc., Philadelphia, PA.

Sincock, J. L., and G. E. Swedberg (1969), "Rediscovery of the nesting grounds of Newell's Manx Shearwater (Puffinus puffinus newelli), with initial observations." *Condor* 71:69–71.

Spear, L.B., Ainley, D.G., Nur, N., and Howell, S.N.G.. 1995. "Population size and factors affecting at-sea distributions of four endangered procellariids in the tropical Pacific." *Condor* 97:613-638.

State of Hawai'i (2002). *Hawai'i Statewide GIS Program*. Hazard Layer. URL: http://www.state.hi.us/dbedt/gis/hazard.htm

Still, D., B. Little and S. Lawrence (1995). *The Effect of Wind Turbines on the Bird Population at Blyth*. ETSU Report W/13/00394.

Strickland, M. D., G. D. Johnson and W. P. Erickson (2000). Avian use, flight behaviour, and mortality on the Buffalo Ridge, Minnesota, wind resource area. In Proceedings of National Avian - Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ontario. 202 pp.

SWCA (2009). Draft Kaheawa Wind Power II Wind Energy Generation Facility Habitat Conservation Plan. Prepared for First Wind, January 2009.

Telfer, T. C. (1986). Newell's Shearwater nesting colony establishment study on the island of Kaua'i. Final Report, Statewide Pittman-Robertson Program. Department of Lands and Natural Resources, State of Hawai'i, Honolulu, HI.

Telfer, T. C., J. L. Sincock, G. V. Byrd, and J. R. Reed (1987). "Attraction of Hawaiian seabirds to lights: conservation efforts and effects of moon phase." *Wildlife Society Bulletin* 15: 406–413.

Tetra Tech EC, Inc. (2008a). Draft Environmental Assessment For Issuance of an Endangered Species Act Section 10 (a)(1)(B) Permit for the Incidental Take of Listed Species for the Lanai Meteorological Towers Project. Castle & Cooke Resorts, LLC. Prepared for U.S. Fish & Wildlife Service.

––– (2008b). DRAFT Habitat Conservation Plan for the construction and operation of Lanai met towers, Lanai, Hawaii (Revised February 8, 2008, TTEC-PTLD-2008-080). Unpubl. report by Tetratech EC, Honolulu, HI for Castle and Cooke Resorts LLC, Lanai City, HI. 52 pp. + appendices. Available at: http:// www.state.hi.us/dlnr/dofaw/pubs/Lana'i_MetTowers_HCP.pdf.

Tomich, P. Q. (1986). "Mammals in Hawai'i: A synopsis and notational bibliography." Rev. ed. B.P. Museum, Honolulu, HI. Spec. Pub. 76.384 pp.

––– (1969). "Mammals in Hawaii: A Synopsis and Notational Bibliography." *B.P. Bishop Museum, Honolulu, HI.* Spec. Pub. 57. 238 pp.

Tomonari-Tuggle, M.J. (1998). *An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui.* Prepared for Warren S. Bollmeier, II, WSB Hawai‘i, Kaneohe, Hawai‘i. International Archaeological Research Institute, Inc., Honolulu.

––– (1995). *A Cultural Resource Management Plan for the Lahaina Pali Trail.* International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW and Tri-Isles RC&D Council, Inc., Wailuku.

Tomonari Tuggle, M.J., and C. Rasmussen. (2005). *Preservation plan for Site 50-50-09-5232, an upland heiau in Ukumehame Ahupua‘a, Island of Maui. TMK 4-8-01:1.* International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Tomonari-Tuggle, M.J., and H. Tuggle. (1991). Archaeological Survey of Two Deomonstration Trails of the Hawai‘i Statewide Trail and Access System: Lahaina Pali Trail, Island of Maui and Kaiolohia-Kahue Trail, Island of Lana‘i. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW.

Tulp, I., H. Schekkerman, J. K. Larsen, J. van der Winden, R. J. W. van de Haterd, P. van Horssen, S. Dirksen and A. L. Spaans. 1999. *Nocturnal flight activity of sea ducks near the windfarm Tunø Knob in the Kattegat*. IBN-DLO Report No. 99.30. (As cited in Percival 2001.)

USDA (United States Department of Agriculture) (1972). *Soil survey of the islands of Kaua‘i, Oahu, Maui, Moloka‘i, and Lana‘i, State of Hawai‘i.* Prepared by Donald E. Foote, Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens, USDA Soil Conservation Service.

USFWS (United States Fish and Wildlife Service). (2006). Final Environmental Assessment for the Issuance of an Endangered Species Act Section 10(a)(1)(B) Incidental Take Permit for the Hawaiian Petrel, Newell’s (Townsend) Shearwater, Hawaiian Goose or Nene, and Hawaiian Hoary Bat to the Kaheawa Pastures Wind Energy Generation Facility.

USFWS. (2005). *Regional Seabird Conservation Plan, Pacific Region*. U.S. Fish and Wildlife Service, Migratory Birds and Habitat Programs, Pacific Region, Portland, OR.

USFWS. (2004a). Draft revised recovery plan for the Nēnē or Hawaiian Goose (Branta sandvicensis). U. S. Fish and Wildlife Service, Portland, OR. 148 + xi pp.

USFWS. (2004b). *Interim Guidelines To Avoid and Minimize Wildlife Impacts From Wind Turbines.* www.fws.gov. USFWS. 2005. http://pacificislands.fws.gov/wesa/hawanimalsindex.html

USFWS. (1999). Endangered and Threatened Wildlife and Plants. 50 CFR 17.11 & 17.12

USFWS. (1998). *Recovery Plan for the Hawaiian Hoary Bat (Lasiurus cinereus semotus)*. U.S. Fish and Wildlife Service, Portland, OR. 50 pp.

USFWS. (1983). Hawaiian *Dark-rumped Petrel and Newell’s Manx Shearwater Recovery Plan.* U. S. Fish and Wildlife Service, Portland, OR. 57 pp.

U.S. Environmental Protection Agency and U.S. Department of Energy (July 2000). *Carbon Dioxide Emissions from the Generation of Electric Power in the United States.* (http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2report.html). Washington, D.C.

U.S. Geological Survey (2000). Water Resources Data, Hawai‘i and Other Pacific Areas, Water Years, 1999 and 2000.

––– (1999). Groundwater Atlas of the United States: Alaska, Hawai‘i, Puerto Rico and the U. S. Virgin Islands. HA 730-N O‘ahu Regional Aquifer System

––– (1997). *Hawai‘i Seismic Zone Assignments, 1988 and 1997.* URL: http://hvo.wr.usgs.gov/earthquakes/hazards/

Vuich Environmental Consultants (VEC) (2005). Environmental Site Assessment: Phase I Investigation. Kaheawa Pastures Proposed Windfarm, West Maui Mountains. Prepared for Kaheawa Wind Power LLC. Wailuku, HI.

Walker, W. (1931). *Archaeology of Maui*. Manuscript, Department of Anthropology, B.P. Bishop Museum, Honolulu.

Warham, J. (1996). The behaviour, population biology and physiology of the petrels. Academic Press, San Diego, CA.

Whitaker, J.O. and P.Q. Tomich. (1983). Food Habits of the Hoary Bat Lasiurus cinereus, from Hawaii. *Journal of Mammalogy* 64:151-52.

Wilson, K. Lehua, and R. Rechtman (2009). *Cultural Impact Assessment of the Kaheawa Wind Power II Project Area, Ukumehame Ahupuaʻa, Lahaina District, Island of Maui*. Rechtman Consulting, LLC Report RC-0590. Prepared for First Wind, Maui.

Woog, F. and J. M. Black (2001). "Foraging behavior and the temporal use of grasslands by Nēnē: implications for management." *Studies in Avian Biology* 22:319-328.

WSB Hawaii (1999). *Final Environmental Impact Statement, Kaheawa Pastures 20 MW Windfarm, Maui, Hawaii*. Prepared for Zond Pacific.

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10.0 PARTIES CONSULTED

10.1 EISPN CONSULTATION & DISTRIBUTION

10.1.1 CONSULTATION

KWP II LLC consulted the State Department of Land and Natural Resources Office of Conservation and Coastal Lands, Division of Forestry and Wildlife, Land Division, State Historic Preservation Division, and the U.S. Fish and Wildlife Service during the preparation of the EISPN.

10.1.2 EA/EISPN DISTRIBUTION

KWP II LLC distributed the EISPN to the individuals and organizations listed in Table 10.1 and requested their comments on the proposed scope of the analysis and on the completeness of the alternatives that it proposed to evaluate. It provided a limited number of loan copies to libraries.

Table 10.1. EISPN Distribution List

Maui County	**Libraries and Depositories**
Department of Water Supply	DBEDT Library
Department of Public Works & Environmental Mgmt.	Hawai‘i State Library Hawai‘i Documents Center
Department of Parks and Recreation	Legislative Reference Bureau
Department of Planning	Maui Community College Library
Department of Transportation Services	UH Hamilton Library
Department of Fire Control	Lahaina Public Library
Police Department	Kahului Regional Library
State Agencies	**Elected Officials**
Commission on Water Resource Management	Governor Linda Lingle
Department of Defense	U.S. Representative Mazie Hirono
Department of Hawaiian Homelands	U.S. Senator Daniel K. Inouye
Hawai‘i State Civil Defense	U.S. Senator Daniel Akaka
Office of Environmental Quality Control	State Representative Angus McKelvey
Office of Hawaiian Affairs	State Senator Rosalyn Baker
Department of Accounting and General Services	Mayor Charmaine Tavares
Department of Agriculture	Councilmember Jo Anne Johnson
Department of Business, Economic Development, and Tourism (DBEDT) Office of Planning	
DBEDT Energy, Resources & Technology Division	**Local Utilities**
Department of Health, Environ. Planning Office	Hawaiian Telcom
Department of Land and Natural Resources (5 copies)	Maui Electric Company
Department of Transportation	
DLNR Historic Preservation Division	**Other Parties**
UH Environmental Center	Sierra Club, Maui Group
	Maui Tomorrow
Federal Agencies	
Environmental Protection Agency (PICO)	**News & Media**
National Marine Fisheries Service	Honolulu Advertiser
US Army Engineer Division	Honolulu Star-Bulletin
US Fish and Wildlife Service	Maui News
US Federal Aviation Administration	
US Natural Resources Conservation Service	
US Geological Survey	
Source: Compiled by Planning Solutions, Inc.	

10.1.3 WRITTEN COMMENTS RECEIVED ON THE EISPN

KWP II LLC received written comments on the EISPN from the individuals and organizations listed in Table 10.2 below. The comment letters and KWP II LLC's responses to them are reproduced at the end of this Section.

Table 10.2. Written Comments Received on the EISPN

Number	*Name & Title of Commenter*	*Organizational Affiliation*
1	Thomas M. Phillips, Chief of Police	Maui Police Department
2	Ernest Y.W. Lau, Public Works Administrator	Department of Accounting and General Services, State of Hawai‘i
3	Tamara Horcajo, Director	Department of Parks and Recreation, Maui County
4	Edward T. Teixeira, Vice Director	Civil Defense, State of Hawai‘i
5	Irene Bowie, Executive Director	Maui Tomorrow Foundation, Inc.
6	Lawrence T. Yamamoto, Director	Natural Resources Conservation Service, Pacific Islands
7	Abbey Seth Mayer, Interim Director	Department of Business, Economic Development, & Tourism, State of Hawai‘i
8	Brennon T. Morioka, Interim Director	Department of Transportation, State of Hawai‘i
9	Clyde W. Nāmu‘o, Administrator	Office of Hawaiian Affairs, State of Hawai‘i
10	Paul J. Conry, Administrator	Division of Forestry & Wildlife, Department of Land & Natural Resources, State of Hawai‘i
11	Ken C. Kawahara, Deputy Director	Commission on Water Resource Management, State of Hawai‘i
12	Jeffrey S. Hunt, Planning Director	Maui County Planning Department
13	Kelvin H. Sunada, Manager	Environmental Planning Office, Department of Health, State of Hawai‘i
14	Gary Moniz, Chief	Division of Conservation & Resource Enforcement, Dept. of Land & Natural Resources, State of Hawai‘i
15	Morris Atta, Acting Administrator	Land Division, Department of Land & Natural Resources, State of Hawai‘i
Source: Compiled by Planning Solutions, Inc.		

POLICE DEPARTMENT
COUNTY OF MAUI

CHARMAINE TAVARES
MAYOR

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

GARY A. YABUTA
DEPUTY CHIEF OF POLICE

OUR REFERENCE
YOUR REFERENCE

February 21, 2008

Mr. Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, HI 96814-4012

Dear Mr. White:

SUBJECT: Kaheawa Wind Power II: EA/EISPN

Thank you for your letter of February 12, 2008 requesting comments on the above subject.

We have reviewed the Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN) and have enclosed our comments and recommendations. Thank you for giving us the opportunity to comment on the proposed project.

Very truly yours,

Assistant Chief Wayne T. Ribao
for: Thomas M. Phillips
Chief of Police

Enclosure

c: Jeffrey Hunt, Maui County Planning Department

COPY

TO : THOMAS PHILLIPS, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

FROM : BRAD HICKLE, POLICE OFFICER III, DISTRICT VI KIHEI

SUBJECT : KAHEAWA WIND POWER PROJECT II: ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EA/EISPN) @ TMK (2) 4-8-001:001 AND (2) 3-6-001:014

concur:
AC Wayne Ribao
02/21/08

APPLICANT INFORMATION:

Kaheawa Wind Power II, LLC (KWP II, LLC) is submitting this Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN) in order to obtain land use approvals from the State Department of Land and Natural Resources for an approximate 300- 400 acre portion of land located at TMK (2) 4-8-001:0001 and (2) 3-6-001:014 which is the Kaheawa Pastures above Maalaea, Maui, Hawaii.

IMPACT ON POLICE:

During the construction phase of Project I, uniform Off-duty Police Officers were utilized to assist with traffic control when transporting equipment and the wind towers from the harbor and to the job site in Maalaea. This union seemed to work well by minimizing potential traffic hazards to the general public. With this in mind I don't anticipate any additional impact on Police services created by the Phase II Project.

RECOMMENDATIONS:

Recommend Kaheawa Wind Power LLC continue to utilize trained traffic control personnel when transporting equipment and other supplies to the phase II job site to minimize traffic impact to the public.

Further recommend this information be returned to Mr. Perry J. White of Planning Solutions with our comments and recommendations. Thank you for the opportunity to submit our comments on this project.

Respectfully Submitted,

Officer Brad Hickle, E-9966
02/20/08 08:20 hours

Noted:
Capt 02/20/08

PLANNING SOLUTIONS

February 28, 2008

Mr. Thomas M. Phillips, Chief of Police
Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawai'i 96793

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Chief Phillips:

Thank you for your February 21, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II LLC's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written recommendations for minimizing impacts to traffic and police services. Our response to your comments is provided below. To simplify your examination, we have reproduced the text of your comments and recommendations in *italics* before our response.

Comments:

IMPACT ON POLICE:

During the construction phase of Project I, uniform Off-duty Police Officers were utilized to assist with traffic control when transporting equipment and the wind towers from the harbor and to the job site in Maalaea. This union seemed to work well by minimizing potential traffic hazards to the general public. With this in mind I don't anticipate any additional impact on Police services created by the Phase II Project.

RECOMMENDATIONS:

Recommend Kaheawa Wind Power LLC continue to utilize trained traffic control personnel when transporting equipment and other supplies to the phase II job site to minimize traffic impact to the public.

Response: Thank you for noting that the KWP I project successfully minimized traffic hazards with the assistance of uniformed off-duty police officers and providing a specific recommendation that the same methods be used for Kaheawa Wind Power II. KWP II LLC has informed us that it plans to implement these same traffic control measures for the proposed project.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

BARBARA A. ANNIS
DEPUTY COMPTROLLER

(P)1057.8

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

FEB 26 2008

Mr. Perry J. White
Planning Solutions, Inc.
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White:

Subject: Kaheawa Wind Power II: Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN)

Thank you for the opportunity to review the Environmental Impact Statement Preparation Notice for the Kaheawa Wind Power II, Wind Energy Generation Facility project at Ukumehame, Maui, Hawaii. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer.

If you have any questions, please have your staff call Mr. Clarence Kubo of the Planning Branch at 586-0488.

Sincerely,

ERNEST Y. W. LAU
Public Works Administrator

CKK:vca

PLANNING SOLUTIONS

February 28, 2008

Mr. Ernest Y.W. Lau, Public Works Administrator
Department of Accounting and General Services
State of Hawai'i
P.O. Box 119
Honolulu, Hawai'i 96810

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Lau:

Thank you for your February 26, 2008 letter [your reference (P)1057.8] concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter.

We appreciate your confirmation that the project will not impact any of your Department's projects or existing facilities and understand that your Department has no further comments to offer at this time.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
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CHARMAINE TAVARES
Mayor

TAMARA HORCAJO
Director

ZACHARY Z. HELM
Deputy Director

(808) 270-7230
Fax (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2 , Wailuku, Hawaii 96793

February 22, 2008

Planning Solutions
Attention: Perry J. White
219 Ward Avenue Suite 330
Honolulu, Hawaii 96814 - 4012

Dear Mr. Perry J. White

Subject: Kaheawa Wind power II Environmental Assessment / Environmental Impact Statement Preparation Notice (EA / EISPN)

We have reviewed the Kaheawa Wind power II Environmental Assessment / Environmental Impact Statement Preparation Notice (EA / EISPN) , and we have no comments or objections to the subject project.

Thank you for the opportunity to comment. Please contact me or Patrick Matsui, Chief of Planning and Development, at 270-7387 if there are any questions.

Sincerely,

TAMARA HORCAJO
Director, Parks & Recreation

xc: Patrick Matsui, Chief of Planning & Development

TH:PM:tk

PLANNING SOLUTIONS

March 4, 2008

Ms. Tamara Horcajo, Director
Department of Parks and Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Hawai'i 96793

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Horcajo:

Thank you for your February 22, 2008 letter concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter.

We understand that your Department has no comments to offer on the project at this time. If you have any questions in the future, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
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LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

March 4, 2008

Mr. Perry White
Planning Solutions, Inc.
210 Ward Ave., Suite 330
Honolulu, Hawaii 96814

Dear Mr. White:

Environmental Impact Statement Preparation Notice
Wind Energy Generation Facility, Ukumehame, Maui, Hawaii

Thank you for the opportunity to comment on this project. After careful review of the documents in the Environmental Impact Statement, we recommend a study of wind amplification in the West Maui Mountains which could impact the project area. Tropical cyclone systems, from tropical depressions to full hurricanes, are possible on any of the Hawaiian Islands. A study may show the potential effects of these weather hazards on the current wind farm, along with the proposed additional wind generating turbines. Beyond that, we have no further comments to make at this time.

If you have any questions, please call Mr. Richard Stercho, State Civil Defense Mitigation Planner, at (808) 733-4300, ext. 583.

Sincerely,

EDWARD T. TEIXEIRA,
Vice Director of Civil Defense

c: Kaheawa Wind Power II, LLC
Office of Conservation and Coastal Lands, DLNR
Department of Emergency Management (City and County of Honolulu)
State Civil Defense Radio Shop

PLANNING SOLUTIONS

May 19, 2008

Mr. Edward T. Teixeira, Vice Director of Civil Defense
Office of the Director of Civil Defense
Department of Defense
State of Hawai'i
3949 Diamond Head Road
Honolulu, Hawai'i 96816-4495

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Teixeira:

Thank you for your March 4, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments. To simplify your examination, we have reproduced the text of your comment in *italics* below, followed by our response.

Comment 1:

> *Thank you for the opportunity to comment on this project. After careful review of the documents in the Environmental Impact Statement, we recommend a study of wind amplification in the West Maui Mountains which could impact the project area. Tropical cyclone systems, from tropical depressions to full hurricanes, are possible on any of the Hawaiian Islands. A study may show the potential effects of these weather hazards on the current wind farm, along with the proposed additional wind generating turbines. Beyond that, we have no further comments to make at this time.*

Response: The GE 1.5 MW wind turbine generators (WTGs) proposed for the KWP II project are designed to operate (i.e., generate power) in wind speeds between about 9 and 55 mph. At winds above that velocity the WTGs automatically cut out and the blades feather to an inactive position (i.e., perpendicular to the wind), which allows them to withstand hurricane-force winds. KWP II engineers' analysis of the available wind data indicates that winds in excess of the design speed are extremely rare. Hence, KWP II believes it is very unlikely that the equipment will be overstressed to the point of breakage during the 30-year project life span. The results of KWP II's failure analysis of the equipment will be included in the *Draft EIS.*

Thank you again for your comments. If you have any questions or would like to discuss this further, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

Ward Plaza, Suite 330 • 210 Ward Avenue • Honolulu, Hawaii 96814-4012
Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

MAUI TOMORROW FOUNDATION, INC.

Protecting Maui's Future

March 8, 2008

Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96914-4012

Subject: Comments on Kaheawa Wind Power II: Environmental Assessment/Environmental Impact Statement

In reviewing the above-referenced materials Maui Tomorrow Foundation, Inc. strongly agrees that additional 1.5 MW wind turbine generators ("WTG's) are needed and that they should be sited near the existing farm to leverage infrastructure while minimizing visual impact. We believe that two distant farms are more visually jarring than a single, larger one. Further, from the wind data presented in Figures 3.3 and 3.4 of this document, there is doubt of the viability of the competing Shell/Ulupalakua project.

Maui Tomorrow does have several specific observations:

1. This document cites MECO's April 2007 "Preferred Plan" calling for another 10.5MW (7 WTG's) in 2011. While this proposal is for another 14 to 20 WTG's, they are "not actively investigating a farm with fewer than 14 WTG's and would not consider a facility with fewer than 7 WTG's." Maps indicate 37 potential sites, subject to the conclusions of on-going wind studies. We are unsure how useful an EIS could be with so many variables -- specifically, how many turbines will there be and in which locations?

2. An archaeological survey in 2006 covered "most of the proposed KWP II project area." Section 4.8 seems to indicate that additional archaeological fieldwork will not be done for the EIS, despite the fact that a note on Figure 3.5 indicates 19 of the 37 proposed locations are in areas not covered by the 2006 survey.

3. The proposed on-site battery storage facility using "Power Cell technology" needs further details. Maui needs more assurance than merely stating that this

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MAUI TOMORROW FOUNDATION, INC.
"Protecting Maui's Future"

technology "offers several environmental advantages."

4. No mention is made of Maui Cultural Lands' efforts to plant native vegetation on Kaheawa Pasture areas disrupted by construction. While guided by the Wild Life Fire Contingency Plan that is in place for KWF I, and as part of a continued Habitat Conservation Plan, inclusion of Maui Cultural Lands' efforts should be specifically endorsed and fully funded by KWP II.

Maui Tomorrow Foundation would hope that Kaheawa Wind Power would also install some type of energy storage devise to assure MECO that the energy is from a firm power source, not a wind-variable source. This might be possible using "pump-storage" on the steep slopes above Maalaea or in Ukumahame Canyon on the west side of the mountain ridge.

In summation, Kaheawa Wind Power II builds on the successes of its initial phase. It further substitutes renewable energy for fossil fuel and thus receives Maui Tomorrow Foundation's general support.

Sincerely,

Irene Bowie

Irene Bowie
Executive Director

P.O. Box 299 • Makawao, HI 96768 • Phone: 579-9802 • Fax: 572-9802 • aina@maui-tomorrow.org • www.maui-tomorrow.org

PLANNING
SOLUTIONS

May 6, 2008

Ms. Irene Bowie, Executive Director
Maui Tomorrow Foundation, Inc.
P.O. Box 299
Makawao, Hawai'i 96768

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Bowie:

Thank you very much for your March 8, 2008 letter expressing support for Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and others in your organization spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice (EA/EISPN)* and providing written comments.

Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

In reviewing the above-referenced materials Maui Tomorrow Foundation, Inc. strongly agrees that additional 1.5 MW wind turbine generators (WTG's) are needed and that they should be sited near the existing farm to leverage infrastructure while minimizing visual impact. We believe that two distant farms are more visually jarring than a single, larger one. Further, from the wind data presented in Figures 3.3 and 3.4 of this document, there is doubt of the viability of the competing Shell/Ulupalakua project.

Response: Thank you very much for expressing your organization's strong belief that additional wind generating capacity is needed on Maui and that placing the additional turbines adjacent to the existing KWP facility would minimize visual impacts while making the most of existing infrastructure and wind resources. KWP II shares your conviction that the proposed project site represents the most viable site for harnessing additional wind energy.

Comment 2:

This document cites MECO's April 2007 "Preferred Plan" calling for another 10.5MW (7 WTG's) in 2011. While this proposal is for another 14 to 20 WTG's, they are "not actively investigating a farm with fewer than 14 WTG's and would not consider a facility with fewer than 7 WTG's. Maps indicate 37 potential sites, subject to the conclusions of on-going wind studies. We are unsure how useful an EIS could be with so many variables – specifically, how many turbines will there be and in which locations?

Response: You are correct in noting that the *EA/EISPN* includes 37 potential turbine locations in four siting areas but, as discussed in the EA/EISPN, only a fraction of the sites would actually be used. We feel it is important to evaluate a wide range of alternatives in the environmental documentation for the project. There are two fundamental reasons for this. First, KWP II has not yet finished collecting the wind data needed to determine exactly which locations have the best wind resources. In fact, the data may show that some are not viable, and it is important to ensure that at least some of the locations covered in the environmental documentation are viable. Because it would be premature to eliminate sites at this time, we must discuss all in the report.

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Comment 3:

An archaeological survey in 2006 covered "most of the proposed KWP II project area." Section 4.8 seems to indicate that additional archaeological fieldwork will not be done for the EIS, despite the fact that a note on Figure 3.5 indicates 19 of the 37 proposed locations are in areas not covered by the 2006 survey.

Response: The discussion in Section 4.8 of the EA/EISPN was not meant to imply that no further archaeological work would be performed on sites that had not been covered by previous surveys. On the contrary, KWP II is in the process or commissioning the additional work and consultation, and the results of those studies and discussions will be included in the Draft EIS.

Comment 4:

The proposed on-site battery storage facility using "Power Cell technology" needs further details. Maui needs more assurance than merely stating that this technology "offers several environmental advantages."

Response: Your comment is duly noted. KWP II has continued working with MECO on battery storage technology and will include further details on the proposed system in the *Draft EIS.*

Comment 5:

No mention is made of Maui Cultural Lands' efforts to plant native vegetation on Kaheawa Pasture areas disrupted by construction. While guided by the Wild Life Fire Contingency Plan that is in place for KWP I, and as part of a continued Habitat Conservation Plan, inclusion of Maui Cultural Lands' efforts should be specifically endorsed and fully funded by KWP II.

Response: Thank you for your suggestion concerning Maui Cultural Lands' (MCL) possible involvement in KWP II. Kaheawa Wind Power greatly appreciates the service that MCL has provided to the existing wind farm and the community. KWP provided funding to MCL for the care and replanting of native plants that were removed during the development of the existing wind farm site. Under this agreement MCL is propagating native plants at a nursery on Maui for ongoing reintroduction to Kaheawa Pastures. KWP II representatives have informed us that it will continue being supportive of MCL should it wish to continue its restoration initiatives. It should be noted that the Conservation District Use Permit (CDUP) that was issued for the existing wind farm makes Kaheawa Wind Power responsible for replanting areas disturbed by construction with native vegetation. The same is likely to be true if a CDUP is issued for KWP II.

Comment 6:

Maui Tomorrow Foundation would hope that Kaheawa Wind Power would also install some type of energy storage devise [sic] *to assure MECO that the energy is from a firm power source, not a wind-variable source. This might be possible using "pump-storage" on the steep slopes above Maalaea or in Ukumahame* [sic] *Canyon on the west side of the mountain ridge.*

Response: KWP II agrees that some energy storage is a desirable component of any future expansion of wind generating capacity at Kaheawa Pastures. As noted in Section 2.5.3.4 of the *EA/EISPN,* several storage technologies are available, some of which are better suited to the

proposed project than others. The absence of a readily available fresh water source and lack of space for the required upper and lower water storage reservoirs has led KWP II to conclude that it is not feasible to use pumped storage at this location. However, as noted above KWP II plans to provide storage capacity using battery technology and will explore this further in the *DEIS*.

Thank you again for your comments and support of the project. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850
808-541-2600

March 5, 2008

Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White,

Please find enclosed an NRCS Soil Survey Map, soil reports, and maps indicating areas of Important Farmlands, and Hydric soils. The Important Farmlands map has been enclosed for your aid in determining if an AD-1006 form, Farmland Impact Conversion Rating Form is needed for the USDA-Natural Resources Conservation Service Review of Kaheawa Wind power II Project. Typically, this form is required on projects that convert farmlands into non-farmland uses and have federal dollars attached to the project. See the website link below for more information on the Farmland Protection Act, and a copy of the (AD-1006) form, with instructions. The hydric soils map enclosed identifies potential areas of wetlands. In this project area hydric soils are of very small extent. If wetlands do exist, any proposed impacts to these wetlands would need compliance with the "Clean Water Act", and may need an Army Corp of Engineers 404 permit.

The NRCS Soil Survey Map identifies all soil map units in the project area. The soil reports provide selected soil properties and interpretations, i.e. flooding hazard, limitations for roads, and dwellings, soil layers with USDA textures, and engineering classifications. The limitation ratings for the selected uses, i.e. roads and streets, range from somewhat limited to very limited. Somewhat limited to very limited rating does not preclude the intended land use, however it does identify limitations for the specific use, which may require corrective measures, increase costs, and require continued maintenance. In addition, if the planned service roads are located on the steep slopes in this area, design and construction should consider the potential soil erosion hazard.

The NRCS Soil Survey is a general planning tool and does not eliminate the need for an onsite investigation. If you have any questions concerning the soils or interpretations for this project please contact, Tony Rolfes, Assistant State Soil Scientist, by phone (808-541-2600 x129), or email, Tony.Rolfes@hi.usda.gov.

NRCS - Farmland Protection Policy Act Website:
http://www.nrcs.usda.gov/programs/fppa/

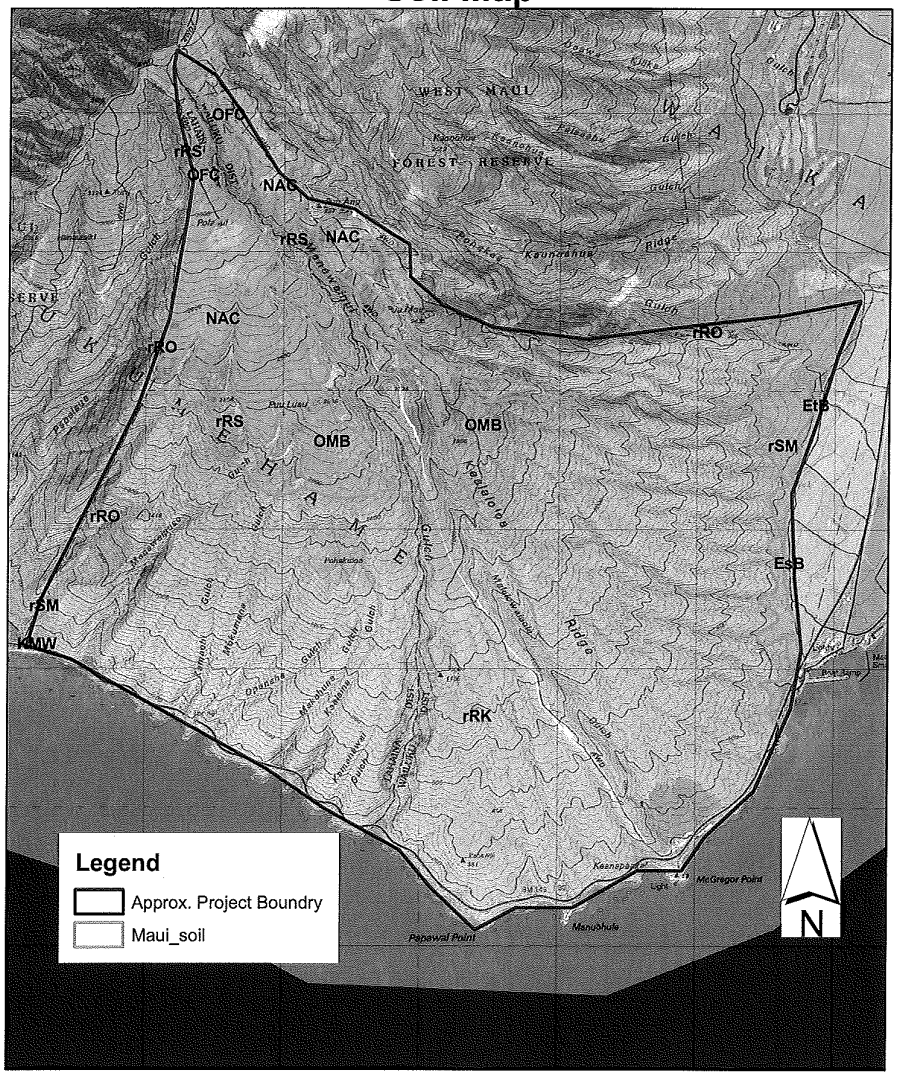
Sincerely,

LAWRENCE T. YAMAMOTO
Director
Pacific Islands Area

Enclosures:

cc: Michael Robotham, Assistant Director for Soil Science and Natural Resource Assessments, USDA-NRCS, Pacific Islands Area, Honolulu, HI

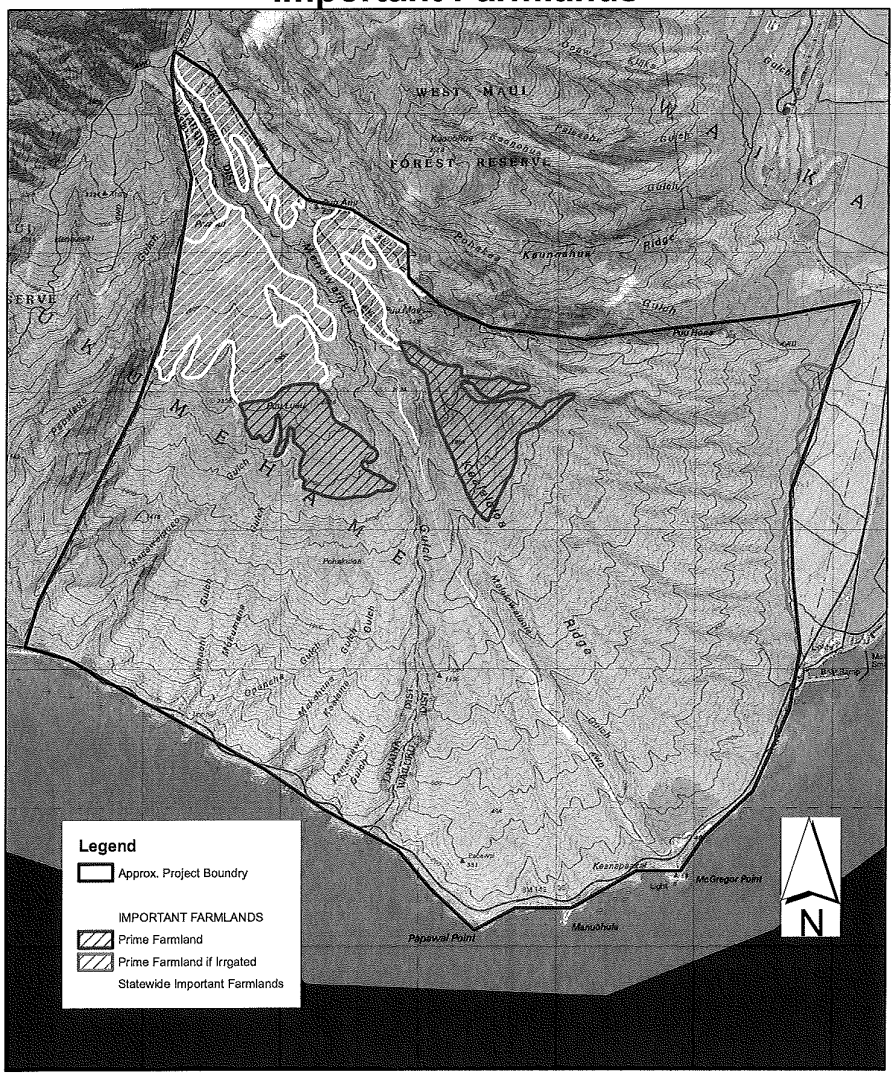
Kaheawa Wind Power II Project Site
Soil Map



0 950 1,900 3,800 5,700 7,600 Feet

NRCS
3/2008

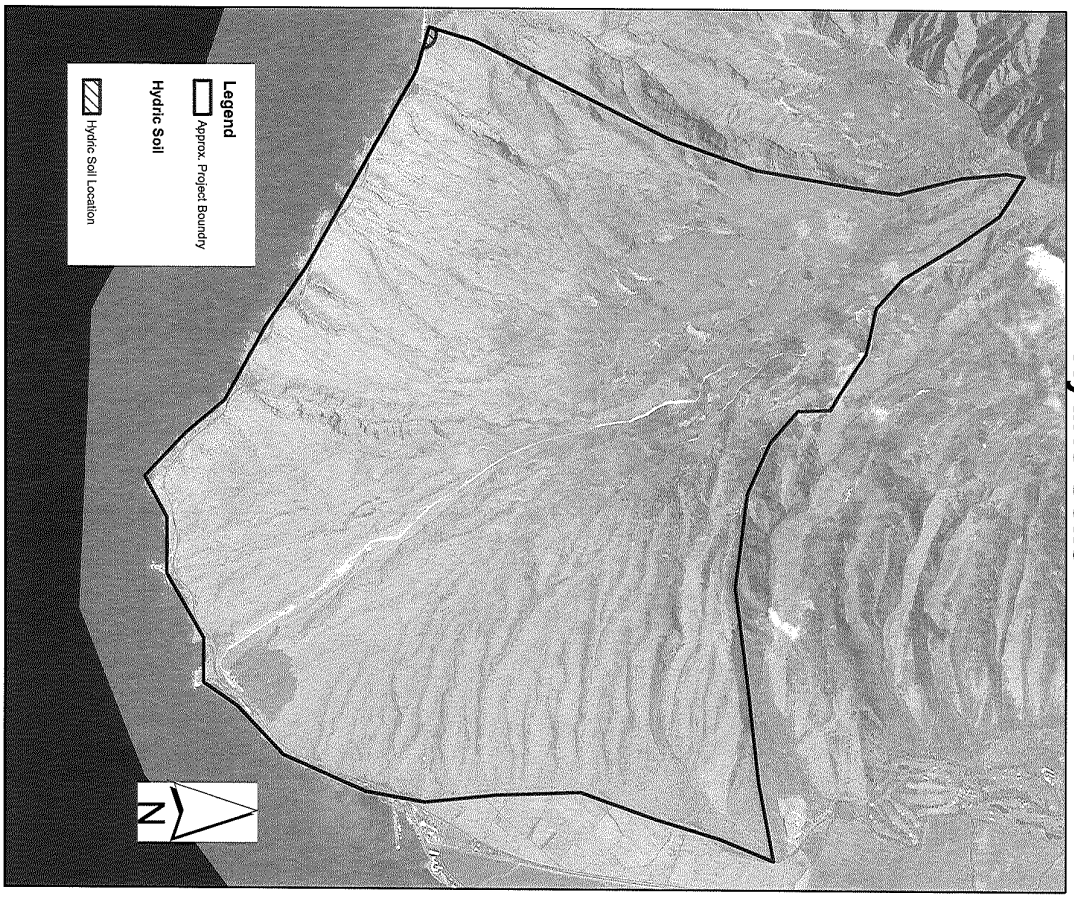
Kaheawa Wind Power II Project Site
Important Farmlands



0 950 1,900 3,800 5,700 7,600 Feet

NRCS
3/2008

Kaheawa Wind Power II Project Site
Hydric Soils



Physical Soil Properties

Island of Maui, Hawaii

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
OMB:														
Oli	0-13	---	---	12-27	0.25-0.60	4.23-42.00	0.12-0.14	0.0-2.9	5.0-10	.17	.17	2	6	48
	13-30	---	---	12-27	0.25-0.60	4.23-42.00	0.12-0.14	0.0-2.9	1.0-4.0	.17	.17			
	30-40	---	---	0	---	0.02-0.42	0.00	0.0	0.0	.02	.02			
rRK:														
Rock land	0-4	---	---	30-55	1.20-1.40	4.00-14.00	0.12-0.16	0.0-2.9	3.0-6.0	.10	.10	1	7	38
	4-8	---	---	30-55	1.20-1.40	4.00-14.00	0.12-0.16	0.0-2.9	1.0-4.0	.10	.10			
	8-20	---	---	0	---	0.02-0.42	0.00	0.0	0.0	.02	.02			
rRO:														
Rock outcrop	0-60	---	---	0	---	0.02-0.42	0.00	0.0	0.0	---	---	---	---	---
rRS:														
Rough broken and stony land	0-8	---	---	30-50	0.45-0.90	4.00-14.00	0.06-0.11	0.0-2.9	2.0-10	.05	.10	3	8	0
	8-18	---	---	30-50	0.45-0.90	4.00-14.00	0.14-0.16	0.0-2.9	2.0-5.0	.10	.10			
	18-60	---	---	0	---	0.02-0.42	0.00	0.0	0.0-0.3	.02	.02			

Physical Soil Properties

Island of Maui, Hawaii

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
EsB:														
Ewa	0-18	---	---	40-60	1.10-1.35	4.23-14.00	0.09-0.14	0.0-2.9	1.0-4.0	.17	.17	5	7	38
	18-60	---	---	40-60	1.10-1.30	4.23-14.00	0.11-0.17	0.0-2.9	0.1-2.0	.17	.17			
EtB:														
Ewa, cobbly	0-18	---	---	40-60	1.10-1.35	4.23-14.00	0.09-0.11	0.0-2.9	1.0-4.0	.15	.17	5	7	38
	18-60	---	---	40-60	1.10-1.30	4.23-14.00	0.10-0.12	0.0-2.9	0.1-2.0	.17	.17			
KlWV:														
Kealia	0-3	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	1.0-3.0	.17	.17	5	5	56
	3-19	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
	19-63	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
Kealia, deep water table	0-3	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	1.0-3.0	.17	.17	5	5	56
	3-19	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
	19-63	---	---	10-18	1.00-1.30	4.23-42.00	0.09-0.11	0.0-2.9	0.0	.17	.17			
NAC:														
Naiwa	0-11	---	---	35-40	0.80-1.10	4.23-42.00	0.09-0.11	0.0-2.9	7.0-14	.37	.37	4	4	86
	11-40	---	---	20-27	0.60-0.90	4.23-42.00	0.09-0.11	0.0-2.9	6.0-8.0	.37	.37			
	40-52	---	---	15-25	0.60-0.90	4.23-42.00	0.09-0.11	0.0-2.9	2.0-4.0	.17	.37			
	52-60	---	---	0	—	0.02-0.42	0.00	0.0	0.0	.02	.02			
OFC:														
Olelo	0-10	---	---	55-60	1.20-1.30	1.41-14.11	0.10-0.12	0.0-2.9	4.0-7.0	.10	.10	5	7	38
	10-37	---	---	55-60	1.10-1.20	0.42-4.23	0.10-0.12	0.0-2.9	2.0-4.0	.10	.10			
	37-60	---	---	35-60	1.10-1.20	0.01-1.41	0.10-0.12	0.0-2.9	2.0-4.0	.10	.10			

Sewage Disposal

Island of Maui, Hawaii

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
rRK:					
Rock land	55	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
rRO:					
Rock outcrop	100	Not rated		Not rated	
rRS:					
Rough broken and stony land	100	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Large stones content	0.01	Seepage	0.50
				Large stones content	0.09

Sewage Disposal

Island of Maui, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
EsB:					
Ewa	100	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.68
				Seepage	0.50
EtB:					
Ewa, cobbly	100	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Large stones content	0.83
				Slope	0.68
				Seepage	0.50
KMW:					
Kealia	45	Very limited		Very limited	
		Flooding	1.00	Ponding	1.00
		Ponding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
				Seepage	1.00
Kealia, deep water table	35	Very limited		Very limited	
		Flooding	1.00	Ponding	1.00
		Ponding	1.00	Flooding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00
				Seepage	1.00
NAC:					
Naiwa	100	Very limited		Very limited	
		Seepage, bottom layer	1.00	Slope	1.00
		Depth to bedrock	0.69	Seepage	1.00
		Slope	0.63	Depth to soft bedrock	0.26
OFC:					
Olelo	100	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.04		
OMB:					
Oli	100	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Seepage, bottom layer	1.00	Slope	1.00
				Seepage	1.00

Dwellings and Small Commercial Buildings

Island of Maui, Hawaii

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
rRS:							
Rough broken and stony land	100	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Depth to soft bedrock	0.50	Depth to soft bedrock	1.00	Depth to soft bedrock	1.00
		Large stones content	0.01	Large stones content	0.01	Large stones content	0.01

Dwellings and Small Commercial Buildings

Island of Maui, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EsB:							
Ewa	100	Not limited		Not limited		Somewhat limited	
						Slope	0.13
EtB:							
Ewa, cobbly	100	Not limited		Not limited		Somewhat limited	
						Slope	0.13
KMW:							
Kealia	45	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.07	Depth to saturated zone	1.00	Depth to saturated zone	0.07
Kealia, deep water table	35	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Depth to saturated zone	0.07	Depth to saturated zone	1.00	Depth to saturated zone	0.07
NAC:							
Naiwa	100	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
OFC:							
Olelo	100	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.04	Slope	0.04	Slope	1.00
OMB:							
Oli	100	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.46	Depth to hard bedrock	1.00	Slope	0.88
						Depth to hard bedrock	0.46
rRK:							
Rock land	55	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00	Slope	1.00
rRO:							
Rock outcrop	100	Not rated		Not rated		Not rated	

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Island of Maui, Hawaii

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
rRK:							
Rock land	55	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Low strength	1.00	Slope	1.00	Droughty	1.00
		Slope	1.00	Cutbanks cave	0.10	Too clayey	1.00
						Slope	1.00
						Large stones content	0.03
rRO:							
Rock outcrop	100	Not rated		Not rated		Not rated	
rRS:							
Rough broken and stony land	100	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00	Slope	1.00
		Depth to soft bedrock	1.00	Slope	1.00	Large stones content	1.00
		Low strength	1.00	Cutbanks cave	0.10	Depth to bedrock	1.00
		Large stones content	0.01	Large stones content	0.01	Droughty	0.96

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

Island of Maui, Hawaii

[The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The columns that identify the rating class and limiting features show no more than five limitations for any given soil. The soil may have additional limitations. This report shows only the major soils in each map unit]

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
EsB:							
Ewa	100	Somewhat limited		Somewhat limited		Very limited	
		Low strength	0.10	Too clayey	0.96	Too clayey	1.00
				Cutbanks cave	0.10		
EtB:							
Ewa, cobbly	100	Somewhat limited		Somewhat limited		Very limited	
		Low strength	0.10	Too clayey	0.96	Large stones content	1.00
				Cutbanks cave	0.10	Too clayey	1.00
KMW:							
Kealia	45	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Depth to saturated zone	1.00	Flooding	1.00
		Depth to saturated zone	0.03	Flooding	0.80	Salinity	1.00
				Cutbanks cave	0.10	Depth to saturated zone	0.03
						Droughty	0.01
Kealia, deep water table	35	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Flooding	1.00	Depth to saturated zone	1.00	Flooding	1.00
		Depth to saturated zone	0.03	Flooding	0.80	Salinity	1.00
				Cutbanks cave	0.10	Depth to saturated zone	0.03
						Droughty	0.01
NAC:							
Naiwa	100	Very limited		Very limited		Somewhat limited	
		Low strength	1.00	Cutbanks cave	1.00	Slope	0.63
		Slope	0.63	Slope	0.63	Droughty	0.01
OFC:							
Olelo	100	Very limited		Somewhat limited		Very limited	
		Low strength	1.00	Too clayey	0.97	Too clayey	1.00
		Slope	0.04	Cutbanks cave	0.10	Slope	0.04
				Slope	0.04		
OMB:							
Oli	100	Somewhat limited		Very limited		Very limited	
		Depth to hard bedrock	0.46	Depth to hard bedrock	1.00	Gravel content	1.00
				Cutbanks cave	0.10	Depth to bedrock	0.46
						Droughty	0.01

Map Unit Description (Brief, Generated)

Island of Maui, Hawaii

Map unit: rRS - Rough broken and stony land

Component: Rough broken and stony land (100%)

Generated brief soil descriptions are created for major soil components. The Rough broken and stony land is a miscellaneous area.

Map Unit Description (Brief, Generated)

Island of Maui, Hawaii

Map unit: NAC - Naiwa silty clay loam, 3 to 20 percent slopes

Component: Naiwa (100%)

The Naiwa component makes up 100 percent of the map unit. Slopes are 3 to 20 percent. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: OFC - Olelo silty clay, 3 to 15 percent slopes

Component: Olelo (100%)

The Olelo component makes up 100 percent of the map unit. Slopes are 3 to 15 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: OMB - Oli silt loam, 3 to 10 percent slopes

Component: Oli (100%)

The Oli component makes up 100 percent of the map unit. Slopes are 3 to 10 percent. Depth to a root restrictive layer, bedrock, lithic, is 24 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 8 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: rRK - Rock land

Component: Rock land (55%)

The Rock land component makes up 55 percent of the map unit. Slopes are 0 to 70 percent. Depth to a root restrictive layer, bedrock, lithic, is 4 to 10 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: rRO - Rock outcrop

Component: Rock outcrop (100%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map Unit Description (Brief, Generated)

Island of Maui, Hawaii

[Minor map unit components are excluded from this report]

Map unit: EsB - Ewa silty clay, 3 to 7 percent slopes

Component: Ewa (100%)

The Ewa component makes up 100 percent of the map unit. Slopes are 3 to 7 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4c. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: EtB - Ewa cobbly silty clay, 3 to 7 percent slopes

Component: Ewa, cobbly (100%)

The Ewa, cobbly component makes up 100 percent of the map unit. Slopes are 3 to 7 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 4s. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: KMW - Kealia silt loam

Component: Kealia (45%)

The Kealia component makes up 45 percent of the map unit. Slopes are 0 to 1 percent. This component is on salt marshes. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. The soil has a strongly saline horizon within 30 inches of the soil surface.

Component: Kealia, deep water table (35%)

The Kealia, deep water table component makes up 35 percent of the map unit. Slopes are 0 to 1 percent. Depth to a root restrictive layer is greater than 60 inches. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 27 inches during February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 2 percent. This soil does not meet hydric criteria. The soil has a strongly saline horizon within 30 inches of the soil surface.

Map Unit Legend

Island of Maui, Hawaii

Map symbol	Map unit name
EsB	Ewa silty clay, 3 to 7 percent slopes
EtB	Ewa cobbly silty clay, 3 to 7 percent slopes
KMW	Kealia silt loam
NAC	Naiwa silty clay loam, 3 to 20 percent slopes
OFC	Olelo silty clay, 3 to 15 percent slopes
OMB	Olil silt loam, 3 to 10 percent slopes
rRK	Rock land
rRO	Rock outcrop
rRS	Rough broken and stony land

Engineering Properties

Island of Maui, Hawaii

[Absence of an entry indicates that the data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
EsB:												
Ewa	0-18	Silty clay	CL-K (proposed), ML-K (proposed)	A-6, A-7	0	0	100	100	95-100	85-100	35-45	10-20
	18-60	Silty clay loam	CL-K (proposed), ML-K (proposed)	A-6, A-7	0	0-5	100	95-100	90-100	85-100	35-45	10-20
EtB:												
Ewa, cobbly	0-18	Cobbly silty clay	CL-K (proposed), ML-K (proposed)	A-6, A-7	0-20	15-30	100	100	95-100	85-100	35-45	10-20
	18-60	Silty clay loam	CL-K (proposed), ML-K (proposed)	A-6, A-7	0	0-5	100	95-100	90-100	85-100	35-45	10-20
KMW:												
Kealia	0-3	Silt loam	ML-K (proposed)	A-4	0	0	100	100	90-100	70-90	30-40	NP-10
	3-19	Loam	ML-K (proposed)	A-4	0	0	100	100	85-95	60-75	30-40	NP-10
	19-63	Fine sandy loam	SM	A-4	0	0	90-100	85-95	65-75	40-50	30-40	NP-10

Engineering Properties

Island of Maui, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
KMW:												
Kealia, deep water table	0-3	Silt loam	ML-K (proposed)	A-4	0	0	100	100	90-100	70-90	30-40	NP-10
	3-19	Loam	ML-K (proposed)	A-4	0	0	100	100	85-95	60-75	30-40	NP-10
	19-63	Fine sandy loam	SM	A-4	0	0	90-100	85-95	65-75	40-50	30-40	NP-10
NAC:												
Naiwa	0-11	Silty clay loam	MH-A (proposed), ML-A (proposed)	A-5, A-7	0	0	100	100	95-100	85-100	45-55	5-15
	11-40	Loam, silt loam	MH-A (proposed), ML-A (proposed)	A-5, A-7	0	0	95-100	90-100	80-100	60-90	45-55	5-15
	40-52	Very gravelly loam	SM	A-5	0	5-22	75-90	50-60	40-55	35-45	45-55	NP-10
	52-60	Bedrock	---	---	0	0	0	0	0	0	0	NP
OFC:												
Olelo	0-10	Silty clay	MH-O (proposed)	A-7	0	0	90-100	85-95	85-90	80-85	55-75	20-35
	10-37	Silty clay	MH-O (proposed)	A-7	0	0	95-100	95-100	95-100	95-100	55-75	20-35
	37-60	Silty clay, silty clay loam	MH-O (proposed)	A-7	0	10-20	95-100	95-100	95-100	95-100	55-75	20-35

Engineering Properties
Island of Maui, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number–				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
OMB:												
Oil	0-13	Silt loam	MH-A (proposed), ML-A (proposed)	A-7	0	0	0	0	0	0	45-70	10-25
	13-30	Loam, silty clay loam, silt loam	MH-A (proposed), ML-A (proposed)	A-7	0	0	0	0	0	0	45-70	10-25
	30-40	Bedrock	---	---	0	0	0	0	0	0	0	NP
rRK:												
Rock land	0-4	Silty clay loam	MH-K (proposed)	A-7	0-10	0-5	90-100	90-100	90-100	85-95	50-60	10-20
	4-8	Silty clay, silty clay loam	MH-K (proposed)	A-7	0-10	0-5	90-100	90-100	90-100	85-95	50-60	10-20
	8-20	Bedrock	---	---	0	0	0	0	0	0	0	NP
rRO:												
Rock outcrop	0-60	Bedrock	---	---	0	0	0	0	0	0	0	NP

Engineering Properties

Island of Maui, Hawaii

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
rRS:												
Rough broken and stony land	0-8	Very stony silty clay	MH-A (proposed), MH-O (proposed)	A-7	30-50	5-15	90-100	90-100	85-100	80-95	50-60	10-20
	8-18	Silty clay, silty clay loam	MH-A (proposed), MH-O (proposed)	A-7	0-5	0-5	90-100	90-100	85-100	80-95	50-60	10-20
	18-60	Bedrock	---	---	0	0	0	0	0	0	0	NP

Water Features

Island of Maui, Hawaii

[Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Hydrologic group	Surface runoff	Months	Water table			Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency		Duration	Frequency
				Ft	*Ft*	*Ft*					
EsB:											
Ewa	B	Medium	Jan-Dec			---	---	None		---	None
ETB:											
Ewa, cobbly	B	Medium	Jan-Dec			---	---	None		---	None
KMW:											
Keaila	C	Negligible	January	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			February	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			March	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			April	1.0-3.5	>6.0	0.0-1.6	Long	Frequent		Brief	Frequent
			May	1.0-3.5	>6.0	0.0-1.6	Brief	Rare		Brief	Rare
			June	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			July	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			August	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			September	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			October	1.0-3.5	>6.0	0.0-0.8	Brief	Rare		Brief	Rare
			November	1.0-3.5	>6.0	0.0-1.0	Long	Frequent		Brief	Frequent
			December	1.0-3.5	>6.0	0.0-1.3	Long	Frequent		Brief	Frequent

Soil Features

Island of Maui, Hawaii

[Absence of an entry indicates that the feature is not a concern or that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Restrictive layer			Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	*In*		*In*	*In*			
ESB:									
Ewa	---	---	---	---	0	---	None	Moderate	Low
ETB:									
Ewa, cobbly	---	---	---	---	0	---	None	Moderate	Low
KMW:									
Kealia	---	---	---	---	0	---	None	High	High
Kealia, deep water table	---	---	---	---	0	---	None	High	High
NAC:									
Naiwa	Paralithic bedrock	40-60	---	Weakly cemented	0	---	None	High	High
OFC:									
Olelo	---	---	---	---	0	---	None	High	High
OMB:									
Oli	Lithic bedrock	24-40	---	Indurated	0	---	None	High	High
rRK:									
Rock land	Lithic bedrock	4-10	---	Indurated	0	---	None	Moderate	Low
rRO:									
Rock outcrop	Lithic bedrock	0	---	Indurated	0	---	None	---	---
rRS:									
Rough broken and stony land	Paralithic bedrock	12-55	---	Weakly cemented	0	---	None	Moderate	Moderate

Water Features

Island of Maui, Hawaii

Map symbol and soil name	Hydrologic group	Surface runoff	Months	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
KMW:										
Kealia, deep water table	C	Negligible	January	---	---	0.0-1.6	Long	Frequent	Brief	Frequent
			February	1.0-3.5	>6.0	0.0-1.6	Long	Frequent	Brief	Frequent
			March	1.0-3.5	>6.0	0.0-1.6	Long	Frequent	Brief	Frequent
			April	1.0-3.5	>6.0	0.0-1.6	Long	Frequent	Brief	Frequent
			May	1.0-3.5	>6.0	0.0-1.6	Brief	Rare	Brief	Rare
			June	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			July	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			August	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			September	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			October	1.0-3.5	>6.0	0.0-0.8	Brief	Rare	Brief	Rare
			November	1.0-3.5	>6.0	0.0-1.0	Long	Frequent	Brief	Frequent
			December	1.0-3.5	>6.0	0.0-1.3	Long	Frequent	Brief	Frequent
NAC:										
Naiwa	B	Medium	Jan-Dec			---	---	None	---	None
OFC:										
Olelo	C	Medium	Jan-Dec			---	---	None	---	None
OMB:										
Oli	B	Medium	Jan-Dec			---	---	None	---	None
rRK:										
Rock land	D	Very high	Jan-Dec			---	---	None	---	None
rRO:										
Rock outcrop	D	---	Jan-Dec			---	---	None	---	None
rRS:										
Rough broken and stony land	C	Very high	Jan-Dec			---	---	None	---	None

PLANNING
SOLUTIONS

April 21, 2008

Mr. Lawrence T. Yamamoto, Director
Pacific Islands Area
Natural Resources Conservation Service
P.O. Box 50004, Rm. 4-118
Honolulu, Hawai'i 96850

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Yamamoto:

Thank you for your March 5, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments. Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

The Important Farmlands map has been enclosed for your aid in determining if an AD-1006 form, Farmland Impact Conversion Rating Form is needed for the USDA-Natural Resources Conservation Service Review of Kaheawa Wind power II Project. Typically, this form is required on projects that convert farmlands into non-farmland uses and have federal dollars attached to the project.

Response: Thank you for forwarding the information concerning the Farmland Impact Conversion Rating Form. Because the proposed project does not involve federal monies, it is our understanding that the AD-1006 form is not required.

Comment 2:

The hydric soils map enclosed identifies potential areas of wetlands. In this project area hydric soils are of very small extent. If wetlands do exist, any proposed impacts to these wetlands would need compliance with the "Clean Water Act", and may need an Army Corp of Engineers 404 permit.

Response: Thank you for enclosing a map identifying areas of hydric soils. As you mentioned, hydric soils are limited to a very small area in the extreme southwestern corner of one of the subject parcels. No activities are planned on or near that area as part of the project; consequently no wetlands will be affected.

Comment 3:

The NRCS Soil Survey Map identifies all soil map units in the project area. The soil reports provide selected soil properties and interpretations, i.e. flooding hazard, limitations for roads, and dwellings, soil layers with USDA textures, and engineering classifications, The limitation ratings for the selected uses, i.e. roads and streets, range from somewhat limited to very limited. Somewhat limited to very limited rating does not preclude the intended land use, however it does identify limitations for the specific use, which may require corrective

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measures, increase costs, and require continued maintenance. In addition, if the planned service roads are located on the steep slopes in this area, design and construction should consider the potential soil erosion hazard.

Response: We appreciate the NRCS Soil Survey Map that you provided showing soil map units in the project area. Information from the soil survey was used in identifying potential sites, and KWP II will supplement this information as needed as the design progresses. All of the planned internal service routes will be designed and evaluated by a geotechnical engineer to ensure that all necessary measures are taken to ensure safety and stability. KWP II is committed to preventing erosion through ground stabilization and re-vegetation of disturbed slopes. This will be elaborated on in the *Draft EIS.*

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

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Ref. No. P-12057

March 10, 2008

Mr. Perry J. White
Planning Solutions
210 Ward Avenue, Suite 330
Honolulu, Hawaii 96814-4012

Dear Mr. White:

Subject: Kaheawa Wind Power II
Environmental Assessment/Preparation Notice (EA/EISPN)
TMK(s): 2-4-8-001:001 and 2-3-6-001:014
Maalaea, Maui

Thank you for sending the Office of Planning the EA/EISPN for the above referenced proposal.

The Office of Planning requests that the Draft Environmental Impact Statement (DEIS) consider the impacts of the proposed project on the following issues:

1. **Cultural/Historic Resources** – Please include an inventory survey of cultural and historic sites, with monitoring and preservation plans approved by the State Historic Preservation Division. The current document discusses archaeological studies that have been or will be conducted (down-road and up-wind siting areas) but does not discuss the intent to conduct a cultural impact study. Please discuss how access for Native Hawaiians for traditional and customary practices will be preserved to include visual landmarks if applicable.

2. **Environmental, Recreational, and Scenic Resources** – Please include an inventory of flora and fauna on the project site, and any required protections that cover areas not included in the earlier October 2006 survey (i.e., the down-road and up-wind sites.) The DEIS should discuss the proximity of the project and its components to existing State Forest Reserves, Natural Area Reserves, or public-private Watershed Partnerships. These areas have been established for the protection and management of important natural and cultural resources. Impacts to resources and possible mitigation measures should be discussed in the DEIS, particularly with respect to the introduction of invasive species.

3. **Coastal Zone Management** – The State oversees protection of natural, cultural, and economic resources within the coastal zone. Please discuss how the proposed project will balance the competing values of economic development and preservation of coastal resources, including protection from hurricane, storm surge, flood hazard, volcano, and soil erosion, as applicable and found in Chapter 205A, Hawaii Revised Statutes.

4. **Lease of State Lands** – The use and lease of State lands may affect beneficiaries of the State Office of Hawaiian Affairs. Please include a discussion of whether the land parcels in question are part of the ceded lands inventory and how that might affect the lease.

The Office of Planning looks forward to receiving the DEIS with the potential impacts and mitigation measures for the above issues addressed. If you have any questions, please call Scott Derrickson in the Land Use Division at 587-2805.

Sincerely,

Abbey Seth Mayer
Interim Director

c: Department of Land and Natural Resources,
Office of Conservation and Coastal Lands
Department of Health, Office of Environmental Quality Control

PLANNING
SOLUTIONS

April 23, 2008

Ms. Abbey Seth Mayer, Interim Director
Office of Planning
Department of Business, Economic
Development, & Tourism
State of Hawai'i
P.O. Box 2359
Honolulu, Hawai'i 96804

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Ms. Mayer:

Thank you for your March 10, 2008 letter [your reference P-12057] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Item-by-item responses to your comments are provided below using the headings provided in your letter. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Cultural/Historic Resources

Comment 1:

Please include an inventory survey of cultural and historic sites, with monitoring and preservation plans approved by the State Historic Preservation Division. The current document discusses archaeological studies that have been or will be conducted (down-road and up-wind siting areas) but does not discuss the intent to conduct a cultural impact study. Please discuss how access for Native Hawaiians for traditional and customary practices will be preserved to include visual landmarks if applicable.

Response: The *Draft Environmental Impact Statement (DEIS)* will include the results of all archaeological inventory surveys conducted in the project area, including those studies that KWP II has commissioned for the "down-road" and "up-wind" siting areas that we described. A cultural impact assessment will be conducted for the various siting areas as well. The *DEIS* will summarize the results of all reports and will describe the mitigation measures that KWP II will implement. Where applicable, the *DEIS* will also reference SHPD-approved monitoring and preservation plans for existing historic and archaeological features.

Environmental, Recreational, and Scenic Resources

Comment 2:

Please include an inventory of flora and fauna on the project site, and any required protections that cover areas not included in the earlier October. 2006 survey (i.e., the down-road and up-wind sites.)_ The DEIS should discuss the proximity of the project and its components to existing State Forest Reserves, Natural Area Reserves, or public-private

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Watershed Partnerships. These areas have been established for the protection and management of important natural and cultural resources. Impacts to resources and possible mitigation measures should be discussed in the DEIS, particularly with respect to the introduction of invasive species.

Response: The *DEIS* will include the results of floral and faunal surveys conducted in all the proposed siting areas and will identify any State Forest Reserves, Natural Area Reserves, and public-private Watershed Partnerships in proximity to the site. It will identify potential impacts to these resources and, where applicable, the report will include the mitigation measures KWP II proposes to implement to avoid or minimize these impacts. The discussion will include measures designed to minimize the potential for the spread of invasive species.

Coastal Zone Management

Comment 3:

The State oversees protection of natural, cultural, and economic resources within the coastal zone. Please discuss how the proposed project will balance the competing values of economic development and preservation of coastal resources, including protection from hurricane, storm surge, flood hazard, volcano, and soil erosion, as applicable and found in Chapter 205A, Hawaii Revised Statutes.

Response: The *DEIS* will include a section that evaluates the proposed project's compliance with each of the policy objectives listed in Chapter 205A, Hawaii Revised Statutes.

Lease of State Lands

Comment 4:

The use and lease of State lands may affect beneficiaries of the State Office of Hawaiian Affairs. Please include a discussion of whether the land parcels in question are part of the ceded lands inventory and how that might affect the lease.

Response: The lands on which the proposed project would be constructed are identified as ceded lands. The *DEIS* will include a discussion of how the ceded lands designation affects the lease.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR

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

BRENNON T. MORIOKA
INTERIM DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

STP 8.2791

March 5, 2008

Mr. Perry J. White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White:

Subject: Kaheawa Wind Power II
Environmental Assessment
Environmental Impact Statement Preparation Notice (EA/EISPN)

Thank you for the notice of the subject wind power generating facility project. The State Department of Transportation submits the following comments:

1. While the project itself is not expected to significantly impact DOT transportation facilities, DOT is interested in the forthcoming EA/EIS for the reasons below.

2. Request that the EA/EIS address the access and intersection conditions on State Highway Route 30 (Honoapiilani Highway). The project must satisfy access and highway intersection requirements as determined by the DOT Highways Division. Please consult with the Highways Division Maui District Office and/or Planning Branch on this matter.

3. Your notice briefly discussed the effects of construction activities on drainage conditions at the affected site. The EA/EIS should include events, if any, where storm water flow from the site would reach and affect Honoapiilani Highway.

4. Your notice mentions that due to the height of the wind power towers and lines may affect aircraft flights, and that the Federal Aviation Administration requirements for safety indicators or lights and height obstruction would be addressed. Although the wind power facility does not directly affect the DOT's airports on Maui, your recognition of these safety factors is acknowledged.

The DOT would appreciate receiving four (4) copies of the Draft EA/EIS when it is completed for further review and comment.

Very truly yours,

BRENNON T. MORIOKA, PH.D., P.E.
Interim Director of Transportation

c: Laurence Lau, Office of Environmental Quality Control
Samuel Lemmo, DLNR

PLANNING
SOLUTIONS

April 14, 2008

Mr. Brennon T. Morioka, Interim Director
Department of Transportation
State of Hawai'i
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Morioka:

Thank you for your March 5, 2008 letter [your reference STP 8.2791] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

We appreciate your confirmation that the project is not expected to significantly impact DOT transportation facilities and understand that DOT maintains an interest in the *Environmental Impact Statement (EIS)* for the reasons outlined in your letter. Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

Request that the EA/EIS address the access and intersection conditions on State Highway Route 30 (Honoapiilani Highway). The project must satisfy access and highway intersection requirements as determined by the DOT Highways Division. Please consult with the Highways Division Maui District Office and/or Planning Branch on this matter.

Response: The *Draft EIS* will include a description of existing traffic conditions at the project site and a discussion of how the proposed project will comply with access and highway intersection requirements. KWP II plans to consult with the Highways Division Maui District Office on this matter.

Comment 2:

Your notice briefly discussed the effects of construction activities on drainage conditions at the affected site. The EA/EIS should include events, if any, where storm water flow from the site would reach and affect Honoapiilani Highway,

Response: The *Draft EIS* will include a discussion of stormwater drainage patterns and the amount and quality of runoff that is likely to be generated on-site during construction. KWP II will also be required to obtain NPDES General Permit Coverage for construction of the project; its NOI-C application for that will describe the details of the construction BMPs that the contractor will use to treat, reduce, or eliminate runoff leaving the site during construction.

Comment 3:

Your notice mentions that due to the height of the wind power towers and lines may affect aircraft flights, and that the Federal Aviation Administration requirements for safety

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indicators or lights and height obstruction would be addressed. Although the wind power facility does not directly affect the DOT's airports on Maui, your recognition of these safety factors is acknowledged.

Response: Thank you for acknowledging KWP II's recognition of the project's potential impacts to navigable airspace. As mentioned in the *EISPN*, KWP II will comply with all pertinent FAA requirements.

Comment 4:

The DOT would appreciate receiving four (4) copies of the Draft EA/EIS when it is completed for further review and comment.

Response: We have noted on our distribution list for the *Draft EIS* that DOT is to receive four copies of the report when it is completed.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD08/2078D

March 5, 2008

Perry White
Planning Solutions
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, HI 96814-4012

RE: Request for comments on the Draft Environmental Assessment Preparation Notice for the Kaheawa Wind Power II project, located above Mā'alaea, Maui, TMK: (2) 4-8-001:001 and (2) 3-6-001:014.

Dear Perry White,

The Office of Hawaiian Affairs (OHA) is in receipt of the above-referenced Draft Environmental Assessment Preparation Notice. Applicant Kaheawa Wind Power II, LLC, is considering establishing a new 21-30 megawatt wind power generating facility. The project would include the installation of 14 to 20 General Electric 1.5 megawatt wind turbine generators, electrical power lines, an electrical substation, a Battery Energy Storage System and the construction of various other facilities. The project would be located on about 400 acres of state land above Mā'alaea. The project would be located near the existing Kaheawa Wind Power I project. OHA offers the following comments.

We look forward to reviewing the Draft Environmental Assessment's analysis and mitigation measures relating to the project's impact on the area's native plants and birds. Specifically, we are interested in the applicant's plans to mitigate the project's impacts on the area's endangered Hawaiian Petrel, the threatened Newell's Shearwater, the endangered Nēnē and the endangered Hawaiian Hoary Bat. Moreover, we ask the applicant to study the cumulative effects this project will have on the area's natural and cultural resources when combined with impacts from the Kaheawa Wind Power I project.

In addition, OHA requests the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

OHA would like to point out that the subject parcels are designated as Section 5(b) Ceded Lands, which hold a considerable amount of sentimental, historical and legal significance for Native Hawaiians and OHA. These lands were illegally taken from the Hawaiian Kingdom after the 1893 overthrow and later transferred ("ceded") by the United States government to the State of Hawai'i upon statehood. Today, the state holds the Ceded Lands corpus in trust for Native Hawaiians and the general public. OHA is supposed to receive a portion of all revenues generated on these lands.

Thank you for the opportunity to comment. If you have further questions, please contact Sterling Wong (808) 594-0248 or e-mail him at sterlingw@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Sam Lemmo, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

PLANNING
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April 14, 2008

Mr. Clyde W. Nāmuʻo, Administrator
Office of Hawaiian Affairs
State of Hawaiʻi
711 Kapiʻolani Boulevard, Suite 500
Honolulu, Hawaiʻi 96813

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawaiʻi

Dear Mr. Nāmuʻo:

Thank you for your March 5, 2008 letter [your reference HRD08/2078D] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

Specifically, we are interested in the applicant's plans to mitigate the project's impacts on the area's endangered Hawaiian Petrel, the threatened Newell's Shearwater, the endangered Nēnē and the endangered Hawaiian Hoary Bat.

Response: As indicated in the *EA/EISPN,* information concerning the occurrence of the above-mentioned protected species and their interactions with the existing wind project will be included in the *Draft EIS* to inform the discussion of KWP II's potential impacts and mitigation measures. As is true of KWP I, the applicant's Habitat Conservation Plan (HCP) for the proposed KWP II facility will ensure that all anticipated take of protected species is minimized and mitigated to the maximum extent practicable.

Comment 2:

Moreover, we ask the applicant to study the cumulative effects this project will have on the area's natural and cultural resources when combined with impacts from the Kaheawa Wind Power I project.

Response: The *Draft EIS* will study the cumulative effect of wind power development at Kaheawa. The impacts of the existing wind generating facility were evaluated and are being minimized and mitigated in accordance with the environmental permits in place for the facility, including Chapter 343 environmental documentation, an incidental take permit and HCP under the Endangered Species Act, a Conservation District Use Permit, and conditions related to the preservation of cultural and historic resources. The *Draft EIS* will note this, and where applicable, will include the existing facility in its discussion of the cumulative impacts of the KWP II project.

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Comment 3:

In addition, OHA requests the applicant's assurances that should iwi kupuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Response: The *Draft EIS* will specify that should *iwi kupuna* or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work that might affect them will be halted immediately and the appropriate agencies will be contacted pursuant to applicable law.

Comment 4:

OHA would like to point out that the subject parcels are designated as Section 5(b) Ceded Lands, which hold a considerable amount of sentimental, historical and legal significance for Native Hawaiians and OHA. These lands were illegally taken from the Hawaiian Kingdom after the 1893 overthrow and later transferred ("ceded") by the United States government to the State of Hawai`i upon statehood. Today, the state holds the Ceded Lands corpus in trust for Native Hawaiians and the general public. OHA is supposed to receive a portion of all revenues generated on these lands.

Response: Thank you for noting that the subject parcels are designated as Section 5(b) Ceded Lands; we will include this information in the *DEIS*. We will also indicate that the State holds the Ceded Lands corpus in trust for Native Hawaiians and the general public and that OHA is to receive a portion of all revenues generated on these lands. It is our understanding that the sharing of revenues generated by public lands is handled by the Department of Land and Natural Resources, and we presume that agency will comply with all applicable revenue-sharing requirements.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

Laura H. Thielen
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

Russell Y. Tsujii
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR FOR
THE COMMISSION ON
WATER RESOURCE MANAGEMENT

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

March 10, 2008

Mr. Perry J. White
Planning Solutions, Inc.
210 Ward Avenue, Suite 330
Honolulu, Hawaii 96814

Dear Mr. White:

Subject: Kahe'awa Wind Power II (KWP II) HRS 343 FEA-EISPN

Department of Land and Natural Resources, Division of Forestry and Wildlife have reviewed the Kahe'awa Wind Power II FEA-EISPN and provide the following comments for your consideration. Our previous March 21, 2007 and August 23, 2006 (attached) comments remain relevant to this Kahe'awa Wind Power II document. We have the same concerns in the first phase that need mitigation in the second phase.

The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene as well as the upper portion of the downwind site which is closer to the nene open-top release pens. The additional towers will increase bird strikes as anticipated in first phase. A survey by qualified professional i.e. wildlife biologist should be completed for phase II during the flocking and nesting season of nene as identified in our previous review of this extended project. Additional comments that were contained in our previous review include: mitigate fire ignitions, invasive weed control, noise and view plane concerns. Questions should be addressed through our DOFAW Maui Branch – Forestry, Wildlife, and Trails programs office number (808) 984-8100 or my administrative staff, Nelson L. Ayers, at (808) 587-4175. Thank you for allowing us to review your project.

Sincerely yours,

Paul J. Conry
Administrator

C: Maui DOFAW
OCCL

Attachments

DIVISION OF FORESTRY & WILDLIFE - MAUI

MEMORANDUM

DATE: 11 March 2008

TO: Nelson Ayers, Forester — Ph: 808-587-4175

FROM: Dr. Fern P. Duvall II, Wildlife Biologist
808-873-3502 Phone
808-873-3505 Fax

SUBJECT: Comments for EIS preparation Kaheawa Wind II, referenced to application for Direct Lease on a portion of TMK 2-4-8-001 and 3-6-001:014 for Commercial Wind Farm Expansion

Your suspense date: 09 March 2008
My comments about the application that need discussion are bulleted in the following:

1. This application should require that all the issues, items, and stipulations of the original Kaheawa energy development's EIS, EA, HCP, and HCP Incidental Take Permits be addressed anew. It seems that this is now equivalent to significant parceling out, and portioning of what is a very large scale project, the scope and imprint of which should have been all addressed together in the project's original first stage of development and the original EIS, EA and HCP processes.
2. The built out effect of project-introduced invasive species, and impacts on birds, flora of the current site requires scrutiny. No methods are presented for invasive species detection, interception, or mitigation for this new work. At a minimum inspection protocols and methods for all equipment and contractor equipment, tower components, and construction materials (some coming from out-of–country manufacture) should presented. How will mitigation be handled for any invasive species introductions?
3. Meterological Towers are mentioned. Will any be permanently left in place? How will possible take of birds by met towers – temporary assessment type, or permanent - be integrated into this application approval process? Will downed-wildlife searcher efficiency, and downed wildlife search efficiency trials be instituted for met tower, and wind towers?
4. No adequate flora survey has been done since the October 2006 vegetation survey, at that time 80% of the site had been burned. A resurvey of the old burn site should be done to document vegetation

present on the site – especially all areas proposed top be roads, or met tower sites, or wind tower pads sites. The original pre-burned site contained a more diverse native plant biota, than the Phase I (first 20 towers) area, due to its gulch walls and microhabitats.

John Medeiros' comments follow -

Fern,

Here's my comments for the Kaheawa II proposed project.

Concerns:

-- The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene.
-- In the downwind sites, nene are known to flock the area and may become possible nesting sites. The upper portion of the downwind site is also closer to the nene open-top release pen
-- Addition towers may also increase possible bird strikes.

Recommendation:

-- To resurvey the proposed areas during the flocking and nesting season of nene.
--To have the Kaheawa Wind Project fund a full-time permanent position for DLNR, Forestry and Wildlife to monitor nene in the existing and proposed sites. Since the release site is adjacent to the existing and proposed area, this position will be used to monitor nene activities in the area, respond to down birds, and monitor the West side population. It is also recommended that this position be in place at the beginning of any work done in the proposed area and be equipped with a vehicle and necessary equipment.

John S. Medeiros
Department of Land & Natural Resources
Division of Forestry & Wildlife
54 South High Street, Room 101
Wailuku, Hawaii 96793
Phone - (808)-873-3510 Fax (808) 873-3505

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 • Honolulu, HI 96813 • (808) 587-0166 • Fax: (808) 587-0160

August 23, 2006

MEMORANDUM

TO: Gary Martin, Land Agent
Land Division

THRU: Russell Y. Tsuji, Administrator
Land Division

FROM: Paul J. Conry, Administrator
Division of Forestry and Wildlife

SUBJECT: Request for Comments: Kaheawa Wind Power II, LLC, Ukumehame, Lahaina, Wailuku, Maui, TMK: (2) 4-8-001: por. 001.

DOFAW understands that the applicant is requesting authorization through the Board of Land and Natural Resources and Land Division to negotiate a lease of additional state land for the expansion of their wind farm at Ukumehame, Maui, Hawaii. We provide the following comments to your subject request.

- The applicant must comply with all state and federal environmental protection laws appropriate to this project.
- The applicant must continue their compliance of the terms they agreed to regarding their existing Habitat Conservation Plan.
- The applicant must obtain another Habitat Conservation Plan and Incidental Take approval or an approved amendment to their existing Habitat Conservation Plan and Incidental Take License prior to any new construction activities.
- The applicant must implement an active monitoring and response protocol to prevent further invasive plant introductions to the area and most importantly, keep them from spreading into nearby forest reserve.
- There is an apparent confusion to the number of additional towers being requested (14 or 18). Please confirm the correct number of towers that is being requested.
- DOFAW is concerned on the location of these towers once the numbers are confirmed because they may be located on possible nene nesting sites. Please work with the Maui DOFAW Wildlife staff regarding this issue.
- The applicant will need to take seriously the removal of construction debris and materials during construction. Stricter regulations of the applicant's lease by DLNR (landowner) or Department of Health (environment laws) are needed to

prevent debris from settling into the gulch areas with the current lease or should be added to the amended lease. Thank you for the opportunity to comment on this project.

C: DOFAW Maui Branch
John Medeiros, DOFAW Maui Wildlife
Bill Standley, DOFAW Administration

Division of Forestry & Wildlife

1151 Punchbowl Street, Rm. 325 ▯ Honolulu, HI 96813 ▯ (808) 587-0166 ▯ Fax: (808) 587-0160

March 21, 2007

MEMORANDUM

TO: Tiger Mills, Planner
Office of Conservation and Coastal Land

FROM: Paul J. Conry, Administrator
Division of Forestry and Wildlife

SUBJECT: CDUA MA-3380, Meteorological Measurement Towers, Kaheawa Wind Power II, LLC's (KWPII) TMK: (2) 4-8-001: 001 & (2) 3-6-001: 014 Olowalu-Ukumehame, Lahaina, Maui, Hawaii.

We appreciate the opportunity to comment on this project. DLNR, Division of Forestry and Wildlife have the following comments from DOFAW wildlife staff in administration and from our DOFAW Maui branch staff.

Administration wildlife staff:

The applicant should be able to proceed with the construction of the tower but should be required to comply with, in addition to the standard conditions OCCL generally applies to all such CDUAs, the following conditions (which are the same with those applied under a similar request made by KWP 2 years ago file MA-2778). A qualified wildlife biologist should be retained to survey the area surrounding each tower for downed birds/bats two to three times a week in March through November 15th. These surveys should be conducted using the protocol for the Habitat Conservation Plan that was previously approved by the Board of Land and Natural Resources. The applicant should use a combination of fluorescent foam wraps and "bird diverters" along all guy wires. If any impacts to listed species do occur, the tower should be removed as soon as possible and not reconstructed until impacts are covered under a new amended Habitat Conservation Plan. Any take to listed species that occur prior to the approval of a Habitat Conservation Plan and the issuance of the accompanying Incidental Take License will not be authorized and the

applicant will be liable to prosecution under the State and Federal endangered species laws.

Maui Branch:

Prior and during construction of these met towers, a survey is required to determine the species of wildlife in the area i.e. nene, pueo, seabirds etc. Encasing the guy wires with PVC tubing or fencing tape along the entire length of the guy wires is recommended. Project managers will need to flag and gps all areas where the met towers will be located and installed. This will allow wildlife staff to review pas and current records of nesting site and field observations on nene; especially those near met towers 3 and 4. Thank you for the opportunity to review this project.

C: DOFAW Maui Branch

PLANNING SOLUTIONS

May 12, 2008

Mr. Paul J. Conry, Administrator
Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawai'i
1151 Punchbowl Street
Honolulu, Hawai'i 96813

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Conry:

Thank you for your March 10, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and compiling written comments from DOFAW's Maui and O'ahu Offices.

Your comments are reproduced below in italics, grouped by office and date. Our responses are given under each comment.

O'ahu DOFAW Office – March 10, 2008

Comment 1:

The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene as well as the upper portion of the downwind site which is closer to the nene open-top release pens. The additional towers will increase bird strikes as anticipated in first phase. A survey by qualified professional i.e. wildlife biologist should be completed for phase II during the flocking and nesting season of nene as identified in our previous review of this extended project.

Response: KWP II has retained a qualified wildlife biologist to complete surveys during the Nēnē flocking and nesting season to determine the extent to which nesting and use of the area is occurring by that and other protected species. As with KWP I, the results of Nēnē surveys will be used to help avoid and minimize potential adverse effects through careful siting and construction and operations practices. The results of the surveys will also help to identify additional mitigation as necessary to ensure a net conservation benefit to the species. Detailed plans for accomplishing these goals will be addressed either in an amendment to the existing Habitat Conservation Plan (HCP) for wind facilities at Kaheawa or in a separate HCP for the Kaheawa Wind Power II project, as appropriate.

Comment 2:

Additional comments that were contained in our previous review include: mitigate fire ignitions, invasive weed control, noise and view plane concerns.

Response: The *Draft EIS* for the project will discuss the measures that KWP II will take to protect against wildfires, control invasive weeds, and minimize noise and visual impacts.

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Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Maui DOFAW Office (Dr. Fern Duvall) – March 11, 2008

Comment 3:

This application should require that all the issues, items, and stipulations of the original Kaheawa energy development's EIS, EA, HCP, and HCP Incidental Take Permits be addressed anew. It seems that this is now equivalent to significant parceling out, and portioning of what is a very large scale project, the scope and imprint of which should have been all addressed together in the project's original first stage of development and the original EIS, EA and HCP processes.

Response: At the time the KWP I project was developed it was unknown whether there would be a market demand for further wind energy on Maui. The KWP II project proposal is the result of recent dramatic changes in the price of conventional (i.e., fossil fuel) energy, as well as the island utility's new-found confidence in its ability to integrate substantial amounts of fluctuating wind energy into its grid. This opportunity was neither anticipated nor planned for at the time that the KWP I facility was proposed and approved.

In order to develop the facilities described in the EA/EISPN, KWP II must obtain additional approvals and undergo a complete review, including an assessment of the cumulative effects of both the existing and proposed wind generation facilities in the Kaheawa area. If possible and allowed by the permit-issuing agencies, KWP II will seek a modification to the Incidental Take Permit and HCP that was originally issued for KWP I, thereby revisiting their issues, scope, and stipulations anew as this comment suggests. We note that this review will now have the benefit of a large amount of data that has been collected at the site through the efforts of KWP in coordination with DOFAW and USFWS. Accordingly, the *EIS* will discuss the impacts of the facilities associated with KWP II and relate them to the cumulative impacts of both wind facilities where relevant.

Comment 4:

The built out effect of project-introduced invasive species and impacts on birds, flora of the current site requires scrutiny. No methods are presented for invasive species detection, interception, or mitigation for this new work. At a minimum inspection protocols and methods for all equipment and contractor equipment, tower components, and construction materials (some coming from out-of-country manufacture) should presented [sic]. *How will mitigation be handled for any invasive species introductions?*

Response: Thank you for your input. The *Draft EIS* will include a discussion on measures KWP II will implement for invasive species detection, interception, or mitigation for the project. The discussion will benefit from knowledge gained during the development and operation of the existing wind generating facilities at Kaheawa Pastures, but we do not anticipate that the *EIS* will scrutinize the existing facilities.

Comment 5:

Meteorological Towers are mentioned. Will any be permanently left in place? How will possible take of birds by met towers – temporary assessment type, or permanent - be integrated into this application approval process? Will downed-wildlife searcher efficiency, and downed wildlife search efficiency trials be instituted for met tower, and wind towers?

Response: As stated on page 2-4 of the *EA/EISPN*, two permanent meteorological towers and a communications tower are planned as part of the project. KWP II plans to monitor take of birds from these structures and the wind turbines using the same approved methodologies that are currently in use for KWP I. This will be discussed in detail in the *Draft EIS.*

Comment 6:

No adequate flora survey has been done since the October 2006 vegetation survey, at that time 80% of the site had been burned. A resurvey of the old burn site should be done to document vegetation present on the site – especially all areas proposed top [sic] *be roads, or met tower sites, or wind tower pads sites. The original pre-burned site contained a more diverse native plant biota, than the Phase I (first 20 towers) area, due to its gulch walls and microhabitats.*

Response: KWP II will commission a flora survey of all four siting areas being considered as part of its proposed project. The results will be included in the *Draft EIS.* At the present time we do not plan to survey other areas on and around the KWP I area that may have been affected by the fire. If the Department has undertaken (or plans to undertake in the near future) a survey of any of its lands that were affected by the fire that encroached upon the area near the existing wind farm we would very much appreciate it if you would send us a copy of the survey report and/or apprise us of the proposed survey methodology and timing.

Maui DOFAW Office (John Medeiros) – March 11, 2008

Comment 7:

Concerns:

-- The proposed substation (option 1) and the downwind sites are in known nesting areas for the nene.

-- In the downwind sites, nene are known to flock the area and may become possible nesting sites [sic]. *The upper portion of the downwind site is also closer to the nene open-top release pen.*

-- Addition towers may also increase possible bird strikes.

Recommendation:

-- To resurvey the proposed areas during the flocking and nesting season of nene.

--To have the Kaheawa Wind Project fund a full-time permanent position for DLNR, Forestry and Wildlife to monitor nene in the existing and proposed sites. Since the release site is adjacent to the existing and proposed area, this position will be used to monitor nene activities in the area, respond to down birds, and monitor the West side population. It is also recommended that this position be in place at the beginning of any work done in the proposed area and be equipped with a vehicle and necessary equipment.

Response: For a response to the first recommendation contained in this comment please see our earlier response to Comment #1. Regarding your second recommendation that KWP II provide funding for a DOFAW position to monitor Nēnē activities in the area, respond to down birds, and monitor the West side population, we note that KWP has two (2) full-time biologists in charge of

HCP wildlife resources and conservation initiatives at KWP I and the areas presently occupied by and adjacent to 4 temporary met towers on portions of the proposed KWP II site. These biologists work closely at various times of the year alongside and in coordination with DOFAW Nēnē biologists to obtain information on Nēnē distribution, nesting, flocking behavior, and provide valuable information on banded birds that enable DOFAW to estimate population status. Under its present HCP, Kaheawa Wind Power continues to dedicate financial support for DOFAW wildlife personnel and has provided funding for a vehicle to support their work. Close coordination between KWP II wildlife biologists and DOFAW personnel on matters associated with Nēnē ecology and monitoring in the immediate area prior to, during, and after site development will be addressed in the *Draft EIS*.

O'ahu DOFAW Office to DLNR Land Division Regarding Proposed KWP II Land Lease – August 23, 2006

Comment 8:

The applicant must comply with all state and federal environmental protection laws appropriate to this project.

Response: KWP II has informed us that it will comply with all State and federal environmental protection laws appropriate to the project.

Comment 9:

The applicant must continue their compliance of the terms they agreed to regarding their existing Habitat Conservation Plan..

Response: KWP I has informed us that it will continue its compliance with the terms agreed to in the Habitat Conservation Plan for the existing facility.

Comment 10:

The applicant must obtain another Habitat Conservation Plan and Incidental Take approval or an approved amendment to their existing Habitat Conservation Plan and Incidental Take License prior to any new construction activities.

Response: KWP II LLC understands that it will need incidental take coverage for the proposed project from both the State and Federal governments. It will work with the U.S. Fish and Wildlife Service, DOFAW, and KWP LLC to either complete another HCP in conjunction with a new Incidental Take Permit (ITP)/Incidental Take License or to amend the existing HCP and Incidental Take Permit (ITP)/Incidental Take License prior to construction of KWP II.

Comment 11:

The applicant must implement an active monitoring and response protocol to prevent further invasive plant introductions to the area and most importantly, keep them from spreading into nearby forest reserve.

Response: The *Draft EIS* will discuss the measures KWP II proposes to take (including monitoring) to prevent invasive plants from spreading or being introduced to the area around its proposed facilities.

Comment 12:

There is an apparent confusion to the number of additional towers being requested (14 or 18). Please confirm the correct number of towers that is being requested.

Response: As described in Section 2.2.1 of the *EA/EISPN*, the proposal is to install from 14 to 20 1.5 MW wind turbine generators (WTGs) on the KWP II site. The actual number of WTGs will depend on the results of the applicant's analysis of the wind data that is now being collected, the outcome of environmental and economic analyses that KWP II is presently conducting, and the applicant's ability to sign a power purchase agreement with the Maui Electric Company. In addition to the WTGs, the project will also entail the installation and operation of two permanent meteorological monitoring towers. The *Draft EIS* will include a detailed description and impact analysis of the action alternatives KWP II is considering.

Comment 13:

DOFAW is concerned on the location of these towers once the numbers are confirmed because they may be located on possible nene nesting sites. Please work with the Maui DOFAW Wildlife staff regarding this issue.

Response: The applicant is committed to working closely with DOFAW and continuing the relationship that its wildlife biologists have established with the agency's staff. Please see response to Comment #1 (regarding Nēnē surveys), Comment #10 (regarding DOFAW coordination), and Comment #12 (regarding the number of proposed towers).

Comment 14:

The applicant will need to take seriously the removal of construction debris and materials during construction. Stricter regulations of the applicant's lease by DLNR (landowner) or Department of Health (environment laws) are needed to prevent debris from settling into the gulch areas with the current lease or should be added to the amended lease.

Response: KWP II has informed us that it will comply with all regulations and lease provisions regarding the removal of construction debris and materials during construction.

O'ahu DOFAW Office to DLNR Office of Conservation and Coastal Lands Commenting on Conservation District Use Application for KWP II Met Towers – March 21, 2007

NOTE: The following comments are reproduced from your March 21, 2007 letter relating to KWP's December 2006 Conservation District Use Application (CDUA) for four meteorological monitoring towers. KWP II responded to those comments in a letter dated May 4, 2007, and DLNR approved the CDUA for the met towers in July 2007. KWP II's previous responses fully address those comments, but we are able to provide updates on the status of certain items.

Comment 15:

A qualified wildlife biologist should be retained to survey the area surrounding each tower for downed birds/bats two to three times a week in March through November 15th. These surveys should be conducted using the protocol for the Habitat Conservation Plan that was previously approved by the Board of Land and Natural Resources.

Response: The approved met towers were installed in August 2007. Since that time a qualified wildlife biologist has searched the area around each tower at least twice a week for downed wildlife. The surveys will continue to be conducted year-round so long as the towers remain in place.

Comment 16:

The applicant should use a combination of fluorescent foam wraps and "bird diverters" along all guy wires.

Response: KWP II has installed the same kinds of Bird-Flight Diverters$_{TM}$ on the temporary met towers as are used on the existing KWP I meteorological monitoring towers. These Bird-Flight Diverters are manufactured of rigid, high impact PVC; this material has good UV and chemical resistance and high tensile strength, which makes them durable. The fact that to date, no birds have been harmed by the towers is testament to the Bird-Flight Diverters' effectiveness.

Comment 17:

If any impacts to listed species do occur, the tower should be removed as soon as possible and not reconstructed until impacts are covered under a new amended Habitat Conservation Plan. Any take to listed species that occur prior to the approval of a Habitat Conservation Plan and the issuance of the accompanying Incidental Take License will not be authorized and the applicant will be liable to prosecution under the State and Federal endangered species laws.

Response: Based on the data collected over the past five years, the potential for incidental impacts to listed species is very low. However, in accordance with Condition 6 of its approved CDUP, if impacts to listed species do occur KWP II will remove the met tower(s) until such time as they are covered by an Incidental Take License and accompanying (amended) Habitat Conservation Plan.

Comment 18:

Prior and during construction of these met towers, a survey is required to determine the species of wildlife in the area i.e. nene, pueo, seabirds etc. Encasing the guy wires with PVC tubing or fencing tape along the entire length of the guy wires is recommended. Project managers will need to flag and gps all areas where the met towers will be located and installed. This will allow wildlife staff to review past and current records of nesting site and field observations on nene; especially those near met towers 3 and 4.

Response: Exhibits N and O of the Conservation District Use Permit (MA-3380) for the temporary met towers contained the results of bird and bat surveys conducted in the project area for the existing wind energy facility. KWP I's ongoing monitoring of the area continues to add to the database, and the monitoring results are shared with DLNR staff on a regular basis. Prior to construction of the four met towers at the KWP II site, staff biologists surveyed the entire area within a 125 meter radius of each tower site to confirm the absence of notable wildlife (e.g., nesting Nēnē). No sensitive

wildlife or nesting activities were observed. As noted in our response to Comment 15, the monitoring around each tower is ongoing.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, First Wind
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

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KEN C. KAWAHARA, P.E.
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

March 14, 2008

Mr. Perry J. White
Planning Solutions
210 Ward Avenue, Suite 330
Honolulu HI 96814-4012

Dear Mr. White:

SUBJECT: Kaheawa Wind Power II EA/EISPN

FILE NO.: N/A

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at *http://www.hawaii.gov/dlnr/cwrm*.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM: Additional information and forms are available at *www.hawaii.gov/dlnr/cwrm/forms.htm*.

☐ 4. The proposed water supply source for the project is located in a designated ground-water management area, and a Water Use Permit is required prior to use of ground water.

☐ 5. A Well Construction Permit(s) is (are) required before the commencement of any well construction work.

☐ 6. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 7. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 8. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 9. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a stream channel.

☐ 10. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

☐ 11. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 12. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ 13. We recommend that the report identify feasible alternative non-potable water resources, including reclaimed wastewater.

☒ OTHER:
No comments

If there are any questions, please contact Charley Ice at 587-0251.

Sincerely,

KEN C. KAWAHARA, P.E.
Deputy Director

CI:ss

PLANNING
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April 14, 2008

Mr. Ken C. Kawahara, P.E., Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Kawahara:

Thank you for your March 14, 2008 letter concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter.

We understand that your Department has no comments to offer on the project at this time. If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

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CHARMAINE TAVARES
Mayor

JEFFREY S. HUNT
Director

COLLEEN M. SUYAMA
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING

March 14, 2008

Mr. Perry J. White
Planning Solutions
Ward Plaza
210 Ward Avenue
Suite 300
Honolulu, Hawaii 96814-4012S

Dear Mr. White:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN) Comments in Preparation of a Draft Environmental Impact Statement for the Proposed Kaheawa Wind Power II Wind Generation Facility located at TMK: 4-8-001:001 and 3-6-001:014, Island of Maui, Hawaii (EAC 2008/0007)

The Maui County Department of Planning (Department) is in receipt of the above-referenced document for the proposed Kaheawa Wind Power II Generation Facility. The Department understands the proposed action includes the following:

- The construction of a new 21 – 30 mega watt (MW) wind power facility (Facility) on approximately 300-400 acres of land adjacent to the existing Kaheawa Wind Power facility located at Ma`alaea, Ukumehame, Lahaina District, Island of Maui.

- The proposed Facility will be comprised of meteorological and communication towers to support data gathering and control functions; internal service roads to be connected to the existing main access road; an operations and maintenance building to house personnel, equipment, and facility spare parts; 14 to 20 General Electric (GE) 1.5 MW wind turbine generators; an electrical substation, battery energy storage system, and interconnected facilities to link the Facility to the

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existing MECO power transmission system; and electrical power lines connecting the turbines with the substation.

Based on the foregoing, the Department provides the following comments in preparation of the Draft EIS:

1. The land use designations for the project area are as follows:
   a. State Land Use – Conservation
   b. Community Plan:
      i. TMK: 3-6-001:014, Kihei-Makena Community Plan - Conservation;
      ii. TMK: 2-4-008:001, West Maui Community Plan - Conservation
   c. County Zoning – Not Zoned
   d. Other – Located outside of the Special Management Area

2. Maui County is generally supportive of the development of alternative energy sources. The Draft EIS should include a thorough discussion of how the proposed project implements the County General Plan as well as the West Maui and Kihei-Makena Community Plans.

3. The West Maui Mountains have been identified as distinctive visual resources in the *Maui Coastal Scenic Resources Study*, August 1990 done for the Department by Environmental Planning Associates Inc. This should be included as part of the proposed visual impacts of the Draft EIS.

4. The proposed project is located on lands within the Coastal Zone Management Area pursuant to Chapter 205A Coastal Zone Management, Hawaii Revised Statutes (HRS). The Draft EIS should include a thorough discussion of how the proposed project complies with the objectives and policies of the Coastal Zone Management Program.

5. The Draft EIS should identify the Conservation District Sub-Zone of the property for the proposed project.

6. The introduction of invasive species, particularly fireweed, has dramatically expanded with the operation of the Kaheawa Wind Power I Project (KWP I). In 2007, the Maui County Environmental Coordinator (MCEC) met with Kaheawa Wind Power Officials and requested that action be taken to control the spread of fireweed. The Draft EIS should include a discussion on the introduction of and

spread of invasive species at KWP I. Further, what mechanisms have been put in place by KWP I for the existing facility to stop the spread and to control the fireweed. Lastly, the Draft EIS should identify how the proposed project will seek to minimize the risk of introducing and spreading invasive species.

7. The maintenance of existing functional native ecosystems and the use of native plants on the proposed project site are strongly encouraged as they can minimize soil erosion and risk of wildfires. The Draft EIS should include a discussion on how this will be accomplished during the construction phase of the project, including the access roadways; as well as after the projects construction.

8. Further, the existing vegetation provides habitat to a number of endemic, indigenous and migratory birds and mammals. The U.S. Fish and Wildlife Service and the State Department of Land and Natural Resources should continue to be consulted on the risks of bird strikes.

9. Economic benefits are cited to Maui Electric Company (MECO) and the project developer for mitigating green house gas (GHG) emissions of equivalent fossil fuel to be displaced by the proposed project. Additionally, the proposed project will assist MECO to achieve its Integrated Resource Planning (IRP) objective as well as meet its renewable portfolio standard (RPS) goal. The Draft EIS should also discuss what actions, if any, will be taken to ensure that these proposed economic benefits will be shared with the public in the form of lower electric bills. For instance could the power purchase agreement (PPA) with MECO be translated into advantageous rates for the public?

10. The proposed storage battery is identified as a flow battery; however, the trade mark mentioned in the project, Power Cell, does not currently exist for this type of storage. The Draft EIS should include the identification of the make and manufacturer of the proposed storage system. This will then determine required mitigation measures based upon the chemical composition and containment methods for the proposed storage system.

11. The Honoapi'ilani Highway can become congested at times. The DEIS should address any impacts to the highway from the proposal, along with mitigation, including timing of impacts during non-peak traffic periods.

12. The DEIS should discuss what information has been acquired from the operation of the existing wind turbines (KWP I) and how this information will be incorporated into the proposal for the new wind turbines.

Thank you for the opportunity to comment. Please include the Department on the distribution list for the Draft. Should you require further clarification, please contact Robyn L. Loudermilk, Staff Planner by email at robyn.loudermilk@mauicounty.gov or by phone at 270-7180.

Sincerely,

JEFFREY S. HUNT, AICP
Planning Director

JSH:RLL:bg
c: Clayton I. Yoshida, AICP, Planning Program Administrator
Robyn L. Loudermilk, Staff Planner
Kuhea Paracuelles, Environmental Coordinator
Victor Reyes, Energy Commissioner
Project File
General File
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PLANNING
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April 21, 2008

Mr. Jeffrey S. Hunt, Planning Director
Department of Planning
County of Maui
250 S. High Street
Wailuku, Hawai'i 96793

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Hunt:

Thank you for your March 14, 2008 letter concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Item-by-item responses to your comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

The land use designations for the project area are as follows:

a. State Land Use – Conservation

b. Community Plan:

i. TMK: 3-6-001:014, Kihei-Makena Community Plan - Conservation

ii. TMK: 2-4-008:001, West Maui Community Plan - Conservation

c. County Zoning – Not Zoned

d. Other – Located outside of the Special Management Area

Response: Thank you for confirming the land use designations for the KWP II project site. They are consistent with our understandings and will be reflected in the *Draft EIS.*

Comment 2:

Maui County is generally supportive of the development of alternative energy sources. The Draft EIS should include a thorough discussion of how the proposed project implements the County General Plan as well as the West Maui and Kihei-Makena Community Plans.

Response: The *Draft EIS* for the project will include a thorough discussion of how the proposed project implements the County General Plan, the West Maui Community Plan and the Kihei-Makena Community Plan.

Comment 3:

The West Maui Mountains have been identified as distinctive visual resources in the Maui Coastal Scenic Resources Study, August 1990 done for the Department by Environmental Planning Associates Inc. This should be included as part of the proposed visual impacts of the Draft EIS.

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Phone: 808 550-4483 • Fax: 808 550-4549 • www.psi-hi.com

Response: Thank you for noting that the West Maui Mountains are identified as distinctive visual resources and providing a citation. We will address the effects that the proposed facilities will have on them in the visual impact section of the *Draft EIS.*

Comment 4:

The proposed project is located on lands within the Coastal Zone Management Area pursuant to Chapter 205A Coastal Zone Management, Hawaii Revised Statutes (HRS). The Draft EIS should include a thorough discussion of how the proposed project complies with the objectives and policies of the Coastal Zone Management Program.

Response: The *Draft EIS* will include a section that evaluates the proposed project's compliance with each of the applicable objectives and policies listed in Chapter 205A, Hawaii Revised Statutes.

Comment 5:

The Draft EIS should identify the Conservation District Sub-Zone of the property for the proposed project.

Response: The KWP II project site is within the "General" subzone of the Conservation District, and we will include this information in the *Draft EIS.*

Comment 6:

The introduction of invasive species, particularly fireweed, has dramatically expanded with the operation of the Kaheawa Wind Power 1 Project (KWP I). In 2007, the Maui County Environmental Coordinator (MCEC) met with Kaheawa Wind Power Officials and requested that action be taken to control the spread of fireweed. The Draft EIS should include a discussion on the introduction of and spread of invasive species at KWP I. Further, what mechanisms have been put in place by KWP 1 for the existing facility to stop the spread and to control the fireweed. Lastly, the Draft EIS should identify how the proposed project will seek to minimize the risk of introducing and spreading invasive species.

Response: The *Draft EIS* will include a discussion of the fireweed situation at Kaheawa Pastures and the invasive species detection, interception, and mitigation measures KWP II will implement for its proposed project. However, it is worth noting that the biologist responsible for the invasive species program at the existing wind farm has noted that fireweed was first seen at Kaheawa Pastures in and around the existing windfarm only after an extensive wildfire swept through the region in September 2006. Fireweed is a fire-adapted pasture species that readily establishes in areas that have been disturbed by events such as fire. Its seeds are naturally dispersed by wind and once established it is a challenge to control. There are seed banks associated with fireweed stands in West Maui immediately upwind of Kaheawa Pastures, and it is likely that seeds spread from there across the burned area (including the KWP I site) following the wildfire. In short, the species' spread was not triggered by construction or operation of the existing wind farm. In fact, KWP staff, equipment and infrastructure shortened the time needed to bring the fire under control, thereby limiting the burned area where fireweed could easily become established.

Following the 2007 meeting referenced in your letter, KWP and the Maui County Office of the Environmental Coordinator co-founded the Fireweed Working Group (FWG). The FWG provides a forum where individuals from various sectors of the conservation community (County of Maui, State of Hawai'i, Maui Invasive Species Commission, USDA, University of Hawaii, and KWP) with expertise in fireweed management can share ideas and coordinate efforts. Since its founding, the FWG has facilitated information gathering, conducted field surveys, and coordinated manual removal initiatives that have enhanced land managers' understanding of fireweed and the factors that control and/or limit its distribution. For its part, KWP has hosted research teams who are independently looking for ways to better characterize the conditions that promote fireweed growth and dispersal and to evaluate possible control methods. KWP continues to look for guidance from these specialists and will rely upon the results of ongoing studies to determine the most effective means of countering the ingress of this species at Kaheawa Pastures.

KWP II LLC, if the proposed project is approved, will support the existing collaborative efforts to control and manage fireweed by implementing pro-active measures to reduce the likelihood of fireweed introduction to other areas of Kaheawa Pastures that might be affected by its activities. These measures will be discussed in detail in the *Draft EIS,* and will include:

- Surveying areas proposed for expansion and ground clearing in advance to delineate proximity to established beds of fireweed;
- Implementing control and management initiatives aimed at excluding fireweed propagules on bare ground using manual and, where warranted, chemical treatments;
- Working in advance with local experts and stakeholders to obtain the best recommendations for control measures and to develop protocols for documentation and sharing results;
- Inspecting potential off-site sources of materials (gravel, fill, etc.), and prohibiting the import of materials from sites that are known or likely to contain seeds or propagules of invasive species. ;
- Requiring that vehicle operators transporting materials to KWP II from off-site follow protocols for removing soils and plant materials from vehicles and equipment prior to entry onto the site.

Comment 7:

The maintenance of existing functional native ecosystems and the use of native plants on the proposed project site are strongly encouraged as they can minimize soil erosion and risk of wildfires. The Draft EIS should include a discussion on how this will be accomplished during the construction phase of the project, including the access roadways; as well as after the projects construction.

Response: The *Draft EIS* will discuss the extent to which native vegetation is still present on the land that would be affected by construction of the proposed facilities and will explain the measures (including revegetation) it will take to minimize erosion during and after construction of KWP II. KWP II has indicated that native plants will be used whenever possible just as has been done at the existing Kaheawa Pastures wind farm.

Comment 8:

Further, the existing vegetation provides habitat to a number of endemic, indigenous and migratory birds and mammals. The U.S. Fish and Wildlife Service and the State Department of Land and Natural Resources should continue to be consulted on the risks of bird strikes.

Response: Under the HCP for the existing wind farm, its environmental and wildlife staff work in coordination with the U.S. Fish and Wildlife Service and the State Department of Land and Natural Resources to ensure that appropriate minimization and mitigation measures are implemented on behalf of native, indigenous, and migratory bird species. KWP II LLC understands that it will also need to coordinate with the resource agencies to prepare either an independent Habitat Conservation Plan or to amend and become a party to the HCP and permits for the existing wind farm. In any event, the HCP and binding implementing agreement will provide avoidance, minimization, and mitigation measures for addressing the threats posed to native, indigenous, and migratory bird species. Monitoring and documenting bird strikes and interaction with project structures is a fundamental component of the existing HCP for KWP I and is anticipated to be similarly regarded under the proposed KWP II project.

Comment 9:

Economic benefits are cited to Maui Electric Company (MECO) and the project developer for mitigating green house gas (GHG) emissions of equivalent fossil fuel to be displaced by the proposed project. Additionally, the proposed project will assist MECO to achieve its Integrated Resource Planning (IRP) objective as well as meet its renewable portfolio standard (RPS) goal. The Draft EIS should also discuss what actions, if any, will be taken to ensure that these proposed economic benefits will be shared with the public in the form of lower electric bills. For instance could the power purchase agreement (PPA) with MECO be translated into advantageous rates for the public?

Response: Section 1.2.2 of the EA/EISPN discusses economic benefits of the proposed action. These include generating tax and lease revenue for the State, reducing dependencies on imported (and price-volatile) fossil fuels, and contributing to MECO's IRP and RPS goals, all of which have economic implications. The project's anticipated benefits with respect to reducing greenhouse gas emissions (which are non-economic, though they have economic implications) are discussed separately in Section 1.2.3.

The extent to which the proposed project will produce other economic benefits, particularly "lower electric utility bills", will depend upon many factors that cannot be determined at this time. Among these are the per kilowatt-hour rate established in the Power Purchase Agreement (PPA) between MECO and KWP II and the cost of producing electricity using alternative means (such as the operation of fossil fuel power plants). While it is unlikely that any combination of factors will lead to the non-fuel component of the electric utility bills to consumers being lower than they are at present, given present forecasts of future oil costs it is likely that the availability of electricity from the proposed project will lead to lower utility bills than would be the case if additional wind power is not available. The EIS will discuss this issue in full, but the State of Hawai'i Public Utility Commission will ultimately decide the matter.

Comment 10:

The proposed storage battery is identified as a flow battery; however, the trade mark mentioned in the project, Power Cell, does not currently exist for this type of storage. The Draft EIS should include the identification of the make and manufacturer of the proposed storage system. This will then determine required mitigation measures based upon the chemical composition and containment methods for the proposed storage system.

Response: The *Draft EIS* will describe the proposed battery storage system in detail. It will then discuss the measures (e.g., containment, handling, storage, etc.) that KWP II will take to minimize and/or mitigate the life-cycle effects of the energy storage system.

Comment 11:

The Honoapi'ilani Highway can become congested at times. The DEIS should address any impacts to the highway from the proposal, along with mitigation, including timing of impacts during non-peak traffic periods.

Response: The *Draft EIS* will include a description of existing traffic conditions on Honoapi'ilani Highway and a discussion of how the proposed project will comply with access and highway intersection requirements. It will also discuss potential impacts to traffic during construction and how KWP II plans to minimize and mitigate them. KWP II will consult with the Highways Division Maui District Office on this matter.

Comment 12:

The DEIS should discuss what information has been acquired from the operation of the existing wind turbines (KWP I) and how this information will be incorporated into the proposal for the new wind turbines.

Response: Information from the operation of the existing KWP I facility has helped to inform the design of KWP II. It will also help to inform the minimization and mitigation measures relating to specific aspects of the project such as biota, and the *Draft EIS* will note this.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EPO-08-027

March 18, 2008

Mr. Perry J. White
Planning Solutions, Inc
Ward Plaza, Suite 330
210 Ward Avenue
Honolulu, Hawaii 96814-4012

Dear Mr. White:

SUBJECT: Environmental Impact Statement Preparation Notice for Kaeawa Wind Power II – Wind Energy Generation Facility
Ukumehame, Maui, Hawaii
TMK: (2) 4-8-001: 001
(2) 3-6-001: 014

Thank you for allowing us to review and comment on the subject application. The document was routed to the various branches of the Department of Health (DOH) Environmental Health Administration. We have the following Clean Water Branch, Indoor and Radiological Health Branch, and General comments.

Clean Water Branch

The Department of Health, Clean Water Branch (CWB), has reviewed the subject document and offers these comments on your project. Please note that our review is based solely on the information provided in the subject document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

   a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

   b. Hydrotesting water.

   c. Construction dewatering effluent.

   You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

3. For types of wastewater not listed in Item 2 above or wastewater discharging into Class 1 or Class AA waters, you must obtain an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

4. You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

5. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at 586-4309

Noise, Radiation & Indoor Air Quality Branch

Project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46, Community Noise Control. Should there be any questions, please contact Russell S. Takata, Environmental Health Program Manager, Indoor and Radiological Health Branch, at 586-4701

General

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

If there are any questions about these comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

KELVIN H. SUNADA, MANAGER
Environmental Planning Office

c: EPO
CWB
IRH
EH-Maui

PLANNING SOLUTIONS

April 16, 2008

Mr. Kelvin H. Sunada, Manager
Environmental Planning Office
Department of Health
State of Hawai'i
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Sunada:

Thank you for your March 18, 2008 letter [your reference EPO-080027] concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and compiling written comments from your Department's various branches.

Item-by-item responses to the comments are provided below. To simplify your examination, we have reproduced the text of the comments of each branch in *italics* before each response.

Clean Water Branch

Comment 1:

1. Any project and its potential impacts to State waters must meet the following criteria:

a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

Response: Thank you for providing these references. Plans for the project call for use of appropriate erosion control measures during and after construction. Since operation of the proposed facilities will not involve activities with significant potential to adversely affect water quality, KWP II believes the project will be consistent with the criteria you referenced. The reasons for this conclusion will be described in the *EIS* for the project.

Comment 2:

You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total

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land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

b. Hydrotesting water.

c. Construction dewatering effluent.

You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

Response: Thank you for providing information on activities requiring NPDES General Permit coverage. Construction of the proposed KWP II project will not involve hydrotesting or dewatering; however, it will disturb more than one acre of land. Consequently, KWP II intends to apply for NPDES General Permit coverage for construction-related stormwater runoff.

Comment 3:

For types of wastewater not listed in Item 2 above or wastewater discharging into Class 1 or Class AA waters, you must obtain an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at

http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

Response: The *Draft EIS* will include a discussion of impacts to surface water resources. It will document the fact that there are no wetlands, perennial streams, or Class I or Class AA waters in the vicinity of the project site that could be affected by the proposed wind farm. Consequently, it is KWP II's understanding that an NPDES Individual Permit will not be required.

Comment 4:

You must also submit a copy of the NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

Response: A copy of the NOI-C for construction of the project will be submitted to SHPD. In addition, a copy of KWP II's request for SHPD review or SHPD's determination letter for the project will be submitted to your Department along with the NOI application.

Comment 5:

Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

Response: Thank you for outlining the regulations governing project-related discharges. As noted above, no discharges into State waters are anticipated; therefore the proposed KWP II project is expected to comply with these regulations.

Noise, Radiation & Indoor Air Quality Branch

Comment 6:

Project activities shall comply with the Administrative Rules of the Department of Health, Chapter 11-46, Community Noise Control.

Response: The *Draft EIS* will include a discussion on potential noise impacts of the proposed project. It will explain the extent to which construction and operation of the project will comply with Hawai'i Administrative Rules Chapter 11-46, Community Noise Control.

General

Comment 7:

We strongly recommend that you review all of the Standard Comments on our website: www.state.hi.us/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this project should be adhered to.

Response: Thank you for directing us to the Standard Comments on your Department's website. KWP II has reviewed them and will ensure that those specifically applicable to the proposed project are adhered to.

Thank you again for your comments. If you have any further questions, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

LINDA LINGLE
GOVERNOR OF HAWAII

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

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2008 MAR 11 A 11: 36

DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

REF:OCCL:MC
FILE NO.: MA-08-136

Suspense Date: 21 Days from stamped date

MEMORANDUM:

FEB 19 2008

TO: DLNR
___ Historic Preservation Division
___ Forestry and Wildlife
___ Land Division
✓ Division of Conservation and Resource Enforcement

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: REQUEST FOR COMMENTS
Correspondence MA-08-136
EIS PREPARATION NOTICE
Kaheawa Wind Power II

APPLICANT: Kaheawa Wind Power II LLC

TMKs: (2) 4-8-01:1, 14

LOCATION: Kaheawa, Mā'alea, Maui

RECEIVED
2008 FEB 26 AM 8: 39
DOCARE, MAUI
DEPT. OF LAND AND
NATURAL RESOURCES

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

RECEIVED
2008 MAR 10 PM 4: 59
DOCARE, MAUI
DEPT. OF LAND AND
NATURAL RESOURCES

If no response is received by the suspense date, we will assume there are no comments. The suspense date starts from the date stamp.

( ) Comments Attached
(✓) No Comments

Signature

Attachments: *EIS Prep Notice*

RECEIVED
2008 FEB 20 AM 10: 01
DOCARE, MAUI
DEPT. OF LAND AND
NATURAL RESOURCES

PLANNING
SOLUTIONS

April 16, 2008

Mr. Gary Moniz, Chief
Division of Conservation & Resource Enforcement
Department of Land and Natural Resources
1151 Punchbowl Street, Room 311
Honolulu, HI 96813

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Moniz:

Thank you for your February 2008 communication to Sam Lemmo concerning Kaheawa Wind Power II LLC's proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and preparing your letter. We understand that your Division has no comments to offer on the project at this time.

If you have any questions in the future concerning this project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

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LINDA LINGLE
GOVERNOR OF HAWAII

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

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Coastal Lands
POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

2008 FEB 32 A 8: 07

STATE OF HAWAII

REF:OCCL:MC
FILE NO.: MA-08-136

Suspense Date: 21 Days from stamped date

FEB 19 2008

MEMORANDUM:

TO: DLNR
___ Historic Preservation Division
___ Forestry and Wildlife
✓ Land Division – Room 220
___ Division of Conservation and Resource Enforcement

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: REQUEST FOR COMMENTS
Correspondence MA-08-136
EIS PREPARATION NOTICE
Kaheawa Wind Power II

APPLICANT: Kaheawa Wind Power II LLC

TMKs: (2) 4-8-01:1, 14

LOCATION: Kaheawa, Mā`alea, Maui

2008 MAR -3 A 8: 09

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

If no response is received by the suspense date, we will assume there are no comments. The suspense date starts from the date stamp.

(✓) Comments Attached
( ) No Comments

Signature

Attachments: *EIS Prep Notice*

Separate request to be sent to MDLO by M.C 2/19/08

LINDA LINGLE
GOVERNOR OF HAWAII

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

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

2008 FEB 32 A 8: 08

STATE OF HAWAII

February 25, 2008

2008 MAR -1 A 8: 09

06MD-161
LD-GM

MEMORANDUM:

TO: Samuel J. Lemmo, Administrator
DLNR, OCCL

FROM: Morris Atta, Acting Administrator
DLNR, LD

SUBJECT: Request for Comments, EIS Preparation Notice, Kaheawa Wind Power II, Kaheawa, Maalaea, Maui, TMK: (2) 4-8-001: 014

At its September 22, 2006 meeting, under agenda item D-5, the BLNR approved, in principle, issuance of a direct lease to Kaheawa Wind Power II, LLC for a commercial renewable wind energy generation facility.

On August 8, 2007, a right-of-entry was issued to the Applicant for the purpose of placing meteorological equipment on TMK: (2) 4-8-001: Portion of 1. Should any data collection activities on TMK: (2) 3-6-001: Portion of 014 be necessary in preparing the subject EIS the Applicant will need a right-of-entry permit from the Department covering those portions.

The TMK: 2-4-008: 001 that appears in Figure 1.2 of the Environmental Impact Statement Preparation Notice is incorrect, it should be 4-8-001: 001.

If you have any questions, please call Gary Martin at 587-0421. Thank you.

c: PSF File

PLANNING SOLUTIONS

April 16, 2008

Mr. Morris Atta, Acting Administrator
Land Division
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Environmental Assessment/Environmental Impact Statement Preparation Notice: Kaheawa Wind Power II Project, Ukumehame, Maui, Hawai'i

Dear Mr. Atta:

Thank you for your February 25, 2008 letter to Sam Lemmo concerning Kaheawa Wind Power II LLC's (KWP II's) proposed Kaheawa Wind Power II Project. We appreciate the time you and your staff spent reviewing the *Environmental Assessment/Environmental Impact Statement Preparation Notice* and providing written comments.

Thank you for noting that the Board of Land and Natural Resources approved, in principle, the issuance of a direct lease to KWP II for a commercial renewable wind energy generation facility at the proposed project site on September 22, 2006.

Item-by-item responses to your other comments are provided below. To simplify your examination, we have reproduced the text of your comments in *italics* before each response.

Comment 1:

On August 8, 2007, a right-of-entry was issued to the Applicant for the purpose of placing meteorological equipment on TMK: (2) 4-8-001: Portion of 1. Should any data collection activities on TMK (2) 3-6-001: Portion of 014 be necessary in preparing the subject EIS the Applicant will need a right-of-entry permit from the Department covering these portions.

Response: Thank you for confirming that a right-of-entry was issued to KWP II for its meteorological monitoring equipment on TMK 4-8-001:001. KWP II understands that it needs to obtain a right-of-entry from the Department for any data collection on the adjacent parcel (TMK 3-6-001:014).

Comment 2:

The TMK: 2-4-008: 001 that appears in Figure 1.2 of the Environmental Impact Statement Preparation Notice is incorrect, it should be 4-8-001:001.

Response: Thank you for catching this error. The TMK number will be corrected in the *Draft Environmental Impact Statement.*

If you have any further questions concerning the project, please call me at (808) 550-4483.

Sincerely,

Perry J. White

cc: Mr. Mike Gresham, KWP II LLC
Mr. Dave Cowan, UPC Wind Management LLC
Office of Environmental Quality Control
DLNR Office of Conservation and Coastal Lands

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10.2 DRAFT EIS PREPARATION & DISTRIBUTION

10.2.1 COMMUNITY OUTREACH & SCOPING

KWP II LLC began meeting with Maui community organizations, elected officials serving at the federal, state, and county government, various agency representatives, and individuals in 2006 to discuss its plans for adding additional wind generating capacity at Kaheawa Pastures. Outreach efforts also included educational tours of the existing KWP I facility with community organizations, elected officials, representatives from public agencies, and students of all ages from a number of educational institutions on Maui, including students who participate in home-school programs. Community outreach, consultation, and tours are important facets of KWP II's commitment to joining the Maui community as a long-term partner and will continue throughout the life of the project. This ongoing dialogue provides KWP II with the opportunity to incorporate feedback into the project design and mitigation measures.

Examples of organizations and individuals participating in the ongoing consultation:

- Assistant Secretary of Energy Efficiency & Renewable Energy, USDOE, Andy Karsner & Staff
- Staff from the U.S. Senate Committees on Appropriations and Commerce, Science and Telecommunications
- Staff from the offices of Hawaii's Congressional Delegation
- Governor Linda Lingle & Staff
- Lieutenant Governor Duke Aiona & Staff
- Members of the Hawaii House of Representatives Committee on Finance
- Members of the Hawaii State Senate Committee on Ways and Means
- Senator Kalani English
- Senator Roz Baker
- Senator Mike Gabbard
- Representative Hermina Morita
- Representative Mele Carroll
- Representative Calvin Say
- Representative Cynthia Thielen
- Members of the Hawaiian Homes Commission
- Mayor Charmaine Tavares & Staff
- Participants in the 2008 Hawaii Congress of Planners Conference
- Participants in the 2007 Maui Energy Expo
- Participants in the 2008 Conference sponsored by the Maui County Board of Water Supply
- Students from Maui Community College Sustainability program
- Students from the Na Pua Noeau program
- Students from the Kamehameha Scholars Program
- Kilohana Ridge Home Owners Association
- American Institute of Architects
- Maui Sierra Club
- Kiwanis Club of Maui
- Maui Tomorrow
- Hokulani Holt Padilla
- Paolo Fujishiro

In addition, KWP II LLC has been working with representatives of USFWS and DOFAW regarding the Habitat Conservation Plan (HCP) for the project. Over the past 6 months, First Wind has met with the agencies to conduct site inspections with the agencies, provide regular updates on project developments, and coordinate baseline wildlife and natural resources studies. Contacts have included John Medeiros (District Wildlife Biologist at the DOFAW office in Kahului), Paula Hartzell (DLNR/DOFAW Conservation Initiatives Coordinator), and James Kwon (USFWS). Finally, KWP II LLC has also briefed the State of Hawai‘i Endangered Species Recovery Committee about the KWP II project and HCP.

The public will also have an opportunity to review and comment on this DEIS in accordance with HRS Chapter 343.

10.2.2 LIST OF PREPARERS

The Kaheawa Wind Power II DEIS was prepared by Planning Solutions, Inc. The respective contributions of the individuals and organizations are as follows:

Planning Solutions, Inc.

Perry J. White	Principal-in-Charge
Melissa M. White	Contributing Author
Charles Morgan	Contributing Author
Makena B. White	Maps, Graphic Design, and Contributing Author
Julia Ham Tashima	Contributing Author

Technical Consultants

AECOM Water	Civil Engineering
Electrical Consultants, Inc.	Electrical Engineering & Interconnection
David L. Adams Associates, Inc.	Noise Impact Analysis
ABR, Inc.	Avian Surveys/Modeling
Robert Hobdy	Botanical Survey
Rechtman Consulting	Archaeological/Cultural Impact Assessment
SWCA Environmental Consultants	Habitat Conservation Plan

First Wind

Dave Cowan, Greg Spencer, Mike Goodwin, Noe Kalipi, Mike Gresham, Kelly Bronson, and Donna McClay.

10.2.3 DRAFT EIS DISTRIBUTION

KWP II LLC will distribute this EIS to the individuals and organizations listed in Table 10.3 and request their comments. It will also provide a limited number of loan copies of this document to libraries.

Table 10.3. Draft EIS Distribution List

Maui County	**Libraries and Depositories**
Department of Water Supply	DBEDT Library
Department of Public Works & Environmental Mgmt.	Hawai‘i State Library Hawai‘i Documents Center
Department of Parks and Recreation	Legislative Reference Bureau
Department of Planning	Maui Community College Library
Department of Transportation Services	UH Hamilton Library
Department of Fire Control	Lahaina Public Library
Police Department	Kahului Regional Library
State Agencies	**Elected Officials**
Commission on Water Resource Management	Governor Linda Lingle
Department of Defense	U.S. Representative Mazie Hirono
Department of Hawaiian Homelands	U.S. Senator Daniel K. Inouye
Hawai‘i State Civil Defense	U.S. Senator Daniel Akaka
Office of Environmental Quality Control	State Representative Angus McKelvey
Office of Hawaiian Affairs	State Senator Rosalyn Baker
Department of Accounting and General Services	State Senator Mike Gabbard
Department of Agriculture	State Senator Kalani English
Department of Business, Economic Development, and Tourism (DBEDT) Office of Planning	State Representative Hermina Morita
DBEDT Energy, Resources & Technology Division	State Representative Denny Coffman
Department of Health, Environ. Planning Office	Mayor Charmaine Tavares
Department of Land and Natural Resources (5 copies)	Councilmember Jo Anne Johnson
Department of Transportation	
DLNR Historic Preservation Division	**Local Utilities**
UH Environmental Center	Hawaiian Telcom
	Maui Electric Company
Federal Agencies	
Environmental Protection Agency (PICO)	**Other Parties**
National Marine Fisheries Service	Sovereign Council of Hawaiian Homestead Assembly
US Army Engineer Division	Sierra Club, Maui Group
US Fish and Wildlife Service	Maui Tomorrow
US Federal Aviation Administration	Blue Planet Foundation
US Natural Resources Conservation Service	
US Geological Survey	**News & Media**
	Honolulu Advertiser
	Honolulu Star-Bulletin
	Maui News
Source: Compiled by Planning Solutions, Inc.	

APPENDIX A. KWP II BOTANICAL SURVEYS

BOTANICAL RESOURCES SURVEY

for the

KAHEAWA PASTURES WIND ENERGY PROJECT II

UKUMEHAME, MAUI, HAWAII

by

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October 2006

Prepared for:
Kaheawa Windpower, LLC

INTRODUCTION

The Kaheawa Pastures Wind Energy Project II consists of an array of 18 wind turbines that is to be situated on a remote ridgetop above the southern tip of West Maui between the elevations of 1,440 ft. and 2,880 ft. It is to be located alongside an existing array of 20 wind turbines that came on line in June, 2006. This survey is being conducted in fulfillment of environmental requirements in pursuance of permits for this project.

SITE DESCRIPTION

The project area lies on the edge of a grassy ridge above Papalaua Gulch. The ridgetop is smooth and even in its upper portion with an average slope of about 16% but grades into rough rocky terrain at the bottom below 2,200 ft. Soils consist of Naiwa Silty Clay Loam (NAC) and OLi Silt Loam (OMB) in the upper portions. These soils are deep, dusky-red, moderately acid and highly erodible and are developed from igneous volcanic rock. The lower portion of the project area is characterized as Rock Land (rRK). It is rougher in terrain with abundant surface rock and rocky outcrops (Foote et al, 1972). Rainfall averages 15 in./yr. at the lowest elevation and increases to 40 in./yr. at the top, with the bulk falling between November and March (Armstrong, 1983).

BIOLOGICAL HISTORY

In pre-contact times this mountain slope was entirely covered with native vegetation of low stature with dry grass and shrublands below and mesic to wet windblown forests above. The Hawaiians made some uses of forest resources here and had a cross-island trail cresting the ridge at 1600 ft. elevation. This trail was upgraded during the mid-1800s and used as a horse trail to Lahaina. It was resurrected to use in recent years and is the present Lahaina Pali Trail.

Cattle ranching began in the late 1800s and continued for over 100 years. During this time the grazing animals consumed most of the native vegetation which was gradually replaced by hardy weed species.

During the 1950s Maui Electric Co. installed high voltage powerlines along with access roads through this area. Increased traffic brought more disturbances and weeds. Fires became more frequent, further eliminating remnant native vegetation.

With the cessation of cattle grazing a number of grass and weed species have proliferated, creating a heightened fire hazard. A large fire swept across the mountain in 1999 consuming more than 2500 acres including most of the project area. About a

month prior to this survey another fire burned the same area scorching about 80% of the 333 acre project area, leaving only about 67 acres untouched.

DESCRIPTION OF THE VEGETATION

The vegetation within the project area is a diverse array of grasses and low shrubs with a scattering of small trees. The most abundant species is molasses grass (*Melinis minutiflora*) which is taking over following the 1999 fire. Also common are broomsedge (*Andropogon virginicus*), Natal redtop (*Melinis repens*), hairy horseweed (*Conyza bonariensis*), kilau (*Pteridium aquilinum* var. *decompositum*), fire weed (*Senecio madagascariensis*), narrow-leaved plantain (*Plantago lanceolata*) and ʼūlei (*Osteomeles anthyllidifolia*). A total of 57 plant species were recorded during the course of the survey.

Eighteen native plant species are found scattered within the grassland/shrubland. Ten species are endemic only to the Hawaiian Islands: kilau, (*Carex wahuensis* subsp. *Wahuensis*) no common name, koʼokoʼolau (*Bidens micrantha*), nehe (*Melanthera lavarum*), ʻakoko (*Chamaesyce celastroides* var. *amplectens*), naio (*Myoporum sandwicense*), ʻōhiʼa (*Metrosideros polymorpha* var. *glaberrima*), ʻiliahi aloʼe (*Santalum ellipticum*), ʻakia (*Wikstroemia oahuensis*) and orange-flowered naupaka (*Scaevola gaudichaudii*). An additional eight species are indigenous to Hawaii as well as to other countries: pili (*Heteropogon contortus*), koali awahia (*Ipomoea indica*), pukiawe (*Leptecophylla tameiameiae*), ʻilima (*Sida fallax*), huehue (*Cocculus orbiculatus*), ʻūlei, ʻaʼaliʼi (*Dodonaea viscosa*) and ʻuhaloa (*Waltheria indica*). The remaining 39 species are non-native plants.

The 80% of the project area that burned has only bare, blackened ground with a few charred stumps. The vegetation here was similar to what has been recorded in this report and no additional species native or otherwise probably occurred.

SURVEY OBJECTIVES

This report summarizes the findings of a botanical survey of the proposed Kaheawa Pastures Wind Energy Project II which was conducted in October, 2006.
The objectives of the survey were to:

1. Document what plant species occur on the property or may likely occur in the

existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native plant species, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants and recommend measures that would mitigate or avoid these problems.

SURVEY METHODS

The entire project area was surveyed on foot, with the greatest intensity of effort focused on existing vegetation. There was scant remains of anything within the burned area by which the former vegetation could be identified. Only the author's recollections of what formerly occurred here could be used as a rough guide. Areas more likely to harbor native or rare plants were most carefully examined. Notes were made on plant species, distribution and abundance as well as on terrain and substrate.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within three groups: Ferns, Monocots and Dicots. Taxonomy and nomenclature of the ferns are in accordance with Palmer (2003) and the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005).

For each species, the following information is provided:

1. Scientific name with author citation

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
DENNSTAEDTIACEAE (Bracken Family)			
Pteridium aquilinum (L.) Kuhn. var. *decompositum* (Gaudich.) R.M. Tryon	*kilau*	endemic	common
MONOCOTS			
CYPERACEAE (Sedge Family)			
Carex wahuensis C.A. Mey. subsp. *wahuensis*	----------	endemic	rare
POACEAE (Grass Family)			

Andropogon virginicus L.	broomsedge	non-native	common
Axonopus fissifolius (Raddi) Kuhlm.	narrow-leaved carpetgrass	non-native	rare
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	uncommon
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	non-native	rare
Heteropogon contortus (L.) P.Beauv. ex Roem.&Schult.	*pili*	indigenous	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	abundant
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common
Panicum maximum Jacq.	Guinea grass	non-native	rare
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
Paspalum dilatatum Poir.	Dallis grass	non-native	rare
Pennisetum clandestinum Chiov.	Kikuyu grass	non-native	uncommon
Rhytidosperma pilosum (R.Br.) Connor & Edgar	hairy oatgrass	non-native	rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	rare
Stenotaphrum secundatum (Walter) Kuntze	St.Augustine grass	non-native	rare

DICOTS

ANACARDIACEAE (Mango Family)

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Schinus terebinthifolius Raddi	Christmas berry	non-native	rare

ASTERACEAE (Sun Flower Family)

Bidens micrantha Gaud.	*ko'oko'olau*	endemic	rare
Conyza bonariensis L. Cronq.	hairy horseweed	non-native	common
Conyza canadensis (L.) Cronq. var. pusilla (Nutt.) Cronq.	little horseweed	non-native	rare
Erigeron karvinskianus DC.	daisy fleabane	non-native	rare
Heterotheca grandiflora Nutt.	telegraph weed	non-native	uncommon
Hypochoeris radicata L.	gosmore	non-native	rare
Melanthera lavarum (Gaud.) Wagner & Rob.	*nehe*	endemic	rare

Pluchea carolinensis (Jacq.) G. Don.	sourbush	non-native	rare
Senecio madagascariensis Poir.	fireweed	non-native	common
CACTACEAE (Cactus Family)			
Opuntia ficus-indica (L.) Mill.	*panini*	non-native	rare
CASUARINACEAE (She-oak Family)			
Casuarina equisetifolia L.	common ironwood	non-native	uncommon
Casuarina glauca Siebold ex Spreng.	longleaf ironwood	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	*koali awahia*	indigenous	rare
EPACRIDACEAE (Epacris Family)			
Leptecophylla tameiameiae (Cham.& Schlectend.) C.M. Weiller	*pukiawe*	indigenous	uncommon
EUPHORBIACEAE (Spurge Family)			
Chamaesyce celastroides (Boiss.) Croizat&Degener var. amplectens (Sherff) Degener&I.Degener	*'akoko*	endemic	rare
FABACEAE (Pea Family)			
Acacia farnesiana (L.) Willd.	klu	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	uncommon
Desmodium sandwicense E. Mey.	Spanish clover	non-native	rare
Indigofera suffruticosa Mill.	*iniko*	non-native	uncommon
Leucaena leucocephala (Lam.) de Wit	*koa haole*	non-native	uncommon
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	non-native	rare
GENTIANACEAE (Gentian Family)			
Centaurium erythraea Raf.	bitter herb	non-native	rare
GOODENIACEAE (Goodenia Family)			
Scaevola gaudichaudii Hook. & Arnott	orange naupaka	endemic	rare
LAMIACEAE (Mint Family)			
Salvia coccinea B. Juss. ex Murray	scarlet sage	non-native	rare

MALVACEAE (Mallow Family)			
Sida fallax Walp.	*'ilima*	indigenous	uncommon
MENISPERMACEAE (Moonseed Family)			
Cocculus orbiculatus (L.) DC.	*huehue*	indigenous	rare
MYOPORACEAE (Myoporum Family)			
Myoporum sandwicense A. Gray	*naio*	endemic	rare
MYRTACEAE (Myrtle Family)			
Metrosideros polymorpha Gaud. var. *incana* (H. Lev.) St. John	*'ohi'a*	endemic	rare
Psidium guajava L.	guava	non-native	rare
PLANTAGINACEAE (Plantain Family)			
Plantago lanceolata L.	narrow-leaved plantain	non-native	common
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	----------	non-native	rare
PRIMULACEAE (Primrose Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Anagallis arvensis L.	scarlet pimpernel	non-native	rare
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. ex R.Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia (Sm.) Lindl.	*'ulei*	indigenous	common
SANTALACEAE (Sandalwood Family)			
Santalum ellipticum Gaud.	*'iliahi alo'e*	endemic	rare
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	*'a'ali'i*	indigenous	uncommon
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	*'uhaloa*	indigenous	uncommon
THYMELAEACEAE (‘Akia Family)			
Wikstroemia oahuensis (A.Gray) Rock.	*'akia*	endemic	rare

VERBENACEAE (Verbena Family)

Lantana camara L.	lantana	non-native	uncommon
Verbena littoralis Kunth.	*'owi*	non-native	rare

DISCUSSION

The construction of 18 additional wind turbines will require the development of additional access roads and the clearing and leveling of 18 construction pads within the 333 acre project site. This will result in the loss of vegetation where these occur. The area in general has experienced a dramatic loss of native plant communities over the last century and there is concern that further losses of rare species and special habitats be avoided. The proposed project was analyzed with these concerns in mind.

Of the 18 native plants identified on the property none were found to be Federally listed Threatened or Endangered species (USFWS, 1999) nor were any that are candidates for such status. None were even found to be rare in any way (Species of Concern). All are widespread and fairly common in Hawaii. While some native plants will be lost in the course of the development, it should be noted that probably 15 or 16 of the 18 proposed turbine sites and most of the access roads will occur on areas that have completely burned twice during the past eight years.

With respect to fire it is likely that periodic fires will continue to be a problem into the foreseeable future. The area is being increasingly invaded by fire-prone species that are quick to reproduce following each fire. Each fire also results in fewer and fewer of even the common native plants. Unless land management practices change dramatically across this dry mountain slope, little improvement in this prognosis is

likely. One month since the area burned it was noted that seven plant species are beginning to sprout from stumps or underground rhizomes. Only one of these, the fire adapted kilau fern, is native.

Previous botanical surveys identified a few Endangered plant species growing within a mile of the first wind turbine project, most notably in the Manawainui Plant Sanctuary and upper Papalaua Gulch. This project is further from these protected resources than the first project was.

Due to the general condition of the habitat and the specific lack of any environmentally sensitive native plant species on the project area, the proposed development work is not expected to result in any significant negative impact on the botanical resources in this part of Maui.

RECOMMENDATIONS

The quality of the roads created will have a long term effect on surrounding habitat. Poorly engineered roads in this entire project area quickly erode causing downslope disturbances from moving water and road materials. They have the added effect of necessitating frequent maintenance work resulting in further disturbances. It is recommended that the road surfaces be crowned and rolled with stable material, and that swales, drains and culverts be engineered to channel water from the roadway quickly and effectively.

It is desirable that the incidence of wildfires be minimized because of their devastating long term effects on native plant resources. Fuels in this area are highly flammable. One way to minimize fire here is to limit human access along the road corridor to only those with management or other legitimate functions.

Literature Cited

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Foote, D.E. , E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Dept. of Agriculture, Soil Conservation Service. Washington, D.C.

Palmer, D.D. 2003 Hawai'i's Ferns and Fern Allies. University of Hawaii Press, Honolulu.

Staples, G.W. and D.R. Herbst. 2005. A Tropical Garden Flora, Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press.

U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and Plants. 50 CFR 17.11 & 17.12

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai'i. Univ. of Hawai'i Press and Bishop Museum Press. Honolulu.

POST – FIRE BOTANICAL SURVEY AND ASSESSMENT

for

KAHEAWA WIND POWER II

UKUMEHAME, MAUI, HAWAII

by

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ENVIRONMENTAL CONSULTANT
Kokomo, Maui
January 2009

Prepared for:
Kaheawa Windpower, LLC

POST - FIRE BOTANICAL SURVEY AND ASSESSEMENT
Kaheawa Wind Power II Project

INTRODUCTION

The Kaheawa Wind Power II Project is situated about ¼ mile west of an existing line of functioning wind turbines in Kaheawa Pasture, Ukumehame, West Maui TMK (2) 4-8-01:01 por. (see attached map). The work consists of a botanical followup survey of a proposed wind turbine project area with a special focus on assessing changes in the vegetation resulting from a wild fire that burned the area in 2006. Field work was conducted in January, 2009.

SITE DESCRIPTION

The project area lies on approximately 450 acres of sloping ridge land that is between 1,500 feet and 3,100 feet elevation. Ridge tops are smooth with relatively deep soil. Small to moderate sized gullies cut through the south and western sides of the ridge and are rough and rocky as they run down slope. Vegetation mostly consists of low wind blown grasses and shrubs with occasional patches of small trees. Annual rainfall ranges from about 20 inches at the bottom up to 50 inches at the top with the bulk falling during the winter months (Armstrong, 1983).

SURVEY OBJECTIVES

This report summarizes a botanical survey of the Kaheawa Wind Power II project area which was completed in January, 2009. The objectives of the survey were to:

1. Document what plant species occur within the project area.
2. Document the status and abundance of each species.
3. Determine the presence of any native plant species and particularly any that are Federally listed as Threatened or Endangered under the Endangered Species Act (USFWS,1999). If such occur, identify what features of the habitat may be essential for these species.
4. Assess the changes in the vegetation that may have occurred since a wild fire swept through this area in 2006.

SURVEY METHODS

The botanical survey consisted of a series of sweeps across the different elevations of the property that ensured complete coverage of the area. Areas most likely to harbor

native species such as rocky outcrops and gulch slopes were more intensively examined. Binoculars were used to scan less accessible locations. Notes were made on plant species, distribution, abundance, terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation was predominantly a grassland both in character and in number of species. Most abundant was molasses grass (*Melinis minutiflora*). Also common were Natal redtop (*Melinis repens*), pitted beardgrass (*Bothriochloa pertusa*) and buffelgrass (*Cenchrus ciliaris*). Interspersed within the grass land were a number of common shrubs, herbs, one fern and one tree species. They include: inikö (*Indigofera suffruticosa*), ‘ilima (*Sida fallax*), ‘uhaloa (*Waltheria indica*), ‘ūlei (*Osteomeles anthyllidifolia*), fireweed (*Senecio madagascariensis*), partridge pea (*Chamaecrista nictitans*), narrow-leaved plantain (*Plantago lanceolata*), kilau fern (*Pteridium aquilinum* var. *decompositum*) and common ironwood (*Casuarina equisetifolia*). The remaining 73 plant species were uncommon or rare of occurrence.

Twenty native Hawaiian species were found in the project area. They include: kilau fern, ‘ilima, ‘uhaloa, ‘ūlei, (*Carex wahuensis*) no common name, (*Trisetum inaequale*) no common name, ko’oko’olau (*Bidens mauiensis*), ko’oko’olau (*Bidens micrantha*), nehe (*Melanthera lavarum*), Hawaiian moonflower (*Ipomoea tuboides*), ‘akoko (*Chamaesyce celastroides* var *amplectens*), ‘öhi’a (*Metrosideros polymorpha*), ‘iliahi alo’e (*Santalum ellipticum*), ‘akia (*Wikstroemia oahuensis*), pili grass (*Heteropogon contortus*), koali awahia (*Ipomoea indica*), pukiawe (*Leptecophylla tameiameiae*), huehue (*Cocculus orbiculatus*), naio (*Myoporum sandwicense*) and ‘a’ali’i (*Dodonaea viscosa*). The native plant species are spread throughout the project area, mixed among the grasses, but are less prevalent at the lower, drier parts of the property. There is, however, one pocket of predominantly native shrubland on the western edge of the project area on an eroded rocky ridge between 2,000 ft. and 2,400 ft. elevation.

DISCUSSION AND RECOMMENDATIONS

At the time of the first botanical survey of this project area in October of 2006, the vegetation was just beginning to recover from a fire that had burned 80% of the area. What we are seeing today is the regrowth of just over two years on an area that was basically bare, blackened ground. Only about 40 acres at the top of the present project area escaped the 2006 burn and is representative of unburned vegetation.

What is growing at the top of the project in the unburned area is basically the same as what it was before 2006, a diverse native shrubland mixed with grass. There has been a noticeable increase in molasses grass, but it is in small scattered clumps. Molasses grass along with the other grass species occupies about 20% of the vegetation cover.

The burned area between 2,300 feet and 2,900 feet elevation was regrown with a dramatically noticeable increase in grass species and a decrease in native shrubs. Molasses grass forms a dense, nearly monotypic growth over most of this area with an estimated frequency of 80% cover.

The burned area between 1,900 feet and 2,300 feet elevation has regrown with a similarly dramatic increase in grass species. This grassland is a mixture of molasses grass and Natal redtop in fairly even proportions with an estimated frequency of 80% cover. The eroded ridge with native shrubland sustained only a light burn due to the scarcity of fuels and has recovered with little loss of species or cover.

The lowest part of the project area between 1,500 feet and 1,900 feet elevation has been an open grassland for a long time. Since the 2006 fir it has come back in essentially the same condition. Dominant grasses are pitted beardgrass and buffelgrass with an estimated frequency of nearly 90% cover.

The Ukumehame lands, of which the Kaheawa Wind Power II project area is a small part, had been grazed by cattle for well over 100 years. During this period much of the native vegetation had been converted to non-native grasslands. Cattle grazing, has been discontinued in this area for over ten years now and this has had a profound effect on the vegetation. First, without cattle grazing, the grasses have grown up creating a dense fuel load. During this period there have been three large and devastating fires unlike any that have been experienced in recent memory. Following each fire, regrowth has been with increasing amounts of grass. This encourages a perpetuating cycle of fires as long as there are risks of fire starts. The two grass species which contribute most to fuel loading are molasses grass in the damper areas above 2,000 feet, and buffelgrass in the drier areas below 2,000 feet. Both of these species are considered to be fire adapted grasses that thrive and multiply with periodic burning because they replace or outcompete species that suffer from the effects of burning. This cycle will likely continue unless fuel hazards can be reduced or risks of fire starts can be minimized, or both.

A total of 86 plant species were recorded during the course of the botanical survey. Of these 20 were endemic or indigenous to the Hawaiian Islands. None of these were Federally listed as Threatened or Endangered under the Endangered Species Act. None were candidates for such status either. Only one, (*Trisetum inaequale*) is somewhat rare, having a limited distribution on West Maui and Lana'i. All of the rest of the native species occur on more than one or on several islands.

The Endangered species in this region on southern West Maui occur in remnant forests in the gulches of Papalaua, Manawainui and Pohakea and on ridge top shrub forests, all mauka of the present project. These species were addressed during the first Kaheawa project. The present project is further from these resources. Concerns would be similar, as the planned wind turbines and their placement would be nearly the same.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within three groups: Ferns, Monocots and Dicots. Taxonomy and nomenclature of the ferns are in accordance with Palmer (2003) and the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005).

For each species, the following information is provided:

1. Scientific name with author citation.

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   Polynesian introduction = plants introduced to Hawai'i in the course of Polynesian migrations and prior to western contact.
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
FERNS			
DENNSTAEDTIACEAE (Bracken Family)			
Pteridium aquilinum (L.) Kuhn. var. *decompositum* (Gaudich.) R.M. Tryon	*kilau*	endemic	common
PTERIDACEAE (Brake Fern Family)			
Pityrogramma austroamericana Domin.	gold fern	non-native	rare
MONOCOTS			
CYPERACEAE (Sedge Family)			
Carex wahuensis C.A. Mey. subsp. *wahuensis*	----------	endemic	uncommon
POACEAE (Grass Family)			

Andropogon virginicus L.	broomsedge	non-native	uncommon
Bothriochloa barbinodis (Lag.) Herter	fuzzy top	non-native	rare
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native	common
*Cenchrus ciliaris*L.	buffelgrass	non-native	common
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	rare
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	rare
Heteropogon contortus (L.) P. Beauv. ex Roem.&Schult.	pili grass	indigenous	rare
Hyparrhenia rufa (Nees.) Stapf	thatching grass	non-native	rare
Melinis minutiflora P. Beauv.	molasses grass	non-native	abundant
Melinis repens (Willd.) Zizka	Natal redtop	non-native	common
*Panicum maximum*Jacq.	Guinea grass	non-native	rare
Paspalum conjugatum Bergius	Hilo grass	non-native	rare
*Paspalum dilatatum*Poir.	Dallis grass	non-native	rare
Pennisetum clandestinum Chiov.	Kikuyu grass	non-native	uncommon
Rhytidosperma pilosum (R.Br.) Connor & Edgar	hairy oatgrass	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Setaria parviflora (Poir.) Kerguelen	yellow foxtail	non-native	rare
Setaria verticillata(L.) P. Beauv.	bristly foxtail	non-native	rare
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	non-native	uncommon
*Trisetum inaequale*Whitney	----------	endemic	rare

DICOTS

ANACARDIACEAE (Mango Family)

Schinus terebinthifolius Raddi	Christmas berry	non-native	uncommon

APOCYNACEAE (Dogbane Family)

Stapelia gigantea N.E. Brown	Zulu giant	non-native	rare

ASTERACEAE (Sunflower Family)

Acanthospermum australe (Loefl.) Kuntze	spiny bur	non-native	rare
Ageratina adenophora (Spreng.) R.King & H.Robinson	Maui pamakani	non-native	rare

*Bidens cynapiifolia*Kunth	----------	non-native	rare
Bidens mauiensis (A.Gray) Sherff	ko'oko'olau	endemic	rare
*Bidens micrantha*Gaud.subsp. *micrantha*	ko'oko'olau	endemic	uncommon
Bidens pilosa L.	Spanish needle	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	uncommon
Conyza canadensis (L.) Cronq.	horseweed	non-native	rare
*Emilia fosbergii*Nicolson	red pualele	non-native	rare
Erigeron karvinskianus DC.	daisy fleabane	non-native	uncommon
*Galinsoga parviflora*Cav.	----------	non-native	rare
Heterotheca grandiflora Nutt.	telegraph weed	non-native	rare
*Hypochoeris radicata*L.	gosmore	non-native	rare
Melanthera lavarum (Gaud.) Wagner & Rob.	nehe	endemic	rare
Senecio madagascariensis Poir.	fire weed	non-native	common
Sonchus oleraceus L.	pualele	non-native	uncommon

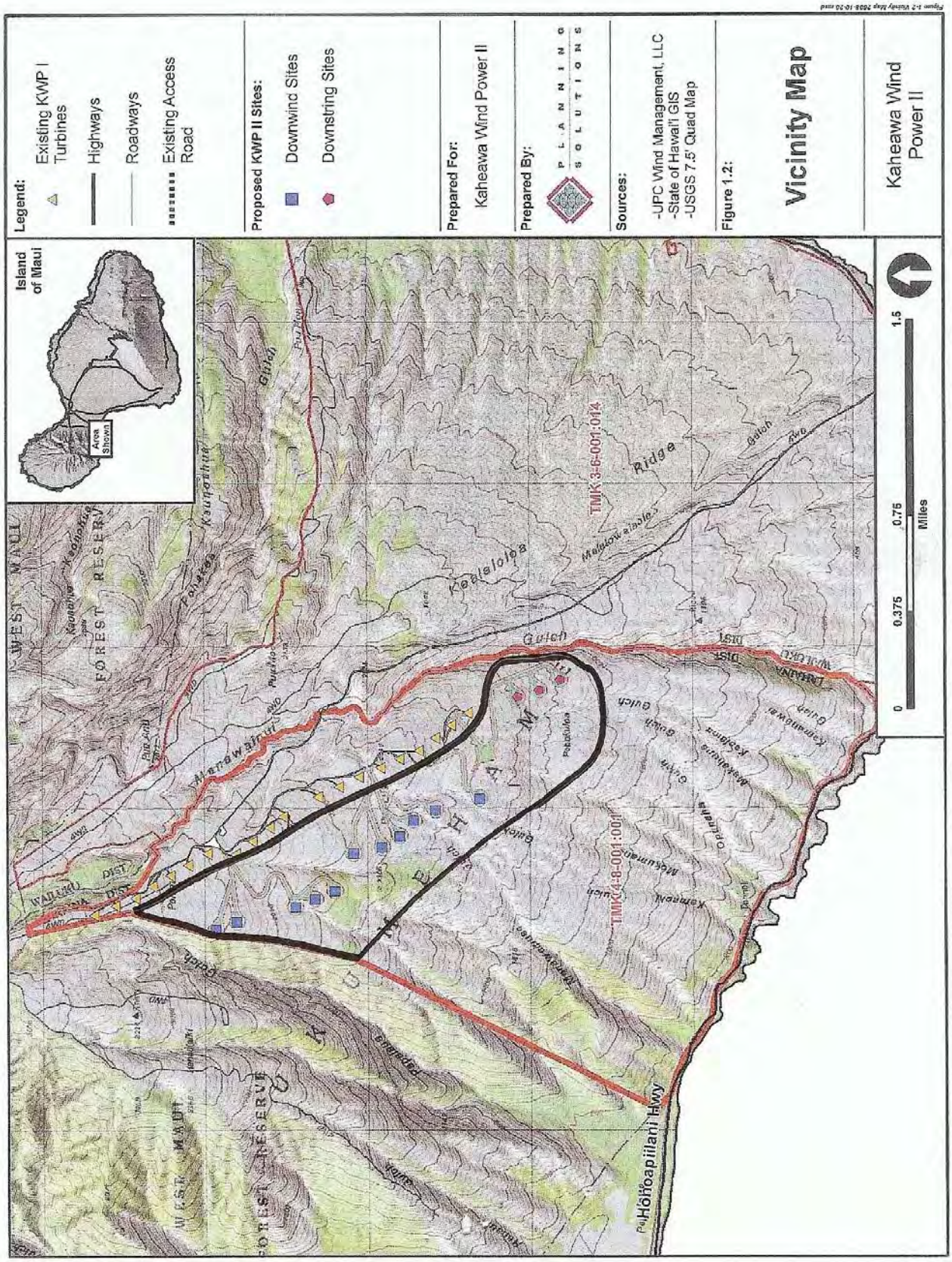
SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
*Tridax procumbens*L.	coat buttons	non-native	rare
Zinnia peruviana (L.) L.	zinnia	non-native	rare
BRASSICACEAE (Mustard Family)			
Sisymbrium officinale (L.) Scop.	hedge mustard	non-native	rare
CACTACEAE (Cactus Family)			
Opuntia ficus-indica (L.) Mill	panini	non-native	rare
CASUARINACEAE (She-oak Family)			
Casuarina equisetifolia L.	common ironwood	non-native	common
Casuarina glauca Siebold ex Spreng.	longleaf ironwood	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea indica (J. Burm.) Merr.	koali awahia	indigenous	uncommon
Ipomoea tuboides Degener & Ooststr.	Hawaiian moon flower	endemic	rare
ERICACEAE (Heath Family)			
Leptecophylla tameiameiae (Cham. & Schlect.) C.M. Weiller	pukiawe	indigenous	uncommon

EUPHORBIACEAE (Spurge Family)			
Chamaesyce celastroides (Boiss.) Croizat & Degener var. amplectens (Sherff) Degener & I.Degener	'akoko	endemic	rare
FABACEAE (Pea Family)			
Acacia farnesiana(L.) Willd.	klu	non-native	uncommon
Chamaecrista nictitans (L.) Moench	partridge pea	non-native	common
*Crotalaria pallida*Aiton	smooth rattlepod	non-native	rare
Crotalaria retusa L.	----------	non-native	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	uncommon
Desmanthus incanum DC.	kaimi clover	non-native	rare
*Desmodium sandwicense*E. Mey.	Spanish clover	non-native	rare
Indigofera suffruticosa Mill.	inikö	non-native	common
Leucaena leucocephala(Lam.) de Wit	koa haole	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Macroptilium lathyroides (L.) Urb	wild bean	non-native	rare
Prosopis pallida(Humb.&Bonpl. ex Willd.) Kunth	kiawe	non-native	rare
LAMIACEAE (Mint Family)			
Salvia coccinea B. Juss. ex Murray	scarlet sage	non-native	rare
MALVACEAE (Mallow Family)			
Abutilon grandifolium(Willd.) Sw.	hairy abutilon	non-native	rare
*Malva parviflora*L.	cheese weed	non-native	rare
Malvastrum coromandelianum(L.) Garcke	false mallow	non-native	rare
Sida fallax Walp	'ilima	indigenous	common
Triumfetta semitriloba Jacq.	Sacramento bur	non-native	rare
Waltheria indica L.	'uhaloa	indigenous	common
MENISPERMACEAE (Moonseed Family)			
Cocculus orbiculatus (L.) DC.	huehue	indigenous	uncommon
MYOPORACEAE (Myoporum Family)			
Myoporum sandwicense A. Gray	naio	indigenous	rare
MYRTACEAE (Myrtle Family)			

Metrosideros polymorpha Gaud.	'öhi'a	endemic	rare
Psidium guajava L.	guava	non-native	rare
OXALIDACEAE (Wood Sorrel Family)			
Oxalis corniculata L.	'ihi	Polynesian	rare
PLANTAGINACEAE (Plantain Family)			
Plantago lanceolata L.	narrow-leaved plantain	non-native	common
POLYGALACEAE (Milkwort Family)			
Polygala paniculata L.	----------	non-native	uncommon
PORTULACACEAE (Purslane Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Portulaca oleracea L.	pigweed	non-native	rare
PRIMULACEAE (Primrose Family)			
Anagallis arvensis L.	scarlet pimpernel	non-native	rare
PROTEACEAE (Protea Family)			
Grevillea robusta A. Cunn. ex R. Br.	silk oak	non-native	rare
ROSACEAE (Rose Family)			
Osteomeles anthyllidifolia (Sm.) Lindl.	'ülei	indigenous	common
SANTALACEAE (Sandalwood Family)			
*Santalum ellipticum*Gaud.	'iliahi alo'e	endemic	uncommon
SAPINDACEAE (Soapberry Family)			
Dodonaea viscosa Jacq.	'a'ali'i	indigenous	uncommon
SOLANACEAE (Nightshade Family)			
Solanum lycopersicum L.	cherry tomato	non-native	rare
THYMELAEACEAE ('Akia Family)			
Wikstroemia oahuensis(A.Gray) Rock	'akia	endemic	uncommon
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	rare
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain	non-native	uncommon



January 2009 Project area
Post-Fire Botanical Survey and Assessment

Literature Cited

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Palmer, D.D. 2003 Hawai'i's Ferns and Fern Allies. University of Hawaii Press, Honolulu.

U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and Plants. 50 CFR 17.11 & 17.12

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawai'i. Univ. of Hawai'i Press and Bishop Museum Press. Honolulu.

APPENDIX B. KWP II ARCHAEOLOGICAL SURVEY

RC-0438

An Archaeological Inventory Survey of 333 Acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK:2-4-8-01: por. 001)

Ukumehame Ahupua'a
Lahaina District
Island of Maui

PREPARED BY:

Matthew R. Clark, B.A.,
and
Robert B. Rechtman, Ph.D.

PREPARED FOR:

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November 2006

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ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

An Archaeological Inventory Survey of 333 acres for the Proposed Expansion of the Kaheawa Wind Farm (TMK: 2-4-8-01:por. 001)

Ukumehame Ahupua'a
Lahaina District
Island of Maui

RECHTMAN CONSULTING

EXECUTIVE SUMMARY

At the request of Mr. Mike Gresham of Kaheawa Wind Power, LLC, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 333-acre project area in Ukumehame Ahupua'a, Lahaina District, Island of Maui (TMK:2-4-8-001:por. 001). The land encompassed by the current project area is owned by the State of Hawai'i and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The objective of the survey was to record the locations of all archaeological sites and features present within the study area and to provide preliminary significance evaluations for any recorded sites. Kaheawa Wind Power, LLC would like to expand its existing wind farm operation by erecting eighteen new power generating wind turbines within the 333-acre project area (Figure 2). Rechtman Consulting, LLC previously conducted an archaeological inventory survey of an adjacent 200 acres for the construction of the existing wind farm (Clark and Rechtman 2005).

Fieldwork for the current project was conducted between October 9-13, 2006 by Matthew R. Clark, B.A., J. David Nelson, B.A., Christopher S. Hand, B.A., and Ashton K. Dircks, B.A. under the direction of Robert B. Rechtman, Ph.D. The survey included a visual inspection of the entire project area. To accomplish this, fieldworkers walked east/west pedestrian transects spaced at 50-meter intervals working from the southern end of the project area to the northern end. This spacing was adequate for locating all archaeological resources, as a recent wildfire had burned the vegetation off nearly the entire project area prior to the commencement of fieldwork. The lack of vegetation allowed for an unobstructed view of the surface terrain.

As a result of the inventory survey SIHP Site 50-50-09-5232, an upland *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (SIHP Site 50-50-09-6218), three cairn (SHIP Sites 50-50-09-6219, 50-50-09-6220, and 50-50-09-6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; SIHP Site 50-50-09-6222) were recorded within the project area. Two segments of an old metal waterline associated with Site 6222 also cross the project area from north to south. With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites are present within the southern portion of the project area *makai* of the existing wind farm. The *heiau* (Site 5232) is located along the southwestern flank of Pu'u Lū'au near the western boundary of the existing wind farm. The site was examined and photographed during the current survey, but no new work was conducted at it, and no new features were discovered in its vicinity. In addition to the recorded archaeological sites a single, isolated piece of branch coral was found on ground surface to the west of Site 6218 and the old metal waterline.

Site 5232 is considered significant under Criterion D because of its important research potential, and under Criterion E because of its important traditional cultural value. This site was previously recommended for preservation (Athens 2002), and a preservation plan has already been prepared and partially implemented for it (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, an archaeological monitor should be present during any future development activities that occur within 500 feet of the *heiau*. The five remaining sites (Sites 6218 to 6222) are all considered significant under Criterion D for information they presented relative to past use of the project area. It is argued that research potential has been exhausted at these sites, and they are therefore recommended for no further work.

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Figures

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INTRODUCTION

At the request of Mr. Mike Gresham of Kaheawa Wind Power, LLC, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 333-acre project area in Ukumehame Ahupua'a, Lahaina District, Island of Maui (TMK:2-4-8-001:por. 001) (Figure 1). The land encompassed by the current project area is owned by the State of Hawai'i and is administered through the Department of Land and Natural Resources (DLNR); it is designated as conservation land. The objective of the survey was to record the locations of all archaeological sites and features present within the study area and to provide preliminary significance evaluations for any recorded sites. Kaheawa Wind Power, LLC would like to expand its existing wind farm operation by erecting eighteen new power generating wind turbines within the 333-acre project area (Figure 2). Rechtman Consulting, LLC previously conducted an archaeological inventory survey of an adjacent 200 acres for the construction of the existing wind farm (Clark and Rechtman 2005). The current project was undertaken in support of all necessary permit approvals and in compliance with both the historic preservation review process requirements (HAR 13§13-275-5) of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) and the County of Maui Planning Department.

This report contains background information outlining the project area's physical and cultural contexts, a presentation of previous archaeological work in the immediate vicinity of the parcel, and current survey expectations based on that previous work. Also presented is an explanation of the project's methods, detailed description of the archaeological resources encountered, interpretation and evaluation of those resources, and treatment recommendations for all of the documented sites.

Project Area Description

The current project area is located on the southern slopes of West Maui Mountains in Ukumehame Ahupua'a, Lahaina District, Island of Maui (TMK:2-3-8-01:por. 001). The 333-acre study area stretches from an elevation of approximately 1,300 to 2,900 feet above sea level. It is located south and west of the existing wind farm between Pāpalaua Gulch (to the west; Figure 3) and Manawainui Gulch (to the east) in an area commonly referred to as Pōhakuloa ("long ridge") (see Figure 1). A prominent hill named Pu'u Lū'au is present in the east-central portion of the project area. The terrain consists of what is commonly referred to as tableland. Typical of the south rift of the West Maui volcano, this land consists of high, inter-valley ridges separated by steep-sided, dry gulches that descend the steep, southwest facing slope to the ocean (Tomonari-Tuggle 1998). There are three soil zones in the project area (Tomonari-Tuggle 1998). The upper edge of the area is Olelo silty clay, which is well-drained upland soil formed in "material derived from basic igneous rock" and occurring on narrow to broad ridge tops (Foote et al. 1972:101). The central portion of the project area, inland of Pu'u Lū'au, consists of Maiwa silty clay loam, which is a well-drained upland soil developed in volcanic ash and weathered igneous rock (Foote et al. 1972:102-103). The top of Pu'u Lū'au and scattered areas along the upper edge of Manawainui gulch are deflated, with exposed dirt and boulders and cobbles. The area below the *pu'u* is steep, rocky, and punctured by numerous boulder outcrops. The adjacent gulches are classified as rough broken and stony land in very steep gulches, and as rock land where exposed rock covers 25 to 90 percent of the surface (Tomonari-Tuggle 1998).

Owing to a recent wild fire, almost no vegetation was present within the project area at the time of the current fieldwork (Figures 4, 5, and 6). Grasses and weeds interspersed with thick stands of lantana (*Lantana camara*), molasses grass (*Melinis minutiflora*), *kiawe* (*Prosopis pallida*), *koa-haole* (*Leucaena leucocephala*), and ironwood trees (*Casuarina equisitfolia*) were the dominant floral species prior to the fire. Native plants such as *pūkiawe* (*Syphelia* sp.), *'a'ali'i* (*Dodonaea viscosa*), and *'ūlei* (*Osteomeles anthyllidifolia*) were also formerly present. Currently, this vegetation pattern exists only at the extreme *mauka* end of the project area, where a newly bulldozed firebreak kept the fire from spreading further *mauka* (Figure 7).

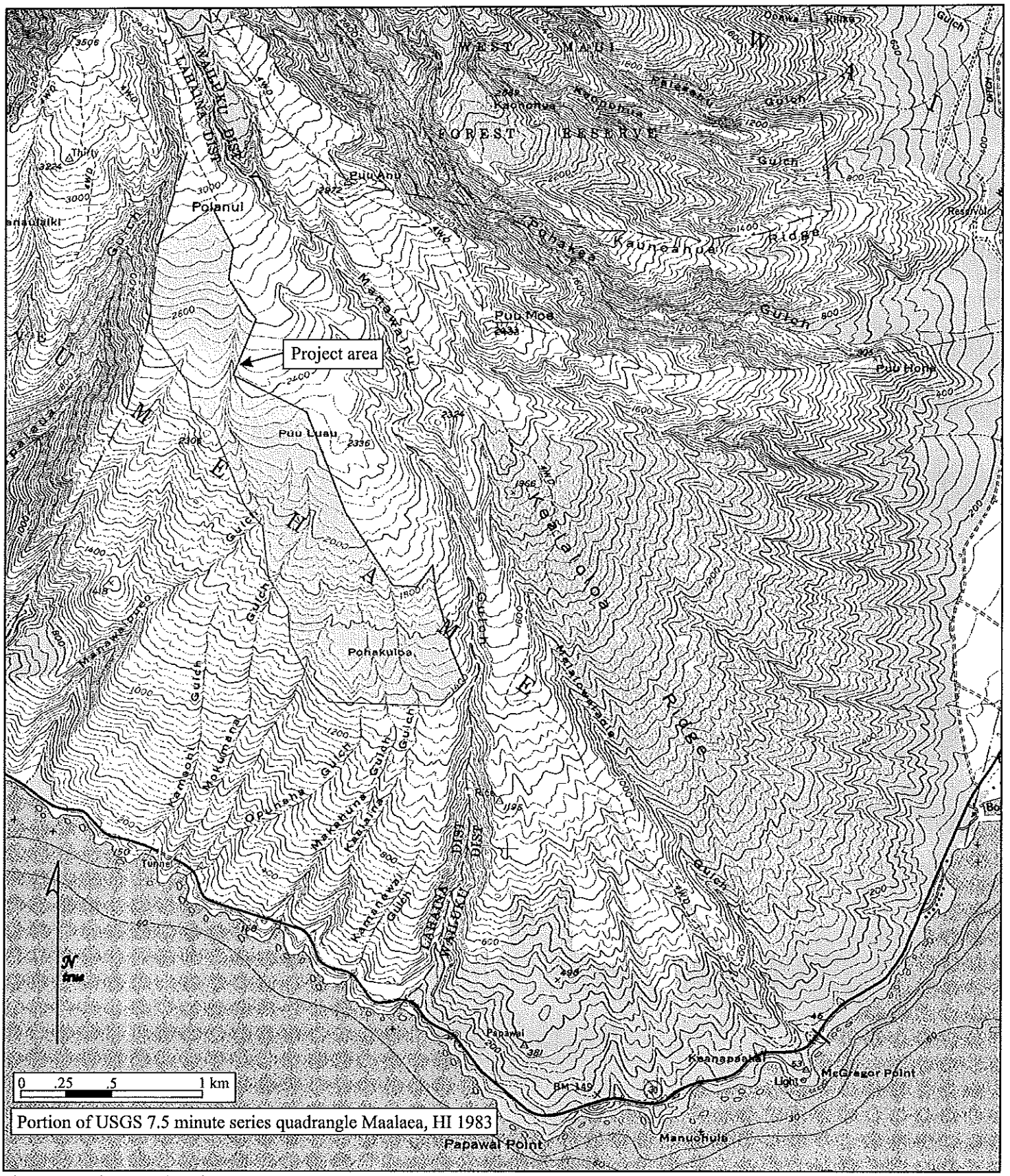


Figure 1. Project area location.

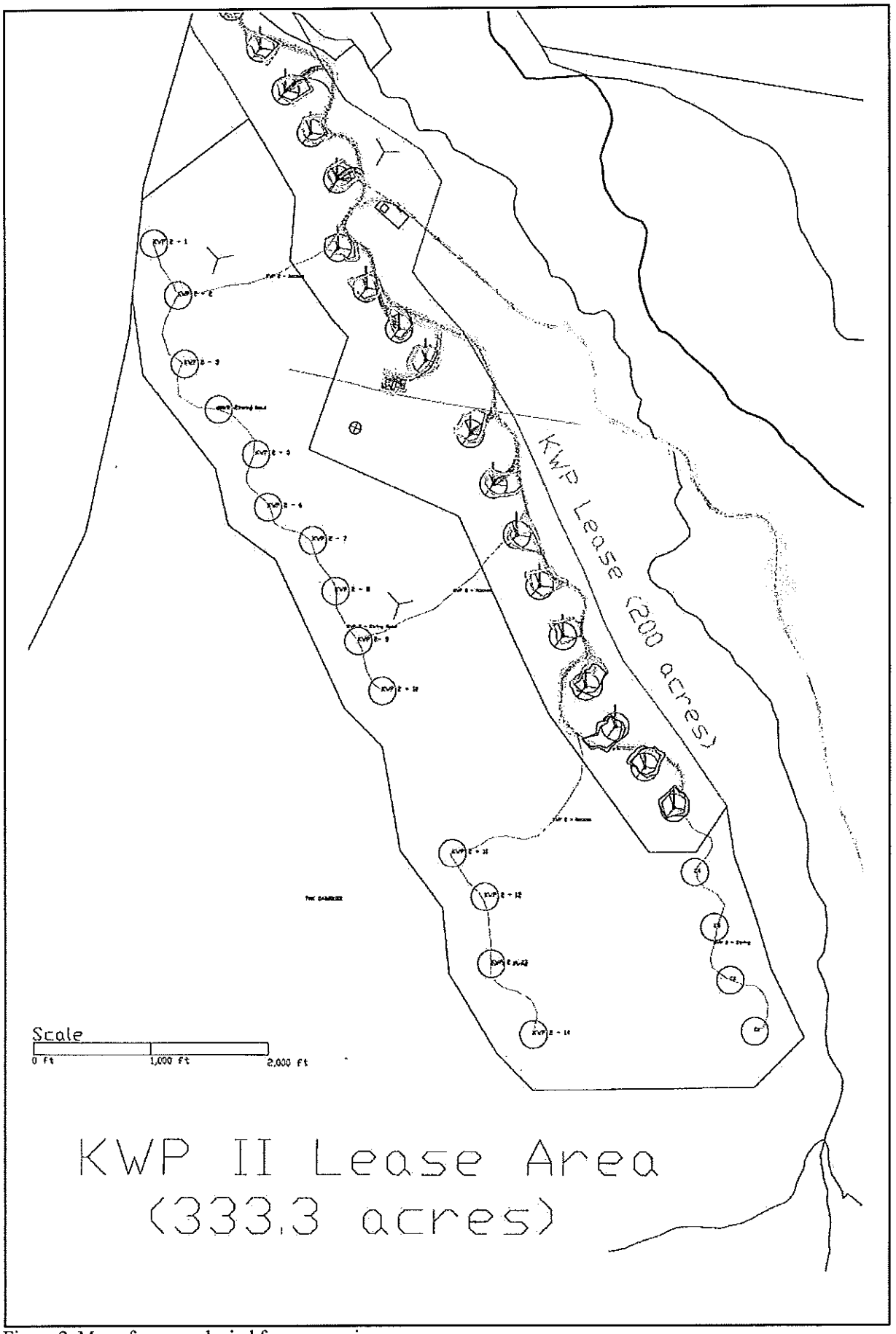


Figure 2. Map of proposed wind farm expansion area.

Figure 3. Pāpalaua Gulch along the western project area boundary, view to southwest.

Figure 4. Middle project area terrain, view to southeast.

Figure 5. Lower project area terrain, view to east toward Manawainui Gulch.

Figure 6. Typical small gulch within the project area, view to southwest.

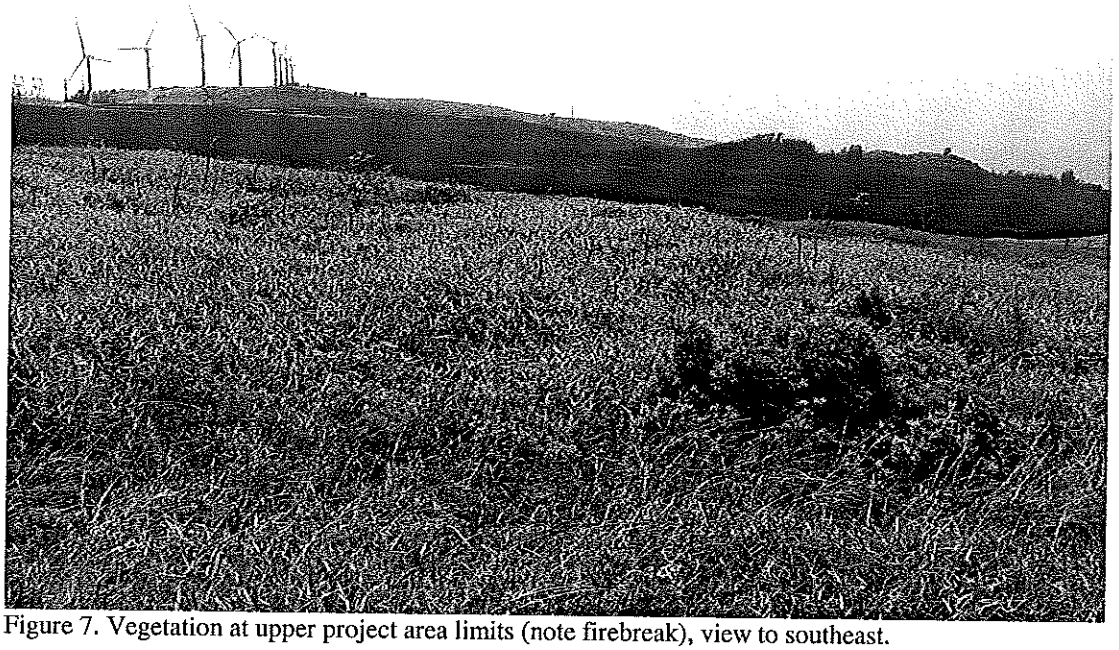


Figure 7. Vegetation at upper project area limits (note firebreak), view to southeast.

BACKGROUND

To generate set of expectations regarding the nature of archaeological resources that might be encountered on the study parcel, and to establish an environment within which to assess the significance of any such resources, previous archaeological studies relative to the project area and a general historical context for the region are presented.

Previous Archaeological Research

Eight previous archaeological studies were conducted for the previously developed portion of the Kaheawa Wind Farm. These studies included a reconnaissance survey of twenty-seven wind turbine locations (Tomonari-Tuggle 1998), a study of an upland *heiau* site (Site 5232; Athens 2002) and a preservation plan for that *heiau* (Tomonari-Tuggle and Rasmussen 2005), a supplemental survey of the wind turbine pad alignments (Magnuson 2003), a supplemental survey for a proposed access road (Athens 2004), a reconnaissance survey of the southern portion of a new low impact road (Rasmussen 2005a), a supplemental reconnaissance survey within the SMA zone for a proposed staging area (Rasmussen 2005b), and an inventory survey of the entire proposed development area (Clark and Rechtman 2005). Three of these studies included portions of the current project area (Athens 2002; Magnuson 2003; Tomonari-Tuggle and Rasmussen 2005). In addition to these studies, an archaeological survey report (Tomonari-Tuggle and Tuggle 1991) and a cultural resource management plan (Tomonari-Tuggle 1995) were prepared for the Lahaina Pali trail, a portion of which crosses *makai* of the current project area, and an inventory survey was conducted for MECO transmission lines that cross the current project area (Hammatt et al. 1996; Robins et al. 1994). The findings of each of the previous archaeological studies are summarized below and their locations are shown in Figure 8.

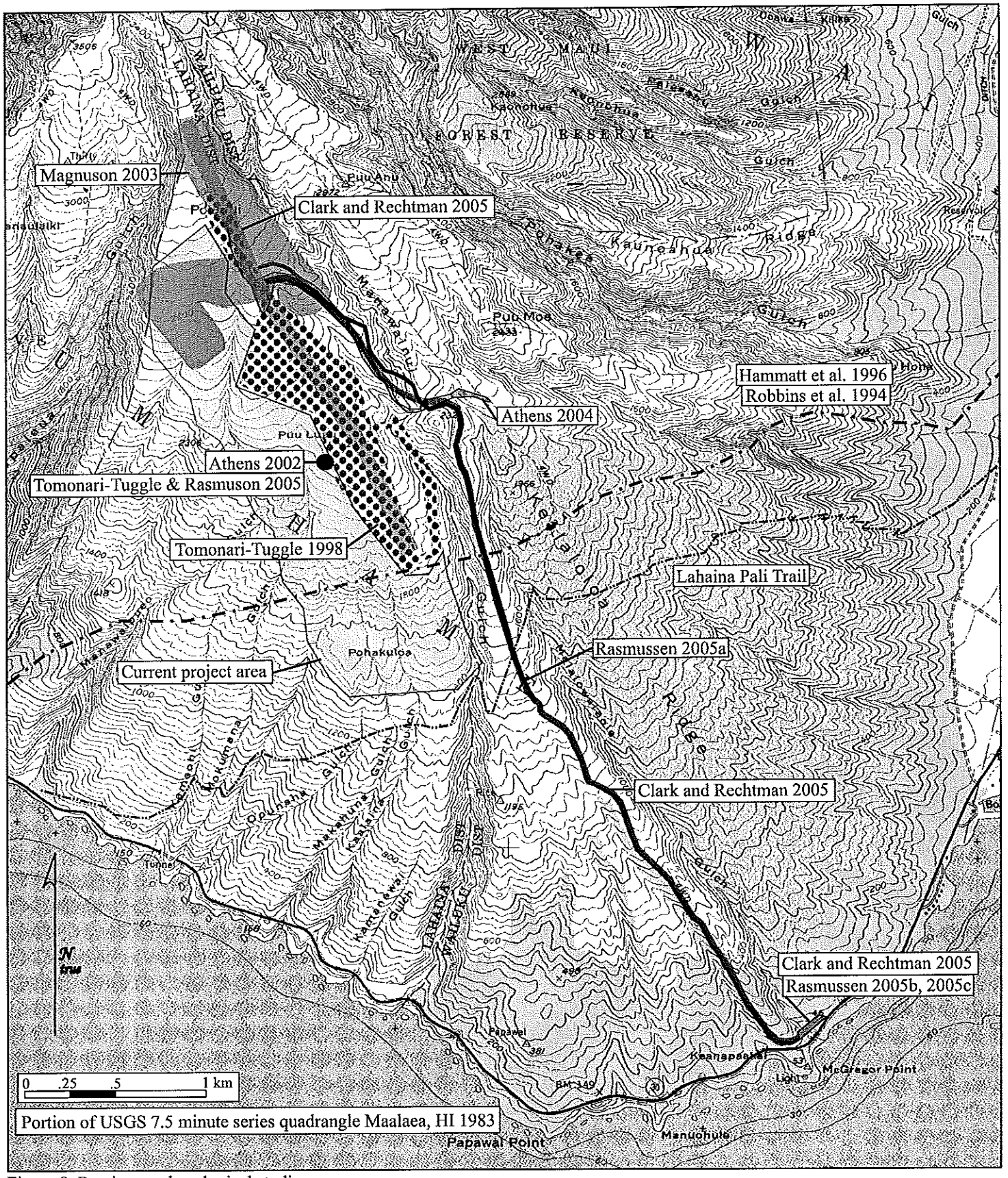


Figure 8. Previous archaeological studies.

Tomonari-Tuggle and Tuggle (1991) conducted an archaeological survey of two demonstration trails for the Hawai'i statewide trail and access system. One of the demonstration trails was the Historic Lahaina Pali trail, a portion of which runs *makai* of the current project area. This trail was constructed around 1841 to accommodate horse traffic between the towns of Lahaina and Wailuku. Tomonari-Tuggle (1995) later prepared a cultural resource management plan for the trail as well. The trail is currently open to the public as part of the Na Ala Hele Statewide Trail and Access System. Tomonari-Tuggle and Tuggle describe the trail thusly:

> The Lahaina Pali trail extends 4.5 miles across the lower southern slopes of West Maui Mountains. At its west end, the trail is anchored inland of the Honoapili'ilani Highway just east of Ukumehame State Beach Park. Its east end is located just inland of the pineapple fields near Ma'alaea Harbor. The trail covers an elevation range from about 100 feet to 1600 feat above sea level. (1991:5)

During the survey of the Lahaina Pali Trail Tomonari-Tuggle and Tuggle (1991) recorded eighteen archaeological sites (Sites 2816 to 2833) along its route, but they did not assign a Site number to the trail itself. Sixteen of the sites were related to the construction and use of the trail or the old coastal road. These sites included alignments, enclosures, walls, petroglyphs, terraces, and C-shaped structures. The two sites not related to the trail included a midden scatter (Site 2816) and a rock shelter (Site 2833). Both of these sites were determined to be of likely Precontact Hawaiian origins. One of the recorded sites (Site 2821) is located directly south of the current project area. Tomonari-Tuggle describes Site 2821 thusly, and makes the following recommendations:

> Probable historic period petroglyphs on large boulder outcrops adjacent to the trail between Ōpūnahā and Makahuna Gulches. There is a quantity of bottle glass and Chinese crockery on the makai edge of the trail and on top of the outcrops on the mauka side of the trail. The outcrops do not have a definite overhang but are high enough to provide afternoon shade, making this an inviting place to rest along the trail. Therefore, there is potential for negative impact on this site. A surface collection of all artifacts, detailed mapping of petroglyphs, and survey of the area *mauka* among the rocks is recommended. The location is also recommended for interpretation. [1995:16]

Robins et al. (1994) conducted an archaeological inventory survey of a then proposed 14.7-mile long transmission line corridor from Mā'alaea to Lahaina. The alignment of the transmission lines crosses the current project area at an elevation of approximately 1,880 feet above sea level. A later survey for access roads leading to the transmission lines was conducted by Hammatt et al. (1996). While these two surveys did locate a number of sites including Historic irrigation ditches, a Historic dam, Historic cattle walls, and Precontact temporary shelters, wind breaks, enclosures, and agricultural features, no archaeological resources were encountered in the vicinity of the current project area.

Archaeological studies of the previously developed portion of the Kaheawa Wind Power project area began in 1998 with a reconnaissance survey of twenty-seven proposed wind turbine locations (Tomonari-Tuggle 1998). This survey took place at elevations ranging from roughly 2,000 to 2,900 feet above sea level. The survey area included a 200-foot wide by roughly 1.5-mile long corridor following a line of five anemometer towers and a potion of Manawainui Gulch extending inland from the MECO transmission line inland approximately 3,000 feet. The only cultural sites observed during the reconnaissance survey were a concrete water trough and a metal waterline. Tomonari-Tuggle concludes that:

> As a result of this one-day survey, it is highly unlikely that any archaeological sites are located within the Maui wind turbine project area. This area was probably not used intensively by Hawaiians and thus, would retain little, if any, evidence of prehistoric or early historic activity. Except for the watering trough and the pipeline, there are no remains of cattle ranching, the only identified use of this area in historic and modern times. (1998:15)

In 1999 a brush fire burned a portion of the wind farm project area, removing some dense brush from the southwestern edge of Pu'u Lū'au, and revealing the presence of an upland *heiau* in Ukumehame Ahupua'a (Site 50-50-09-5232). The location of the *heiau* places it within the current project area, slightly to the west of the area studied by Tomonari-Tuggle (1998). Mr. Ed Lindsey, a cultural monitor for the wind farm project, discovered the site in late 1999 and notified Dr. Melissa Kirkendall, staff archaeologist at the Maui Branch office of the SHPD (Athens 2002:1). After a field visit by SHPD staff members, it was recommended that a qualified archaeologist document the *heiau* in detail. In 2002 IARII conducted archaeological investigations at the *heiau* that included site mapping, photographs, and subsurface testing (Athens 2002).

According to Athens (2002), the *heiau* consists of two adjacent stone enclosures joined by a massive central wall, with one of the enclosures displaying a notch on one side. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau*. An AMS radiocarbon determination on charcoal from a short-lived wood taxon (*Chamaesyce* sp.) indicated that the *heiau* likely dated to AD 1670-1770. Several pieces of branch coral were also recovered from the *heiau*, further confirming the religious nature of the site. No food (marine shell or animal bone) or tool (basalt or volcanic glass flake debris, abraders) remains were found either in the excavation or on the surface of the site.

Tomonari-Tuggle and Rasmussen (2005) prepared a preservation plan for the *heiau* (on behalf of the Michael Gresham of Makani Nui Associates, LLC). The plan calls for several short-term preservation measures including a temporary buffer of 100 to 200 feet around the entire site (this buffer was to be marked by 4 to 6 foot high construction fencing prior to any construction activities), monitoring by a qualified archaeologist during any construction activities that take place within 500 feet of the *heiau*, for a pre-construction briefing to be conducted by a qualified archaeologist with the project manager, construction supervisors, and crews prior to any ground alteration activity, and that a report be prepared detailing these short-term preservation measures and submitted to SHPD (Tomonari-Tuggle and Rasmussen 2005:11-14). Long-term preservation measures called for in the plan include the creation of permanent signage and markers around the site, education for individuals and organizations having access to the project area, and community involvement in the maintenance and protection of the site (Tomonari-Tuggle and Rasmussen 2005:14-15). The long-term preservation of this site would be the responsibility of the State. All of the short-term preservation measures proposed by Tomonari-Tuggle and Rasmussen (2005) were followed during the construction of the existing wind farm, but the long-term preservation measures have not yet been implemented.

In 2003, IARII conducted a supplemental archaeological survey of a revised alignment for wind turbine pad locations that included a portion of the current project area (Magnuson 2003). This supplemental survey included three 200-foot wide corridors for two possible turbine rows and an access road connecting them. The survey corridor extended a total distance of 2,130 meters from elevations of 2,400 to 3,100 feet above sea level. As a result of the survey one site, a watering trough previously noted by Tomonari-Tuggle (1998), was relocated, mapped in detailed, photographed, and assigned an SIHP site number (Site 50-50-09-5402). Based on inscriptions in the concrete of the trough, it appears that Site 5402 was built in 1943 (Magnuson 2003:3).

In 2004, IARII conducted a supplemental archaeological survey for an access road leading to the existing wind farm (Athens 2004). The survey area consisted of a 75-meter wide corridor stretching 2.5 kilometers northwest from an existing jeep road across Manawainui Gulch to the previously surveyed wind farm area. As a result of the survey two small rock piles that probably served as cairns (Sites 50-50-09-5625 and 50-50-09-5626) were located and recorded. Site 5625 was located on a natural bench immediately upslope of a small unnamed cinder cone within a dense growth of ironwood samplings, and Site 5626 was situated on the edge of a small ridge descending into Manawainui Gulch from its western edge (Athens 2004:2). Athens (2004:3) concluded that the two stacked rock piles, probably cairns, were fully documented, and no further archaeological documentation was needed. In addition to these sites, a single

brass 45-70 cartridge casing manufactured by Winchester Repeating Arms Company between 1866 and 1932 was also discovered along the western edge of Manawainui Gulch (Athens 2004:3).

In 2005, IARII conducted a supplemental archaeological reconnaissance survey of a new proposed low impact road leading to the existing wind farm (Rasmussen 2005a). This survey area consisted of a corridor approximately 75 meters wide that extended from roughly 1,400 to 2,300 feet above sea level (Rasmussen 2005a:6). The corridor commenced at an existing access road, followed a narrow ridge to the northwest, ande ventually crossed Manawainui Gulch and joined up with the wind turbine locations. As a result of the reconnaissance survey three previously unrecorded archaeological sites thought to be of traditional Hawaiian origins were discovered (Sites 5648, 5649, and 5650). Two of the recorded sites (Sites 5648 and 5650) were located outside (to the west of) the actual road survey corridor.

Site 50-50-09-5648, located between ca. 1,280 and 1,420 feet above sea level, consisted of six C-shaped rock shelters (Features 1, 2, 5, 6, 7, and 9), a possible C-shaped rock structure (Feature 4), one modified outcrop (Feature 10), and a cupboard (Feature 3). Marine shell was observed near Feature 4. Based on the presence of the shell and the formal attributes of the features, Site 5648 was interpreted as being used habitation, perhaps related to the Lahaina Pali Trail, or an earlier trail (Rasmussen 2005a:7). Site 50-50-09-5649, located between ca. 1,880 and 1,980 feet above sea level, consisted of a rock cairn (Feature 11) and modified outcrop (Feature 12). Site 50-50-5650, located at the top of an unnamed cinder cone at an elevation of ca. 2,300 feet above sea level, consisted of four rock cairns (Features 13 to 16). Rasmussen concluded that, "the location (on top of a *pu'u*) and type of features present (cairn with linear stones that may be fallen upright stones) suggest that this site may have a ceremonial function" (2005a:8).

Later in 2005, IARII conducted a supplemental archaeological reconnaissance survey of a roughly 1.75-acre SMA area located along the northern (*mauka*) edge of Honoapili'ilani Highway (Rasmussen 2005b). As a result of that survey three archaeological sites were recorded. In the Rasmussen (2005b) report the sites are referred to with temporary site numbers, but in a letter dated February 11, 2005 the sites are referred to with SIHP site numbers (Rasmussen 2005c). The three recorded sites included a Historic road remnant (Site 50-50-09-5652), a traditional Hawaiian habitation area comprised of several rough features on a small knoll north of the staging area (Site 50-50-09-5654), and set of concrete steps with the date 1908 inscribed into one of the steps (Site 50-50-09-5654). According to Rasmussen (2005b) only Site 5652 was located within the SMA project area, and according to Rasmussen (2005c) all three sites were located outside of the project area. Nevertheless, Rasmussen (2005c:2) suggests that measures be taken to protect the sites during any construction activities in the area, and recommended that a full archaeological inventory survey be conducted of the access road leading to the proposed wind farm area prior to any development.

Following all of the preliminary work conducted by IARII, Rechtman Consulting, LLC conducted an archaeological inventory survey of the entire wind farm project area (Clark and Rechtman 2005). As a result of the inventory survey seven previously identified archaeological sites and two newly identified sites were recorded. The previously identified sites included the Historic Lahaina Pali Trail, a section of Historic highway (Site 4696), a concrete watering trough (Site 5402), a lone cairn (Site 5625), a cairn and a modified outcrop located next to one another (Site 5649), a terraced section of old road (Site 5652), and the remains of a Historic structure (Site 5654). The newly identified sites included a possible privy (Site 5714) and a Historic hoist location (Site 5715). Two isolated finds, consisting of marine shell fragments and an adze fragment, were also discovered. Five other archaeological sites previously recorded by IARII outside the boundaries of the current project area were also relocated. These sites included an upland *heiau* (Site 5352) located within the current project area, a lone cairn (Site 5626), a Precontact habitation complex located between 1,280 and 1,420 feet above sea level (Site 5648), a grouping of four cairns atop an unnamed *pu'u* (Site 5650), and a Precontact habitation complex located at approximately 70 feet above sea level (Site 5653). Clark and Rechtman summarize the findings within the existing wind farm project area thusly:

A review of archival resources and previous archaeological studies, combined with the findings of the current inventory survey, indicates that Precontact use of the project area centered around coastal habitation and the exploitation of marine resources, as indicated by Site 5653. A network of trails may have connected the coastal habitation area with inland resource areas (Devereux et al. 1999). Site 5648 may have been a Precontact habitation area located along one of these trails, or perhaps an early Historic site related to the use of the Lahaina Pali trail (Rasmussen 2005a). If a Precontact *mauka/makai* trail route traversed the current project area, then it likely accessed inland resource areas, and may have connected to trails leading to other areas of West Maui. No evidence of a Precontact trail was observed during the current survey, and it is likely that if one did exist, it was destroyed by the McGregor Point jeep road (Devereux et al. 1999). In late Precontact times trails likely ran to Site 5352, an inland *heiau* located on Pu'u Lū'au (Athens 2002). Isolated marine shell fragments and an adze fragment observed within the wind turbine survey corridor may have been dropped along such a trail route leading to or from the *heiau*.

Sites related to Historic use of the current project area are far more numerous than Precontact ones. Recorded Historic sites indicate that the area along the old Highway alignment (Site 4696) was the primary focus of Historic use. The date "1908" within the concrete stairs at Site 5654, indicates that a Historic structure was in use on the ridge to the west of Malalowaiole Gulch around that time period. Site 5652, a terraced roadbed may have run from Site 4696 to the structure. A possible privy (Site 5714) and a Hoist location (Site 5715) were also located in the area. All of these sites may relate to the use of the current project area for cattle ranching purposes. The land in the vicinity of the current project area was leased for ranching purposes and used as pasture from the late 1850s to the early 1990s (Tomonari-Tuggle 1998). The only site recorded in the extreme inland portions of the current project area was a concrete watering trough constructed in 1943 (Site 5402).

In addition to these sites the Lahaina Pali trail crosses the current project area. This Historic trail was constructed around 1841 for horse travel between Wailuku and Lahaina. The trail fell into disuse approximately fifty years later with the construction of a carriage road (Site 4696) along the coast in Ukumehame Ahupua'a (Tomonari-Tuggle and Tuggle 1991). The trail brought numerous Historic travelers across the lower slopes of the West Maui Mountains, and it continues to bring modern day visitors to the area as part of the *Nā Ala Hele* Statewide Trail and Access System. [2005:40]

Cultural-Historical Context

A generalized Cultural-Historical model for the Hawaiian Islands, with specific reference to Maui Island, and Ukumehame Ahupua'a is presented in order to better understand the current survey area within its regional context.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model. The Settlement or Colonization Period is believed to have occurred in Hawai'i between A.D. 300–600 from the southern Marquesas Islands. This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods *Kane, Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge; the *'aumakua* concept; various superstitions; and the concept of *mana*.

The Development Period (A.D. 600–1100) brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko'i*) evolved from the typical Polynesian variations of

plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *'ulu maika* stones and *lei niho palaoa*. The later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period (A.D. 1100–1650) is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dryland areas. The *loko* or fishpond aquaculture flourished during this period (Bellwood 1978; Kirch 1985). It was during the Expansion Period that a second major migration settled in Hawai'i, this time from Tahiti in the Society Islands (Kamakau 1976).

The concept of the *ahupua'a* was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). The *ali'i* and the *maka'āinana* (commoners) were not confined to the boundaries of the *ahupua'a*; when there was a perceived need, they also shared with their neighbor *ahupua'a ohana* (Hono-ko-hou 1974).

Handy et al. relate that, "Maui was the only island that had a paved way that ran all the way around both its east and west ends" (1991:489). This road was known as the *Alaloa* (long road). Martha Foss Fleming (1933:3-9 in Handy et al. 1991) writes that:

> ...This road was built in about 1516 by Kihapi'ilani, after his conquest and unification of the whole island. It was paved with stones along much of its extent, hence it was referred to as the "*kipapa* (pavement) of Kihapi'ilani." Beaches were used as crossings where gulches came down to the shore. There were no bridges; and beaches were also used along the seashore in many localities...Travelers were sometimes ferried across streams by canoe, or along shore, as between 'Olowalu and Ma'alaea, around the rough southern tip of West Maui [this includes the area of the current study]. (1991:489).

The *ahupua'a* was further divided into smaller sections such as the *'ili, mo'o'aina, pauku'aina, kihapai, koele, hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206). At least four *heiau* are known to exist in Ukumehame Ahupua'a; Ukumehame Heiau and Hiki'i Heiau, located on either side of Ukumehame Gulch to the west of the current project area, Kawai'aole Heiau located near the coast to the east of the current project area, and an unnamed upland *heiau* located on Pu'u Lū'au slightly to the west of the current project area (Athens 2002; Devereux et al. 1999; Walker 1931).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. This period was one of continual conquest by the reigning *ali'i* of all islands. Kamakau (1992:74) relates that Alapa'i, a Hawai'i Island chief, spent a whole year in preparation for a war with Maui, battles of which may have taken place nearby the current project area. Kamakau writes:

> It was 1738 that he set out for the war in which he swept the country...It employed the usual method of warfare of drying up streams...The wet taro patches and the brooks were dried so that there was no food for Ka-uhi [a Maui chief] or for the country people. Alapa'i's men kept close watch over the brooks of Olowalu, Ukumehame, Wailuku, and Honokawai. (1992:74)

However, Alapa'i's forces, consisting of some 8,440 warriors, were surprised and slaughtered by Peleioholani, an O'ahu chief in cahoots with Kauhi, whose force consisted of only 640 warriors. According

to Kamakau (1992:74), Alapa'i regrouped and held Lahaina District from Ukumehame to Mala on the north. When Peleioholani tried to join his forces with Kauhi's forces, Alapa'i forces, led by Kalani'opu'u and Keoua, attacked at Pu'unene and were victorious.

On Hawai'i Island, Ke'eaumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniopu'u, so he moved to Maui. About A.D. 1759 Kalani'opu'u conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Pu'u Kau'iki as his fortress. He appointed one of his Hawai'i chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Ke'eaumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani'opu'u and his Hana forces raided and destroyed the neighboring Kaupo district, then launched several more raids on Molokai, Lanai, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalaniopu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniopu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992).

History After Contact

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniopu'u, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting, but chose not to participate. The following January [1779], Cook and Kalaniopu'u met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

Around A.D. 1780 Kalaniopu'u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Ku'ka'ilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy et al. 1991). After Kalani'opu'u died in A.D. 1782 civil war broke out: Kiwalao was killed. The wars between Maui and Hawaii continued until A.D. 1795 (Kuykendall and Day 1976; Handy et al. 1991).

In A.D. 1790 two American vessels, the *Eleanora* and *Fair American*, were in Hawaiian waters. Following an altercation between his crew and natives, the Captain of the *Eleanora* massacred more than 100 natives at Olowalu [Maui], then sailed away leaving one of its crew, John Young, on land. The other vessel, the *Fair American,* was captured and its crew killed except for one member, Issac Davis. Kamehameha also observed this but did not participate, although he did prevent Young and Davis from leaving. He also kept the vessel as part of his fleet. Young eventually became governor of the island of Hawai'i. By 1796 Kamehameha had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, the women of Hawai'i had learned the profitable concept of prostitution (Kent 1983). This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 in Kailua-Kona, and once again the culture of Hawai'i was to change radically. Six months after his death, his son and successor, Liholiho (Kamehameha II), met with *kuhina nui,* Ka'ahumanu, and a council of chiefs and chiefesses at Kawaihae. His advisors, which included the *kahuna* Hewahewa, convinced him to abolish the *kapu* system. He signified his agreement by sitting down and eating with his mother Keopulani, breaking the *'ai kapu* (Oliver 1961; Kuykendall and Day 1976; Kamakau 1992).

Liholiho's cousin, Kekuaokalani, caretaker of the war god *Ku-Kailimoku*, disagreed and revolted. By December of 1819 the revolution was quelled. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

The religious, socioeconomic, and demographic changes that gradually took place in the period between 1790 and the 1840s throughout the Hawaiian Kingdom, promoted the establishment of a Euro-American style of land ownership, and the Great *Māhele* was the vehicle for determining ownership of the native land. During this period (1848-1899), the *Māhele* defined the land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki.* The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and speeded the transfers (Chinen 1961:13).

During this process all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. All three types of land were subject to the rights of the native tenants. Commoners could make claims for land, and if substantiated, they would receive awards referred to as *kuleana*, from the Land Commission. During this period, other land grants were also made to individuals directly from the Kingdom. In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai'i to legally set the boundaries of all the *ahupua'a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. The information was collected primarily between 1873 and 1885. The testimonies were generally given in Hawaiian and simultaneously transcribed in English.

Ukumehame Ahupua'a

Ukumehame Ahupua'a straddles the boundary between the modern day judicial districts of Lahaina and Wailuku, but the *ahupua'a* was once the easternmost of the traditional Hawaiian district of Lahaina (Tomonari-Tuggle and Tuggle 1991:8). The main productive area of the *ahupua'a*, as described by Tomonari-Tuggle and Tuggle, was to the west of the current project area on "the broad coastal plain fronting Ukumehame Gulch and the smaller, neighboring gulches of Makiwa, Hanaula and Palaua" (1991:8) (Figure 9). On the Ukumehame plain and further inland within the gulches, Precontact peoples would have cultivated taro in irrigated fields. Handy (1940:103) describes taro cultivation on the flat entering Ukumehame Gulch still occurring in the 1940s. The distribution of Land Commission Awards (LCAw.) within Ukumehame Ahupua'a supports the predicted Precontact settlement model. Although the *ahupua'a* was retained as Crown Lands during the *Māhele*, forty-three claims were made for land in

Ukumehame Ahupua'a, all within the agriculturally productive gulches located to the west of the current project area. Only sixteen of the claims were awarded (Devereux et al. 1999:12). A smaller settlement area was located at Mā'alaea to the east of the current project area.

Although coastal trails once ringed much of Maui, according to Handy et al. no coastal trail was present fronting the current project area because of the rough terrain, so "from 'Olowalu [to the west of the current project area] travelers were ferried by canoe to Ma'alaea [to the east of the current project area], thence to Makena" (1991:490). The main *mauka/makai* trail in the vicinity of the current project area followed Kealaloloa Ridge to the east of the current project area (Devereux et al. 1999:12). Devereux et al. (1999:12) relate that the more accessible areas of the Kealaloloa Trail were probably destroyed by a present day jeep trail.

One trail crosses *makai* of the current project area is the Lahaina Pali trail. This Historic trail was constructed around 1841 for horse traffic between the towns of Wailuku and Lahaina, with another branch connecting to Mā'alaea (Tomonari-Tuggle and Tuggle 1991). Within Ukumehame Ahupua'a the trail runs from the coast at Manawaipueo Gulch, inland to an elevation of 1,600 feet, and then back down towards the coast near Mā'alaea. In Historic times the trail was known as a long and treacherous route. In 1841, Laura Fish Judd, a missionary who was making the trip between Lahaina and Wailuku, called the trail "the crookedest, the rockiest ever traveled by mortals" (Judd in Tomonari-Tuggle and Tuggle 1991:12). In 1847 Chester Lyman, a visitor to Maui, reiterates this point, writing that the trail "is one of the roughest and most difficult imaginable. It is all the way zigzag and winding, up steep, rocky and barren precipices, being in places dangerous on horseback" (Lyman in Tomonari-Tuggle and Tuggle 1991:12).

Robbers were another danger encountered on the Lahaina Pali trail, especially on the remote section of trail in the vicinity of the current project area. Tomonari-Tuggle and Tuggle (1991) record that:

> Kaiaupe was a noted female robber who lived by the pali road of Aala-loloa [Kealaloloa], Maui. She would entice men to lay with her at the edge of the pali and then kick them over the precipice with her foot. This act was known as Ka-ai-a-Kaiaupe. (T. Kelsey, from E. Sterling's notes, Maui Historical Society in Tomonari-Tuggle and Tuggle 1991:12)
>
> About 1836, when I was a young lad at Lahaina, a native employed to bring letters from Wailuku to my father, reported that he was attacked by a robber on the mountain coast route not [far] from Ma'alaea Bay. In the struggle, he bit off one of the robber's big toes. The robber at once relaxed his hold and fled. In proof of his story, the messenger exhibited the bloody toe. (Dr. D. D. Baldwin, in Tomonari-Tuggle and Tuggle 1991:12)

By the 1850s, portions of Ukumehame Ahupua'a were being leased for various enterprises. An 1865 letter from William Enos and Joseph Sylva clarified a lease for the "pali of Ukumehame", which they defined as, "from the foot of the mountain on the west, or Lahaina, side to its boundaries on this, or east side for 10 years at $60 per year. $30 payable every six months in advance" (Enos and Sylva 1865 in Tomonari-Tuggle 1998:8). It appears that they had held this lease from at least the latter part of the 1850s, as an earlier letter, sent in 1858 from E. Duvauchelle to the king's land agent on Maui, William Webster, requested the Wailuku side of Ukumehame mountain, citing that Joe Sylva had related to him that he did not wish to renew his lease on this area. Nothing apparently came of the Duvauchelle letter, however, records indicate that Sylva held the lease on the land until at least 1871. Furthermore, it is apparent from the letter that the lease was for cattle ranching. Duvauchelle writes, "as for the other side of the big gulch on the mountain [presumably Manawainui Gulch] and the Ukumehame side I do not want the lease as it is too far from the run of cattle on this side" (Duvauchelle 1858 in Tomonari-Tuggle 1998:8).

In 1886, the western half of Ukumehame Ahupua'a is listed as being leased to Olowalu Plantation Company, for sugarcane cultivation and sugar production, and the eastern half (including the current project area) is listed as leased to John Richardson and Kahahawai for cattle ranching (Tomonari-Tuggle 1998:8). The 1884 McKenney's Hawaiian Directory reveals that John Richardson was the proprietor of the Maalaea Bay Stock Ranch, with approximately 15,000 acres of pasture and mountain land, 200 head of cattle, and 100 head of horses (Bagot 1884 in Tomonari-Tuggle 1998:8). In a side note, Tomonari-Tuggle (1998:8) relates that the Maalaea Stock Ranch was listed in subsequent directories until at least 1900.

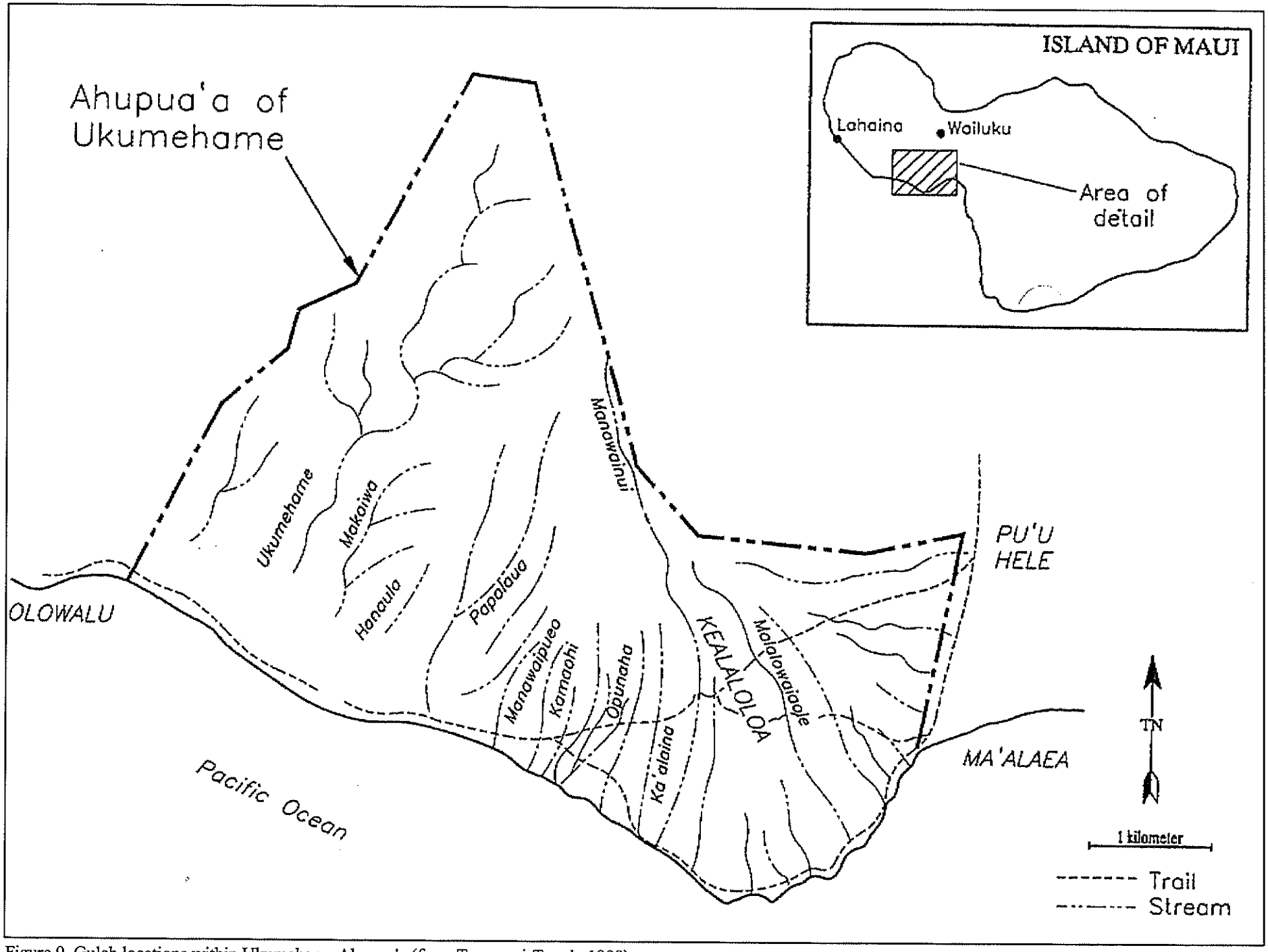


Figure 9. Gulch locations within Ukumehame Ahupua'a (from Tomonari-Tuggle 1998).

By 1889, a new carriage road was under construction from Mā'alaea to Lahaina, along the coast of Ukumehame Ahupua'a. With the opening of this new road, use of the mountainous Lahaina Pali Trail dwindled, and the trail eventually fell into disuse. The new road was gradually widened and straightened to accommodate vehicular use, and then oiled and paved in 1918 (Fleming 1933:22 in Tomonari-Tuggle and Tuggle 1991:13). The road was eventually abandoned in favor of the current alignment of Honoapili'ilani Highway.

Cattle ranching continued in the vicinity of the current project area until the mid-1990s, while portions of the wetter, western half of Ukumehame Ahupua'a continue to be used for sugarcane cultivation. At some point in the mid-1940s the McGregor Point jeep road was bulldozed to the project area, allowing vehicular access to the *mauka* areas, and perhaps obliterating an older road or trail. The road has been subsequently maintained by ranchers, MECO, and DLNR, with newer bulldozer routes approximating the older ones. During the 1970s Maui Electric (MECO) erected power-lines between Mā'alaea and Lahaina (Devereux et al. 1999) that cross the current project area at an elevation of approximately 2,400 feet above sea level.

AHUPUA'A SETTLEMENT PATTERNS AND PROJECT EXPECTATIONS

Devereux et al. (1999) offer a detailed summary of settlement patterns in the vicinity of the current project area, describing that, besides the primary settlement area on the broad costal plain fronting Ukumehame Gulch:

> ...pre-historic occupation of the Ukumehame *ahupua'a* between the alluvial flats of Ukumehame Gulch and the Maui Island isthmus, seems to be focused on the coastal zone, particularly between Mā'alaea Bay and McGregor's Point. This settlement comprises at least 45 "house and shelter" sites, some of which may have been fishing shrines or *koa* (Walker 1931:43). It seems likely a major focus of this village was fishing, given the shrines, its cliff side location, and the lack of abundant agricultural land. A major *heiau* and extensive panels of petroglyphs were also identified by Walker just inland of the village complex.
>
> The steep topography and arid environment of the upper, *mauka* elevations of Ukumehame *ahupua'a* (east of the broad coastal plain fronting Ukumehame Gulch) presents a relatively inhospitable and unproductive agricultural landscape. However, as indicated by a traditional Hawaiian trail present on the Mā'alaea side of the region and the possible existence of comparable trails ascending *mauka* of Walker's coastal settlement, the upper elevations of Ukumehame provide a way to the summit of West Maui and hence to the other side. Kealaloloa "long pathway" Ridge, as it name suggests, may have been the main travel route used during the prehistoric and early historic times to cross to the West Maui Mountain, with auxiliary trails once serving to connect the main travel route. This prominent landform ascends above McGregor's Point, which apparently represents the western extent of the coastal settlement observed by Walker. The main travel route of Kealaloloa and auxiliary *mauka-makai* trails probably provided coastal residents with access to *mauka* resources (*e.g.* wild plant goods, bird catching, and stone materials), and communication with other West Maui regions. (Devereux et al. 1999:85-86)

Based on the results of previous archaeological surveys conducted for the existing wind farm (Athens 2002, 2004; Clark and Rechtman 2005; Magnuson 2003; Rasmussen 2005a, 2005b, 2005c; Tomonari-Tuggle 1998; Tomonari-Tuggle and Rasmussen 2005), it is known that an upland *heiau* (Site 5232) will be present along the southwestern flank of Pu'u Lū'au near the eastern edge of the current project area. Trails may also be present that run to or from this upland *heiau*. These trail routes could be marked by worn paths or cairn (Devereux et al. (1999). It is possible, although unlikely, that Precontact habitation features also exist in this area. If any such features are encountered they are expected to take the form of C-shape enclosures or stone alignments that block the prevailing trade winds, and were likely only used on a short-

term or recurrent basis. These features are likely to be more prevalent along trail routes that received repeated use. It is likely that Historic cattle ranching features are present within the project area. Such features may include concrete water troughs, metal water lines, wire fence lines, windbreak shelters, roads, or cairn that mark Historic trails. One Historic trail, the Lahaina Pali Trail, is known to pass *makai* (south) of the current project area. Tomonari-Tuggle and Tuggle (1991) recorded Historic petroglyphs and temporary shelters (Site 2821) along this trail in the vicinity of the project area, but the trail should be far enough removed from the project area that these features will not be included in the current survey area.

FIELDWORK

Fieldwork for the current project was conducted between October 9-13, 2006 by Matthew R. Clark, B.A., J. David Nelson, B.A., Christopher S. Hand, B.A., and Ashton K. Dircks, B.A. under the direction of Robert B. Rechtman, Ph.D.

Methods

The current inventory survey included a visual inspection of the entire project area. To accomplish this, fieldworkers walked east/west pedestrian transects spaced at 50-meter intervals working from the southern end of the project area to the northern end. This spacing was adequate for locating all archaeological resources, as a recent wildfire had burned the vegetation off nearly the entire project area prior to the commencement of fieldwork. The lack of vegetation allowed for an unobstructed view of the surface terrain. When archaeological features (or land alterations; i.e. bulldozing, roads, etc.) were encountered, they were plotted on a map of the study parcel using Garmin 76s handheld GPS technology (with sub five-meter accuracy), and then (if necessary) cleared of vegetation, mapped in detail, photographed, and described using standardized site record forms. No subsurface testing was conducted during the current inventory survey.

Findings

As a result of the current inventory survey Site 5232, an upland *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (Site 6218), three cairn (Sites 6219, 6220, and 6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; Site 6222) were recorded within the project area (Figure 10). Two segments of an old metal waterline associated with Site 6222 also cross the project area from north to south. With the exception of the previously identified *heiau*, all of the newly recorded archaeological sites are present within the southern portion of the project area *makai* of the existing wind farm. The *heiau* (Site 5232) is located along the southwestern flank of Pu'u Lū'au near the western boundary of the existing wind farm. This site has a previously approved and partially implemented preservation plan (Tomonari-Tuggle and Rasmussen 2005). The site was examined and photographed during the current survey, but no new work was conducted at it, and no new features were discovered in its vicinity. In addition to the recorded archaeological sites a single, isolated piece of branch coral was found on ground surface to the west of Site 6218 and the old metal waterline.

Site 2821, as recorded by Tomonari-Tuggle and Tuggle (1991), was also relocated along the *mauka* edge of the Lahaina Pali Trail. This site and the Lahaina Pali Trail are far enough removed from the current project area that they will not be directly affected by the proposed development. It was noted, however, that feature density, as compared to the low feature density within the current project area, dramatically increases in the vicinity of the Lahaina Pali Trail, where numerous temporary shelters are present. Care should be taken to avoid this area during any future development activities. Also, as a side note, it was discovered that the Historic petroglyphs at Site 2821 have been negatively impacted by pedestrian traffic on the Lahaina Pali Trail since the time of the earlier archaeological study. Several new names and pictures have been scratched into the rocks at that site in recent years. The Department of Land and Natural Resources may want to consider corrective actions, such as signs, to help prevent further deterioration of this site in the future.

Each of the archaeological sites recorded within the project area are discussed in detail below, and their locations relative to the project area boundaries and the proposed wind farm development are shown in Figure 10.

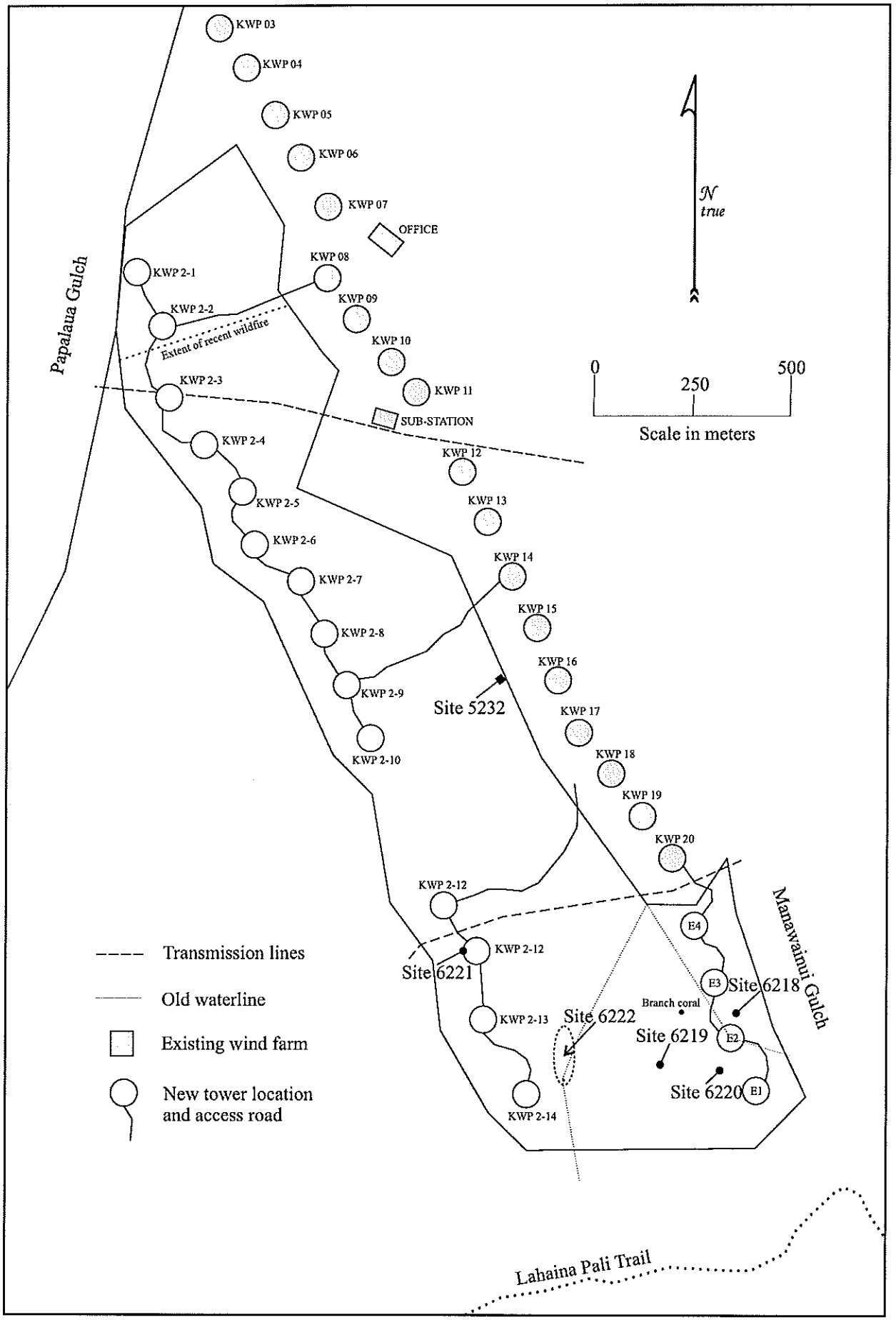


Figure 10. Project area plan view.

SIHP Site 5232

Site 5232 is an upland *heiau* located in the east-central portion of the current project area along the western edge of the existing wind farm (see Figure 10). Site 5232 was fully documented by Athens (2002), and a preservation plan has been prepared and implemented for this site (Tomonari-Tuggle and Rasmussen 2005). Athens describes the *heiau* and summarizes the findings of work conducted at Site 5232 thusly:

> The *heiau*, situated on the lee side of a small hill [Pu'u Lū'au] at an elevation of 686 m, consists of two adjacent stone enclosures joined by a massive central wall. One of the enclosures is distinguished by a "notch" on one side. Notched enclosures are a common design trait for religious architecture on Maui. The site also has several terraces. Excavation inside the notched enclosure revealed a dense deposit of charcoal associated with use of the *heiau*. An AMS radiocarbon determination on charcoal from a short-lived wood taxon (*Chamaesyce* sp.) indicates that the *heiau* likely dates within the range of AD 1670-1770. This date is in agreement with dates of other notched *heiau*, suggesting that the notched enclosure design is a late prehistoric architectural development. Several pieces of branch coral were recovered from the charcoal deposit, further confirming the religious nature of the site (branch coral was commonly brought to *heiau* as offerings). No food (marine shell or animal bone) or tool (basalt or volcanic glass flake debris, abraders) remains were found either in the excavation or on the surface of the site. A sample of the charcoal was identified for its wood species; the findings suggest the environment in the vicinity of the *heiau* was not forested. [2002:iii]

During the current inventory survey Site 5232 was relocated and examined. Photographs were taken (Figures 11, 12, 13, and 14), and the area surrounding the *heiau* was thoroughly inspected for any additional features, portable artifacts, and/or trails. It was found that the work previously conducted at the site by Athens (2002) was accurate and complete, and no additional findings were noted in the vicinity of Site 5232. It was noted however,—and not previously mentioned—that the orientation of the *heiau* is such that the southwestern corner is oriented toward the tallest point on the Island of Kaho'olawe. This may be an important aspect of Site 5232, suggesting that it perhaps functioned as a navigation *heiau* (Kaho'olawe has known associations with Hawaiian navigation).

Figure 11. SIHP Site 5232, view to west.

Figure 12. SIHP Site 5232, view to west of the southern *heiau* enclosure.

Figure 13. SIHP Site 5232, view to west of the northern *heiau* enclosure.

Figure 14. SIHP Site 5232, view to west of the notched northeastern corner of the *heiau*.

SIHP Site 6218

Site 6218 is a windbreak shelter located along the western edge of Manawainui Gulch, approximately 450 meters south of the existing wind farm (see Figure 10). The site consists of six large cobbles and small boulders that have been placed in a line upon the western edge of a raised, decomposing bedrock outcrop to create a crude windbreak shelter (Figure 15). The cobbles and boulders used for the windbreak were taken from ground surface to the west of the outcrop, leaving a sheltered cleared area in that location that measures 4.3 meters by 2.4 meters. The six cobbles and boulders are placed in a line, 1.2 meters long, that stands one to two courses high, or 0.6 meters above the outcrop surface and 1.2 meters above ground surface to the west of the outcrop. The bedrock outcrop to the east of the feature is raised an additional 1.0 meter above the aligned cobbles. This bedrock outcrop would have played a primary role in blocking the prevailing trade winds. The rocks on the outcrop may have simply been those that were removed from ground surface to create the cleared area, as they would not be necessary in the lee of the outcrop to block the wind. The cleared area consists of cobble free soil that is defined by bedrock to the north and loose cobbles to the south and west.

Site 6218 is an extremely crude construction that is obviously intended to block the prevailing, often strong, winds in the area. It would have required very little time or effort to construct, and may have been used only once. No indicator of time of construction is present at Site 6218, and realistically it could have been constructed by anyone at any time. However, the site is located near a metal waterline that was laid in the 1940s, and one possibility is that the windbreak was a rest area constructed by the ranch hands working on that project.

Figure 15. SIHP Site 6218, view to east.

SIHP Site 6219

Site 6219 is a cairn located in the southern portion of the project area roughly 550 meters south of the existing wind farm (see Figure 10). The cairn is constructed of two boulders stacked one on top of the other on top of a third naturally occurring bedrock boulder (Figure 16). Small stones are present beneath the two stacked boulders to help keep them balanced a top one another. The cairn attains a maximum height of 1.4 meters above the surrounding ground surface and 0.9 meters above the bedrock boulder it is resting on. This cairn could have been erected at anytime for any purpose, but it likely would have required the effort of two people to build, as the stacked boulders are large and would have been difficult for a single person to lift into place. It is possible that the cairn marks the route of a former trail, although no such route was observed across the rocky terrain.

SIHP Site 6220

Site 6220 is a small cairn located in the southern portion of the project area roughly 600 meters south of the existing wind farm (see Figure 10). The cairn is constructed of three small cobbles stacked one on top of a large bedrock boulder (Figure 17). Each cobble measures roughly 10 centimeters in diameter, and altogether the cairn stands 27 centimeters above the surface of the boulder. This cairn could have been erected at anytime for any purpose, but it is likely that it was constructed during recent times, as the cobbles are rather precariously balanced and would fall over easily if disturbed. It is possible that the cairn marks the route of a former trail, although no such route was observed across the rocky terrain.

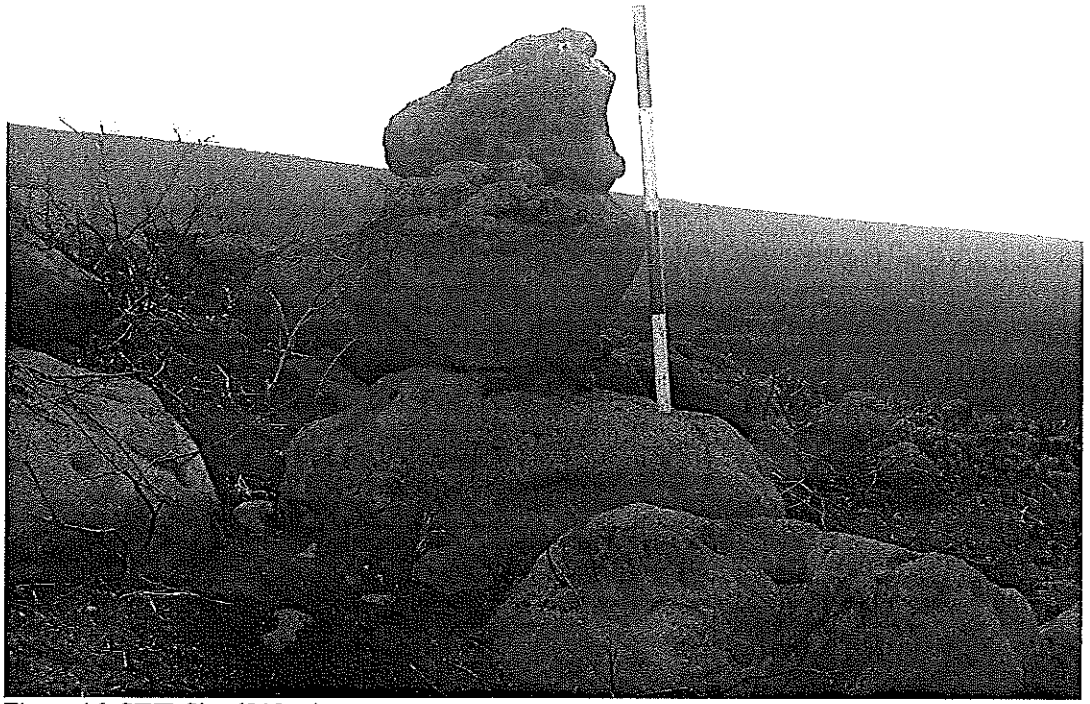


Figure 16. SIHP Site 6219, view to east.

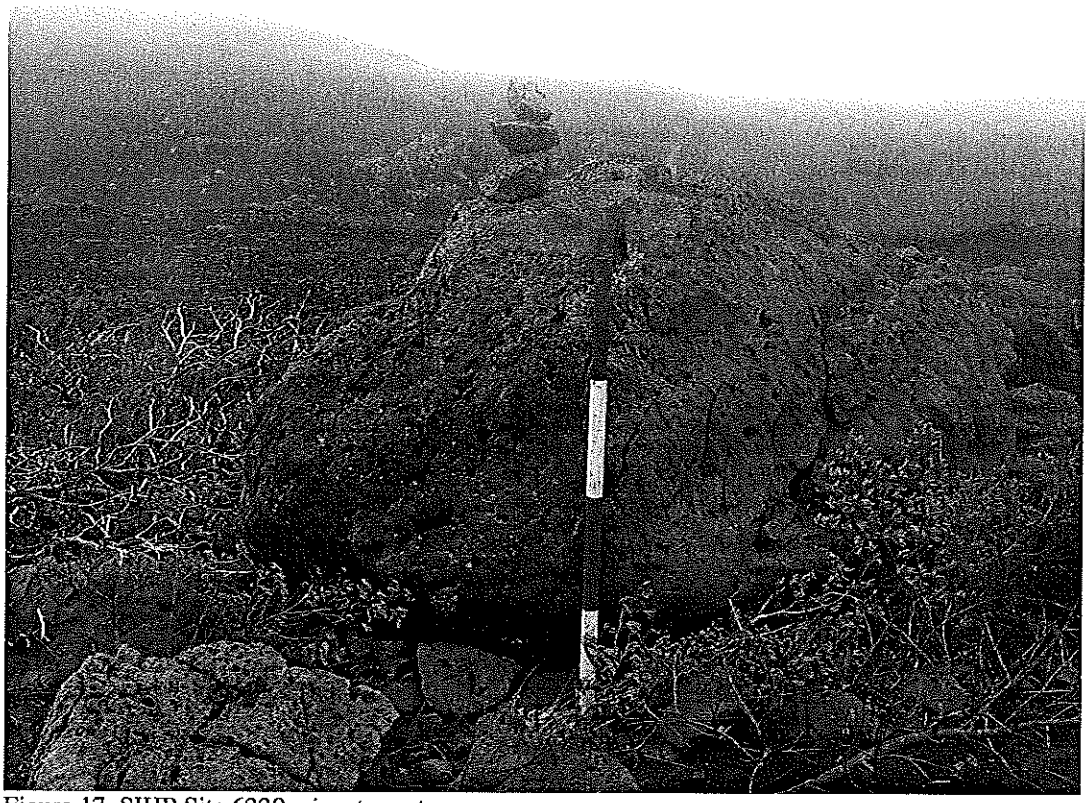


Figure 17. SIHP Site 6220, view to east.

SIHP Site 6221

Site 6221 is a cairn located in the southern portion of the project area roughly 1,000 meters west-southwest of the existing wind farm, and 50 meters south of the MECO transmission lines that cross the southern portion of the project area (see Figure 10). The cairn is constructed of approximately fifteen medium sized cobbles that are loosely stacked/piled on and against two small bedrock boulders (Figures 18 and 19). Site 6221 stands 0.9 meters above the surrounding ground surface and measures 1.0 meter in diameter. This cairn could have been erected at anytime for any purpose. It is possible that the cairn marks the route of a former trail, although no such route was observed across the rocky terrain.

Figure 18. SIHP Site 6221, view to southeast.

Figure 19. SIHP Site 6221, view to southwest.

SIHP Site 6222

Site 6222 consists of a concrete water trough (Feature A) and the remnants of two recently burned wooden structures (Feature B), possibly troughs, located in the southwestern portion of the current project area (see Figure 10). The features of this site are located within a level soil area at the base of a steep south-facing slope. They are roughly 120 meters apart, but are connected by an old metal waterline that passes beneath one of the former wooden structures of Feature B and feeds Feature A. An inscription in the concrete of Feature A reads "12/17/43", revealing that construction of the concrete portion of the water trough was completed on December 17, 1943.

The waterline that connects these two features begins far *mauka* of Site 6222, and four other concrete water troughs are present along the same waterline in the vicinity of the wind farm. The waterline runs south along the western edge of the existing wind farm from Site 5402, a previously recorded water trough near the northern end of the existing wind farm that was constructed on December 8, 1943 (see Clark and Rechtman 2005). Just beyond the southern edge of the wind farm, within the current project area, the line branches, with one branch running to Site 6222, and the other one crossing Manawainui Gulch to a trough that has not been previously studied on the eastern side of the gulch. The line changes directions at Site 6222 and then continues south to a fourth trough located slightly south of the Lahaina Pali Trail. Examination of this trough during the current study revealed that it was constructed on December 21, 1943. Unlike the other troughs, this trough also contained the inscription "HONOULA RANCH", suggesting that this water system (and by association Feature B of Site 6222) was part of that ranch, which was operating in Ukumehame in the 1940s. The waterline no longer carries water.

A water worn coral fragment and a bottle were found on ground surface between Features A and B of Site 6222. The clear glass soda bottle is machine-made and it reads "STAR ICE SODA WORKS, WAILIKU, MAUI". A second bottle, a machine-made, aqua glass, one-gallon jug, that read "MAUI SAKE BREWERY Co., LTD.", was discovered in the vicinity of Feature B (Figure 20). Both of these bottles were manufactured during the middle part of the 20th century, and are likely associated with the Historic ranch use of Site 6222. The locations of these bottles, along with the locations Features A and B of Site 6222 are depicted in Figure 21, and detailed descriptions of each of these features follow below.

Figure 20. Historic bottles discovered at SIHP Site 6222, overviews.

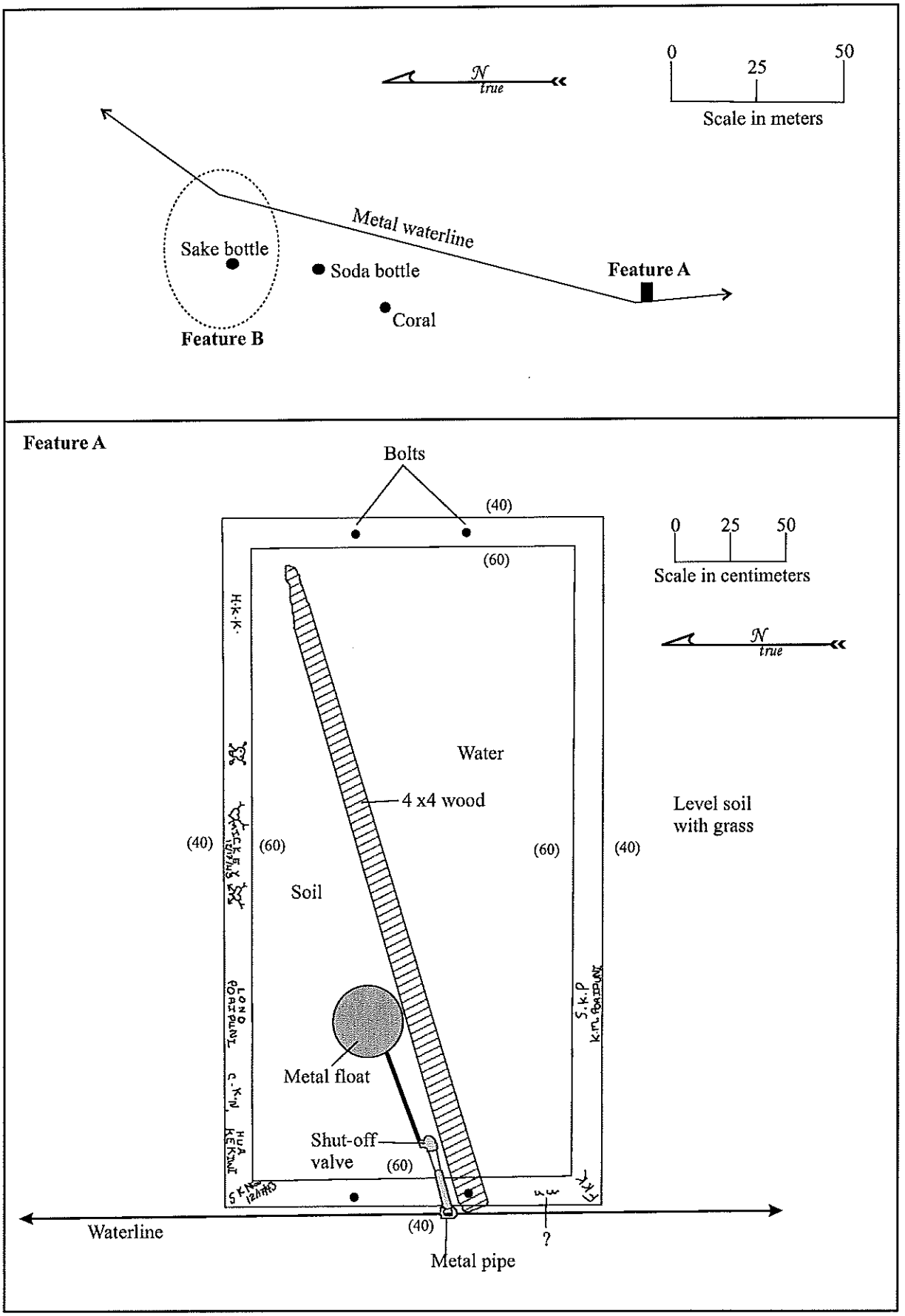


Figure 21. SIHP Site 6222 plan view and Feature A detail.

Feature A

Feature A is a concrete water trough located approximately 120 meters south/southwest of Feature B along the eastern edge of the old metal waterline (see Figure 21). The trough measures 3.05 meters long (east/west) by 1.73 meters wide (north/south) (Figure 22). It stands 0.4 meters above the surrounding ground surface on all sides, and has an interior depth of 0.6 meters. The concrete walls were poured in place using a wooden form. They measure 0.12 meters thick. Four metal anchor bolts are located in the top surface of the walls, two each at the eastern and western ends of the trough, centered and evenly spaced 0.5 meters apart. These bolts formerly anchored two wooden, 4" x 4", cross beams that would have laid flat over the trough. One of the cross beams is still attached by a bolt to the western end of the trough, but its eastern end has rotted away and fallen into the trough. The other cross beam is missing from the feature. A metal pipe runs from the old waterline, up the western exterior edge of the trough and over the lip. The pipe is attached to a shut-off valve, which is in turn attached to a metal ball float on a pivot arm. This mechanism formerly controlled the amount of water in the trough, only allowing new water to enter as the water level lowered and the lowered ball float released the shut-off valve. The mechanism no longer functions, as water is no longer carried through the old metal waterline. The interior of the trough currently contains some soil and a small amount of collected rainwater on the smooth concrete floor.

Several inscriptions are present in the concrete along the upper lip of Feature A. The inscriptions include several names and initials, presumably of the ranch hands that constructed the trough, along with the date "12/17/43" in two locations, a skull and cross bones, and two hearts with crossed arrows through them. The names and initials include "H.K.K", "MICKEY", "LONO POAIPUNI", "C.K.N.", "HUA KEKIWI", "SK Naioa" (?), "FKK", "S.K.P.", and "K. M. POAIPUNI" (Figure 23). Some of these names also show up on the other troughs present in the vicinity of the wind farm.

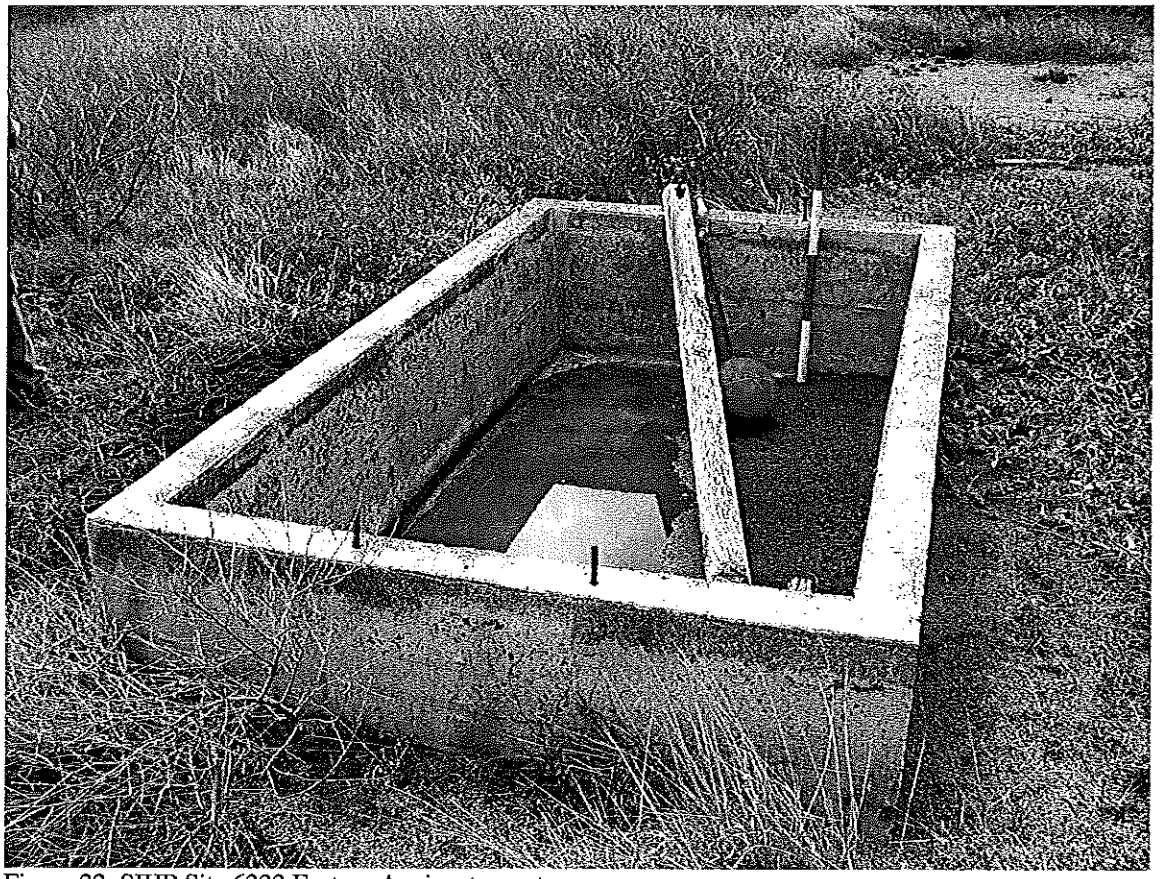


Figure 22. SIHP Site 6222 Feature A, view to west.

Figure 23. SIHP Site 6222, inscriptions in Feature A, various overviews.

Feature B

Feature B consists of the remains of two wooden structures (possibly troughs) located roughly 120 meters north/northeast of Feature A along the old metal waterline (see Figure 21). Both of the structures burned during the recent wild fire that occurred within the current project area. Currently all that remains of the wood structures are some charred fragments of milled lumber and the rusted metal hardware that held them together. The components of this feature are scattered over a roughly 30-meter by 30-meter area to the west of the old metal waterline. Based on the association of Features B with Feature A, it is likely that these wooden structures were used for ranching purposes as early as the 1940s.

The eastern most structure sits on top of the waterline (Figure 24). It is marked by a rectangular shaped discoloration on ground surface that measures 2.8 meters long (east/west) by 0.8 meters wide (north/south). This area has a reddish tint, while the surrounding ground surface is black with charcoal. The discolored area contains charred wood, six iron straps, six iron rods with treaded ends that are capped with iron nuts, and roughly fifty, large-sized, galvanized nails. It is evident from the remaining hardware that the structure was likely a wooden trough. At three separate locations, at the eastern and western ends of the trough and in the middle, two of the straps are held at each end by two different length rods. The straps would have supported the wooden side boards of the trough and the different length rods would have allowed for the top of the trough to be wider than the base. A metal T-fitting that has been capped off is present in the waterline four meters to the south of the trough, and it is possible that the fitting once contained a pipe that was formerly used to fill the trough with water.

The second wooden structure of Feature B is much less well defined than the first. It consists of several burned or partially burned 2" x 6" and 2" x 8" lengths of milled lumber, a couple iron straps, and a bent metal rod located twenty meters west of the eastern structure and spread over a ten by ten meter area. This structure could have been a trough similar to the first, but it is difficult to tell as many of the pieces are missing and most of the lumber has burned. It is likely that this structure was abandoned or dismantled prior to the recent fire, as it did not leave a discolored footprint like the other one did, and no nails were present.

Figure 24. SIHP Site 6222 Feature B, view to west of the easternmost burned structure.

SUMMARY AND CONCLUSIONS

As a result of the current inventory survey Site 5232, a *heiau* previously recorded by Athens (2002) was relocated, and five new sites including a windbreak shelter (Site 6218), three cairn (Sites 6219, 6220, and 6221), and a Historic ranching area containing the remains of a concrete trough and two recently burned wooden structures (possible troughs; Site 6222) were recorded within the project area. Identification of these resources was made easy by the recent occurrence of a wildfire that burned most of the vegetation within the project area. The *heiau* (Site 5232) was reexamined during this study, but no new work was conducted, and there are no new findings to report on with the exception of a possible functional interpretation that the *heiau* may have been intended for Precontact navigational use. This interpretation is derived from the orientation of the *heiau,* which has its corner pointing to the highest point on the Island of Kaho'olawe, an island that has traditional associations with navigation. Athens (2002) reported that the *heiau* was likely in use between A.D. 1670 and 1770. Excavations within the structure revealed the presence of charcoal and branch coral, further attesting to its ceremonial use for possible navigational purposes. This site has a previously approved and partially implemented preservation plan (Tomonari-Tuggle and Rasmussen 2005).

The windbreak shelter (Site 6218) and the cairn (Sites 6219, 6220, and 6221) are all crude constructions that could have been erected at anytime for any number of reasons. It seems clear that the windbreak shelter was designed to provide a cleared area out of the prevailing winds, but it was likely used only once, or on an occasional recurring basis. No indicators of time of construction are present at these sites, and the amount of effort employed in their construction is minimal. It is possible (although unlikely) that cairn mark a former trail route. No such trail route was observed, and the route between the carin would not be the best way to traverse the steep slopes within the project area. The only trail present in the vicinity of the project area is the Historic Lahaina Pali Trail (constructed around 1841), which passes south of the proposed wind farm development area.

The water troughs represented by Site 6222 are part of a water system developed by Honoula Ranch in Ukumehame in the 1940s. This system also included several other water troughs and metal waterlines that carried water between them. The system provided drinking water for cattle in the once extensive, but arid pastures of this upland area. Feature A of Site 6222 is a concrete water trough that was built on December 17, 1943. Feature B consists of two possible wooden troughs that burned during the recent wildfire. Cattle ranching continued within the project area until the 1990s.

SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The above-described archaeological resources are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai'i Administrative Rules 13§13-284-6. These significance evaluations should be considered as preliminary until DLNR-SHPD provides concurrence. For resources to be considered significant they must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

A Be associated with events that have made an important contribution to the broad patterns of our history;

B Be associated with the lives of persons important in our past;

C Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

D Have yielded, or is likely to yield, information important for research on prehistory or history;

E Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The significance and recommended treatments for the recorded sites are discussed below and are presented in Table 1.

Table 1. Site significance and treatment recommendations.

Site #	*Site Type*	*Significance*	*Recommended Treatment*
5232*	*Heiau*	D, E	Preservation
6218	Windbreak shelter	D	No further work
6219	Cairn	D	No further work
6220	Cairn	D	No further work
6221	Cairn	D	No further work
6222	Historic ranching	D	No further work

*Site 5232 has a previously accepted significance evaluation and treatment recommendation from Athens (2002).

Site 5232 is considered significant under Criterion D because of its important research potential, and under Criterion E because of its important traditional cultural value. This site was previously recommended for preservation (Athens 2002), and a preservation plan has already been prepared and partially implemented for it (Tomonari-Tuggle and Rasmussen 2005). As recommended in that plan, an archaeological monitor should be present during any future development activities that occur within 500 feet of the *heiau*.

The five remaining sites (Sites 6218 to 6222) are all considered significant under Criterion D for information they presented relative to past use of the project area. It is argued that research potential has been exhausted at these sites, and they are therefore recommended for no further work. The low-density development of the wind farm, however, should result in the preservation of these sites. Only Site 6221, a cairn, is located in an area that may be impacted by grubbing and grading for the preparation of one of the proposed tower locations. The other four sites are far enough removed from the proposed development that they should not be impacted.

REFERENCES CITED

Athens, J.

2002 *An Upland Heiau Site.* Ukumehame Ahupua'a, Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for GE Wind Energy, LLC, Tehachapi, California.

2004 Supplemental Archaeological Survey for Access Road, Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 4-8-01:1 & 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Bagot, F. (ed.)

1884 *McKenney's Hawaiian Directory.* L.M. McKenney & Co., California.

Bellwood, P.

1978 *The Polynesians: Prehistory of an Island People.* Thames and Hudson, Ltd., London.

Chinen, J.

1961 *Original Land Titles in Hawaii.* Privately published.

Clark, M., and R. Rechtman

2005 An Archaeological Inventory Survey of the Proposed Kaheawa Wind Farm Project Area (Portions of TMK:2-3-6-01:14 and 2-4-8-01:1), Ukamehame Ahupua'a, Lahaina abd Wailuku Districts, Island of Maui. Rechtman Consulting, LLC Report RC-0328. Prepared for Kaheawa Wind Power, LLC, Makawao, HI.

Devereux, T., I. Masterson, M. Heidel, V. Creed, L. Pyle, and H. Hammatt

1999 Archaeological Inventory Survey and Subsurface Testing of a 440 Acre Parcel. Ahupua'a of Ukamehame, District of Lahaina, Island of Maui (TMK 4-8-02:09). Cultural Surveys Hawaii. Prepared for Sugar Way Ltd.

Duvauchelle, E.

1858 Letter from E. Duvauchelle to William Webster. July 16. In the Interior Department Land Files of the Hawaii State Archives.

Enos, W. and J. Sylva

1865 Letters from Wm. Enos and Joseph Sylva to John O. Domini. May 16. In the Interior Department Land Files of the Hawaii State Archives.

Fleming, M.

1933 *Old Trails of Maui.* Wailuku, Maui. Prepared for the William and Mary Alexander Chapter, Daughters of the American Revolution.

Foote, D., E. Hill, S. Nakamura, and F. Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* United States Department of Agriculture, in conjunction with the University of Hawaii Agricultural Extension. U.S. Government Printing Office, Washington, D.C.

Fornander, A.

1969 *An Account of the Polynesian Race: Its Origin and Migrations.* Tokyo: Charles E. Tuttle Co., Inc.

Hammatt, H., I. Masterson, and T. Devereux
1996 Archaeological Inventory Survey of Access Roads Adjacent to the Maalaea-Lahaina Third 69KV Transmission Line Corridor. Cultural Surveys Hawaii. Prepared for Dames and Moore and Maui Electric Co.

Handy, E.S.C., E.G. Handy and M. Pukui
1991 *Native Planters in Old Hawaii: Their Life, Lore and Environment.* B.P. Bishop Museum Bulletin 223. Bishop Museum Press, Honolulu. (Revised edition)

Hommon, R.
1986 Social Evolution in Ancient Hawai'i. IN Kirch, P. (ed.), *Island Societies: Archaeological Approaches to Evolution and Trans-formation*: 55-88. Cambridge: University Press.

Hono-ko-hau Study Advisory Commission
1974 The Spirit of Ka-Loko Hono-Ko-Hau. National Park Service, U.S. Department of the Interior.

Kamakau, S.
1976 The Works of the People of Old, Na hana a ka Po'e Kahiko. *B.P. Bishop Museum Special Publication* 61. Bishop Museum Press, Honolulu.

1992 *Ruling Chiefs of Hawaii.* The Kamehameha Schools Press, Honolulu (revised ed.).

Kent, N.
1983 *Hawaii: Islands Under the Influence.* University of Hawai'i Press, Honolulu.

Kirch, P.
1984 *The Evolution of the Polynesian Chiefdoms.* Cambridge University Press, New York.

1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* University of Hawaii Press, Honolulu.

1990 Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii. *World Archaeology* 22(2).

Kuykendall, R., and A. Day
1976 *Hawaii: A History From Polynesian Kingdom to American Statehood.* Prentice-Hall, Inc., Englewood Cliffs.

Magnuson, C.
2003 Supplemental Archaeological Survey of Turbine Pad Alignments, Kaheawa Pastures, Upland Ukumehame Ahupua'a. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Oliver, D.
1961 *The Pacific Islands.* University of Hawaii Press, Honolulu.

Pogue, J.
1978 *Mooleo Hawaii.* Hale Paipalapala Aupuni, Honolulu (Revised Edition).

Rasmussen, C.
2005a Supplemental Archaeological Reconnaissance Survey of the Southern Portion of the New Low Impact Road for the Wind Turbine Project at Kaheawa Pastures, Upland Ukumehame Ahupua'a, Maui (TMK 3-6-01:14). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

2005b Supplemental Archaeological Reconnaissance Survey within the SMA Zone for the Wind Turbine Project at Ukumehame Ahupua'a, Maui (TMK 3-6-01:14). Draft. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

2005c Field Inspection Letter for the SMA Portion of the New ow Impact Road for the Wind Turbine Project at Kaheawa Pastures, Ukumehame Ahupua'a, Maui. Letter report. International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Robins, J., W. Folk, and H. Hammatt
1994 An Archaeological Inventory Survey of an Approximately 14.7 Mile Proposed Transmission Line, from Ma'alaea to Lahaina, Maui, Hawai'i, Cultural Surveys Hawaii, Kailua, Hawaii. Original 1991, Revised 1994.

Tomonari-Tuggle, M.
1995 A Cultural Resource Management Plan for the Lahaina Pali Trail. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW and Tri-Isles RC&D Council, Inc., Wailuku.

1998 An Archaeological Reconnaissance Survey for 27 Wind Turbines in the Ukumehame Uplands, Island of Maui. International Archaeological Research Institute, Inc., Honolulu. Prepared for Warren S. Bollmeier II, WSB Hawaii, Kaneohe.

Tomonari-Tuggle, M. and C. Rasmussen
2005 Preservation Plan for Site 50-50-09-5232, and Upland Heiau in Ukumehame Ahupua'a, Island of Maui (TMK 4-8-01:1). International Archaeological Research Institute, Inc., Honolulu. Prepared for Kaheawa Wind Power, LLC.

Tomonari-Tuggle, M., and H. Tuggle
1991 Archaeological Survey of Two Demonstration Trails of the Hawaii Statewide Trail and Access System: Lahaina Pali Trail, Island of Maui and Kaiolohia-Kahue Trail, Island of Lana'i. International Archaeological Research Institute, Inc., Honolulu. Prepared for Na Ala Hele Program, DOFAW.

Walker, W.
1931 Archaeology of Maui. Manuscript. Department of Anthropology, B.P. Bishop Museum, Honolulu.

APPENDIX C. KWP II VISUAL IMPACT ANALYSIS

METHODS USED FOR VIEWSHED ANALYSIS

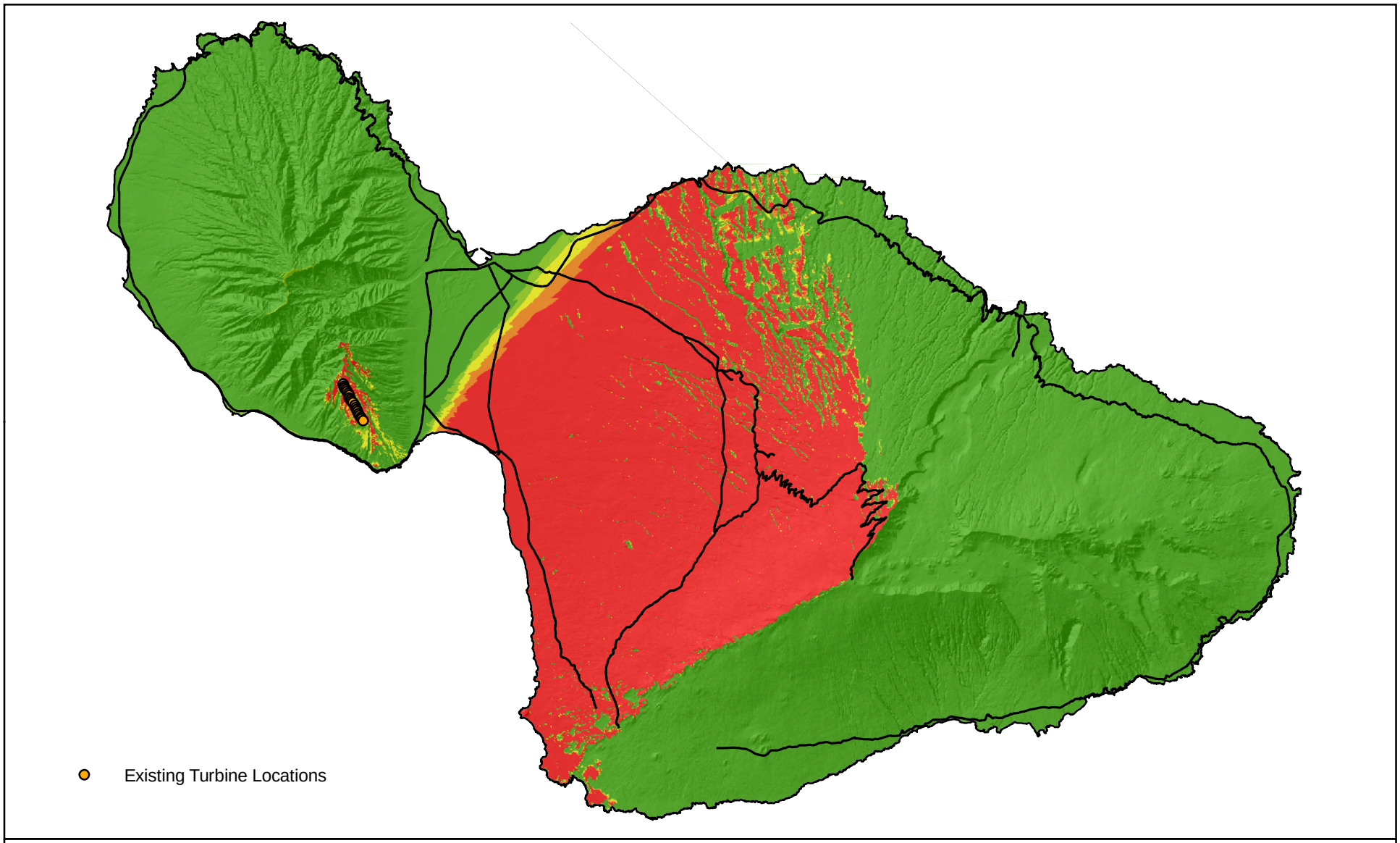
The graphics that are contained in this Appendix were prepared using the ESRI® ArcView® Spatial Analysis Extension software. PSI began by procuring publicly available elevation data for the island of Maui from the USGS national Elevation Dataset (http://seamless.usgs.gov/website/seamless/viewer.htm). These data consist of rasters with pixel sizes of 0.00028 degrees of latitude and longitude (~10,000 ft.2). U.S.G.S. notes that the estimated vertical accuracy of these elevation data varies between 7 meters to 15 meters depending upon the quality of the image and the roughness of the terrain.

In the next step PSI took the specified bitmap of elevations on the island of Maui and the locations and heights of the features to be considered (in this case the highest point of the turbine blade tips at 327 feet and the top of the tubular turbine support towers at 212 feet) and the height of the observer (~6 feet).

Having thus collected data about topography, object height (i.e. turbines and towers), and viewer height (in feet above sea level), color coded viewshed rasters were created for the various combinations of existing and proposed turbines (i.e. upwind, downwind, downstring and downroad sites, see Figure 2.2).

The calculated viewsheds for the proposed new WTGs were compared with those for the existing turbines to determine the change in viewshed that would be created from the new turbines.[1] This process produced ten viewshed maps, two for each of the existing turbines and proposed siting areas. These showed the visibility of the towers and the rotor tips for the existing KWP I turbines and for each of the four proposed sites. To present this information graphically, these rasters were then superimposed on a topographic hillshade map, using colors to distinguish areas of greater and lesser visibility. Colors indicate the range of visibility: areas in red indicate areas of total visibility, areas of orange and yellow less so, and areas shown in green are in locations where turbines would not be visible.

[1] Note: In doing this, and then preparing tabulations for each, two classes of possible viewer location were considered. One consisted of the area covered by all the downloaded elevation data (which included substantial areas over Mā‘alaea Bay and the ocean) and one that includes only the land area of the Island of Maui. Only the Maui Island maps are presented in this appendix.



Prepared For:

Kaheawa Wind Power II

Prepared By:

PLANNING SOLUTIONS

Sources:

-KWP II
-USGS Digital Elevation Model
-State of Hawai'i GIS

Number of Visible Turbines:

- 0
- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 20

0 3 6 12
Miles

Figure:

Existing Turbine Towers Viewshed Analysis

Kaheawa Wind Power II

Existing Towers 2008-06-02.mxd

APPENDIX D. KAHEAWA WIND POWER II POST-CONSTRUCTION REVEGETATION AND RESTORATION PLAN

KAHEAWA WIND POWER II

POST-CONSTRUCTION REVEGETATION AND RESTORATION PLAN

January 2009

Introduction and Summary

Kaheawa Wind Power II, LLC (KWP II) proposes to construct and operate a new 21-megawatt (MW) wind energy generation facility at Kaheawa Pastures above Mā‘alaea in the southwestern portion of the Island of Maui, Hawai‘i. The proposed project is situated on approximately 333 acres (135 ha) of Conservation District Land (State of Hawaii, DLNR) immediately adjacent to the existing 30-MW Kaheawa Wind Power (KWP) project operated and owned by Kaheawa Wind Power LLC (KWP LLC) (Kaheawa Wind Power II 2009).

Approximately 65 acres (26.1 ha) of land may be disturbed during construction of the KWP II facility. The disturbed area is former pasture that was converted from native plant communities well over 100 years ago, and is currently dominated by a mixture of native and non-native grasses and low shrubs with scattered small trees. The area is subject to periodic burning, which suppresses native plant elements and favors the spread of non-native fire-tolerant grasses. Native plants are limited to a few scattered individuals. A recent botanical inventory indicates that native plant species are spread throughout the project area, mixed among the grasses, but are less prevalent at the lower, drier parts of the property where fires have occurred more recently (Hobdy 2009).

This plan is intended to meet the dual objectives of stabilizing disturbed areas immediately following construction, and a longer-term effort to re-introduce and establish several native plant species throughout the site. Most elements of this plan are derived from experiences and lessons learned at the adjacent KWP project site, which underwent construction in early 2006, and which has a comparable plant ecological history.

Existing Conditions

The proposed KWP II project area is located in an area known locally as Kaheawa Pastures, on the southern slope of the mountains of West Maui between 1,440 and 2,880 ft elevation (439 and 878 m). The project area is approximately 4 miles (6.4 km) mauka (inland) of McGregor Point. It is located in the General subzone of the State Conservation District to the west of the existing KWP facility.

Average annual rainfall at the proposed project site ranges from less than 15 inches per year at the Honoapi‘ilani Highway/site access road intersection to slightly over 40 inches per year at the uppermost portion of the existing wind facility (3,200 ft). Most of the rainfall occurs during winter months (80+ percent from November through April).

Botanical surveys of the proposed KWP II area were conducted by Robert Hobdy in October 2006 and again in January 2009. The second survey was conducted to document re-growth following a wildfire in September 2006 that burned about 80 percent of the 333 acre (135 ha) project area (Hobdy 2006). Hobdy (2009) identified 86 plant species, twenty of which are endemic or indigenous to the Hawaiian Islands. He describes the vegetation as mostly low wind-blown grasses and shrubs with occasional patches of small trees. No state or federally threatened, endangered, or candidate species were found during the surveys.

Background of Revegetation Efforts at KWP

Because of the proximity and similarity of the landscape of the two facilities, the proposed KWP II facility will rely heavily on the lessons learned at KWP. The amended Conservation District Use Permit

(CDUP MA-3103) granted to KWP by the Board of Land and Natural Resources (BLNR) on 24 June 2005 contained the following conditions related to revegetation:

20. *"All cleared areas shall be revegetated in a manner consistent with other permit conditions, with specific consideration given to the fire contingency plan and the Habitat Conservation Plan. Any necessary revegetation shall be completed within thirty days of the completion of specific project components that resulted in ground clearing, using native species found in the area;"*

37. *"The applicant shall ensure that operations and maintenance staff do not damage native plants. If construction or operation required the removal of native plants, the plants will be removed, relocated and replanted. The applicant shall pay for the cost of this effort;"*

38. *"The applicant shall work with plant experts to introduce appropriate native plant species back into the Kaheawa Pastures;"*

Similar conditions were required in the NPDES General Permit for the KWP project area:

- *"Temporary soil stabilization with appropriate vegetation will be applied to areas remaining unfinished for more than 30 days; and*

- *Permanent soil stabilization will be applied as soon as practical after final grading. Contractor will coordinate with the Department of Land and Natural Resources (DLNR) regarding selection of appropriate vegetation as a condition of the Conservation District Use Permit."*

After extensive research and efforts at seeking source materials, KWP concluded that establishing vegetation within 30 days by seeding with native species (per Condition 20) would be infeasible due to the unavailability of native species in sufficient commercial quantities. For example, the Hawai'i Department of Transportation is working with the Federal Highway Administration on a three-year research project to develop native grass mixes and hydro-seeding techniques for use on civil projects in Hawai'i. However, techniques have not yet been developed in Hawai'i for hydro-seeding or broadcasting with native seed mixes on a large scale.

In the *Response to October 27, 2005 Letter Regarding the Establishment of Stabilizing Vegetation Cover for Erosion and Sediment Control Related to Wind Farm Access Road Construction*, The State of Hawai'i Department of Land and Natural Resources (DLNR) authorized KWP's request to apply commercially available annual rye (*Lolium multiflorum*) in order to comply with permit conditions of the CDUP and the NPDES permit, given the flowing conditions:

1. *"The permittee shall acquire commercial quantities of native pili grass bundles or other native species as soon as possible to substitute the annual rye; and*

2. *The permittee is responsible for controlling the annual rye if it starts invading adjacent State lands."*

KWP subsequently established a conservation partnership with the USDA/NRCS to obtain native Pili grass (*Heteropogon contortus*) from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Plant Materials Center on Moloka'i. This partnership resulted in field trials to test the ability to establish Pili grass at KWP using seed and bales. Following several treatments, it was determined that while it is possible to establish Pili in limited quantities, and over several months, it probably cannot be expected to meet rapid, site-wide ground cover re-establishment requirements.

Following the trials with Pili grass, KWP petitioned DLNR and the Office of Conservation of Coastal Lands (OCCL) to consider allowing manual application and hydro-seeding with a combination of Kikuyu grass (*Pennisetum clandestinum*), a non-invasive naturalized grass, and Annual rye to accomplish site revegetation goals. Benefits of the Kikuyu grass-Annual rye mixture include rapid soil cover, reduced soil erosion, improved soil organic matter levels, increased water infiltration, weed suppression, and improved conditions for recruitment of native species. DLNR Forestry and Wildlife officials provided

comments on this proposal, citing that Annual rye is expected to die off and provide a more suitable environment for recruitment by adjacent species and that both Kikuyu and Annual rye are desirable in a fire-prone setting. The wildlife section expressed interest in limiting the amount of emergent grass in the immediate vicinity of turbines, while providing recommendations to minimize the attraction of Nene, which are common in the area and browse on a wide range of vegetation types, including Kikuyu. This request is currently pending a decision by OCCL. KWP biologists have documented that Nene are prevalent in the area and currently use the areas in proximity to the turbines on a regular (i.e., almost daily) basis. Thus, revegetating bare areas with a Kikuyu/rye mixture is unlikely to pose an additional risk of bird collisions.

At the same time, KWP has had considerable success at re-introducing native plants grown in the nursery at various locations throughout the site, including along cut and fill slopes and other open earth portions of the roadsides and turbine pads. Although these plantings do not provide a uniform stabilizing cover *per se*, it does appear that they will, over several seasons, come to dominate the areas treated. Between July 2007 and June 2008, approximately 7,500 young a‘ali‘i (*Dodonaea viscosa*) were propagated from seed collected at Kaheawa and planted along cut and fill slopes and other open earth portions of the roadsides and turbine pads. An intensive out-planting effort comprising nearly 16,000 individual plants of several key native species is underway during the winter of 2009.

Project Goals & Timeline

Permits for KWP II have not yet been granted, so for the purposes of the draft EIS and HCP, the goals of the revegetation plan for KWP II are based on the relevant CDUP and NPDES permit conditions for KWP, as well as experiences and lessons learned at KWP.

The proposed revegetation strategy for KWP II has two goals:

1. Address the immediate requirement of stabilizing exposed soils following construction activities at KWP II, in accordance with erosion and sedimentation control Best Management Practices and National Pollutant Discharge Elimination System (NPDES) stormwater discharge permitting requirements; and

2. Set forth a plan for re-introducing native plant elements in selected areas throughout the site over several years, with the goal of re-establishing native plant elements in areas that have been overgrown with non-native species for a century or more.

To accomplish the short-term goal, KWP II proposes to apply a relatively fast-growing mixture of grasses that will enable the establishment of surface vegetation after ground shaping and grading activities have been completed. Areas to be revegetated following construction will be treated with a hydro-mulch and seeding mix of Annual rye and Kikuyu grass. The primary purpose of this approach is to stabilize exposed soil and prevent erosion along road cuts and fill slopes using a suitable cover that has a high likelihood of success. This phase is expected to last for up to several months following construction and will require supplemental irrigation and monitoring to ensure establishment of stabilizing cover.

To accomplish the long-term goal, KWP II proposes to re-introduce native plants in discrete locations over several years, with the intent of eventually re-establishing some of the key elements of the plant communities that historically existed on the site. As at KWP, this phase will involve propagating native plant specimens from seeds and cuttings collected in the area and subsequent out-planting.

Short-term revegetation will follow immediately after construction of the access roads and turbine foundations, while long-term revegetation will occur during the first several years of the project. The two approaches are discussed in more detail below.

Immediate Revegetation to Improve Soil Retention and Prevent Erosion

KWP II will apply a hydro-seed mixture of Annual rye and Kikuyu grass to areas of exposed soil along the edges of turbine pads and along road cuts and fill slopes to provide immediate stabilization. Kikuyu grass, a naturalized species that occurs at the Kaheawa Pastures, is believed to emerge quickly and becomes easily established as a ground cover, and can be procured in commercial quantities and form that are suitable for this type of application. Incorporating Annual rye grass into the seed mixture is expected to provide a more rapid cover, and allow the rye grass to be naturally over-taken by the Kikuyu and neighboring species. Annual rye is readily available for hydro-seeding and emerges more quickly than many other ground cover species.

Although not suitable for establishing the kind of rapid cover needed for immediate stabilization, Pili grass propagated in local nurseries has been successfully transplanted to cut and fill slopes at KWP and is considered one of the principle species that will be used to supplement immediate revegetation requirements at KWP II, while also providing a long-term benefit. The Kahoolawe Island Reserve Commission (KIRC) has been implementing a successful restoration program on the island of Kahoolawe using Pili grass to reduce soil erosion and promote the recovery of native botanical communities on substantial portions of the island. The NRCS Plant Materials Center on Molokai has been instrumental in providing support for the KIRC's efforts by supplying commercial quantities of Pili grass in bale form to be used for a variety of soil stabilization applications. KWP II is working collaboratively with KWP and the NRCS to coordinate and implement similar measures for use in both immediate and longer term revegetation strategies.

Mechanized hydro-seeding along a bare road cut during immediate site revegetation and soil stabilization efforts following construction at KWP.

Long-term Revegetation Using Native Species Common in the Area

KWP II plans to approach this phase of the site revegetation plan in a manner that emulates the successful native plant reintroduction efforts at KWP. This will include collection of native seed on-site

and propagation at local nurseries. Native species currently being collected at KWP and successfully propagated at local native plant nurseries on Maui include ‘akia (*Wikstroemia oahuensis*), ko‘oko‘olau (*Bidens mauiensis*), ‘a‘ali‘i (*Dodonaea viscosa*), ‘ulei (*Osteomeles anthyllidifolia*), ‘ōhi‘a (*Metrosideros polymorpha*), and ‘ilima (*Sida fallix*). These are relatively fast-growing and easily propagated low-stature species and provide excellent root structure for maintaining surface substrate retention and promoting important native elements of the vegetation community.

Because they will come later, many of these plantings will be installed in areas that were previously stabilized with the Kikuyu/rye mixture. In the case of the taller shrub species, the objective will be to have them eventually establish as a shrub layer that is taller than, and partially shading out, the shorter grass layer. Some areas will also be planted with Pili grass, either immediately following construction, or in later years, or other lower growing shrubs and vines. In such cases, it may be necessary to clear some areas of established grass cover, either manually or with the assistance of an approved herbicide. Any use of herbicides would be done only in consultation with DLNR, and only in accordance with applicable restrictions on handling and use.

KWP II will work in collaboration with KWP to share resources and coordinate logistics. KWP II plans to work closely with specialists that may advise and help select areas to be revegetated to ensure the best representation of target conditions for the long-term effort.

Due to the current prevalence of mostly non-native species at the site, revegetation efforts for KWP II are expected to enhance the biological integrity of the region beyond its present condition.

Several native plant species successfully nursery-propagated and out-planted on a turbine fill slope at KWP as part of long-term revegetation efforts.

Monitoring & Success Criteria

Regular irrigation and monitoring will be necessary at KWP II to ensure that immediate revegetation measures are successful. Young grasses are especially vulnerable to root damage in the absence of rain or watering. This phase of the project will be considered successful if it can be demonstrated that >75% of the bare areas, fill slopes, and road cut segments that receive treatment have established cover within one year following treatment. If initial applications appear to be only partially successful, subsequent hand and/or hydro-seeding applications will be performed to ensure adequate coverage.

The longer term revegetation efforts at KWP II are expected to be very successful given the success at KWP. A well-established seed collection and propagation program exists in cooperation with local nurseries, other native plant specialists, contract landscape specialists, and volunteers. Plants will be out-planted and maintained, monitored and documented using resources available at KWP II and in collaboration with community and conservation groups. This effort will be considered to be successful if a minimum of 60,000 plant specimens are installed during the first three years following construction, with an average survival rate of greater than 75% (i.e., a minimum of 45,000 surviving plants), for all plants one year after installation, as determined by representative sampling of planted areas. If mortality exceeds 25%, replacement plantings will be installed as needed to achieve the 75% minimum.

In addition, KWP II will work alongside DLNR Forestry and Wildlife specialists to ensure that revegetation initiatives consider and incorporate all wildlife, forestry, fire and rangeland concerns and are in alignment with the management provisions of the Conservation District.

Literature Cited

Hodby, R.W. 2006. Botanical Resources Survey. Kaheawa Pastures Wind Energy Project II, Ukumehame, Maui, Hawaii. Prepared for Kaheawa Windpower, LLC.

Hodby, R.W. 2009. Post-Fire Botanical Survey and Assessment. Kaheawa Wind Power II, Ukumehame, Maui, Hawaii. Prepared for Kaheawa Wind Power II LLC.

Kaheawa Wind Power II, LLC. 2009. Draft HCP for KWP II.