DOE/EA-1726

FINAL

ENVIRONMENTAL

ASSESSMENT

ENVIRONMENTAL ASSESSMENT FOR DEPARTMENT OF ENERGY LOAN GUARANTEE TO KAHUKU WIND POWER, LLC FOR CONSTRUCTION OF THE KAHUKU WIND POWER FACILITY IN KAHUKU, O'AHU, HAWAI'I

U.S. Department of Energy
Loan Guarantee Program Office
Washington, DC 20585

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SUMMARY

Introduction

The U.S. Department of Energy (DOE) is proposing to issue a $117 million loan guarantee to Kahuku Wind Power, LLC to support construction of the proposed 30 megawatt (MW) Kahuku Wind Power facility in Kahuku, O‘ahu, Hawai‘i.

DOE has prepared this Environmental Assessment (EA) to comply with the National Environmental Policy Act (NEPA) (42 USC 4321, et. seq.), Council on Environmental Quality regulations for implementing NEPA (40 CFR Parts 1500-1508), and DOE NEPA regulations (10 CFR Part 1021). The EA examines the potential environmental impacts associated with the proposed action and No Action Alternative and determines whether the proposed action has the potential for significant environmental impacts. The information contained in the EA will enable DOE to fully consider the potential environmental impacts of issuing a loan guarantee for the Kahuku Wind Power project.

Purpose and Need

The Energy Policy Act of 2005 (EPAct 2005) established a federal loan guarantee program for eligible energy projects in the U.S. that employ innovative energy technologies. Title XVII of the EPAct 2005 authorizes the Secretary of Energy to issue loan guarantees to eligible projects that “(1) avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases; and (2) employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued” (42 USC 16513). The two principal goals of the loan guarantee program are to encourage commercial use in the U.S. of new or significantly improved energy-related technologies and to achieve substantial environmental benefits. The purpose and need for agency action is to comply with DOE’s mandate under EPAct 2005 by selecting eligible projects that meet the goals of the Act. DOE is using the NEPA process to assist in determining whether to issue a loan guarantee to Kahuku Wind Power LLC to support the proposed project.

The proposed Kahuku Wind Power facility would integrate installation of two new or significantly improved technologies compared to commercial technologies currently available in the U.S., the Xtreme Battery Energy Storage System (BESS) and the Clipper Liberty™ wind turbine generators (WTGs). It would also generate electricity from a renewable resource that would otherwise be generated from fossil based fuel, thereby reducing greenhouse gas emissions and other pollutants that are harmful to the environment and human health. The 30 MW of power potentially generated by the proposed facility would be able to eliminate the use of approximately 154,550 barrels of oil annually that would otherwise be used to produce conventional power in Hawai‘i. Eliminating the consumption of this amount of oil would in turn reduce emissions of the following air pollutants:

- carbon dioxide (CO_2): 159 million lbs (72.4 million kg) annually and 3.2 billion lbs (1.4 billion kg) over the life of the project;
- sulfur dioxide (SO_2): 330 thousand lbs (149.8 thousand kg) annually and 6.6 million lbs (2.7 million kg) over the life of the project;
- nitrogen oxides (NO_X): 237 thousand lbs (107 thousand kg) annually and 4.7 million lbs (2.1 million kg) the life of the project; and
- mercury (Hg): 1.5 lbs (0.7 kg) annually and 30 lbs (13.6 kg) over the life of the project.

The proposed Kahuku Wind Power facility would contribute to the avoidance and reduction of air pollutants and anthropogenic emissions of greenhouse gases, as required by EPAct 2005.

Proposed Action and Alternatives

DOE's proposed action is to issue a $117 million loan guarantee to Kahuku Wind Power LLC to support construction of the Kahuku Wind Power facility. The proposed facility would consist of 12 Clipper Liberty™ 2.5-MW WTGs, an operations and maintenance (O&M) building, one permanent unguyed meteorological (met) tower, seven microwave dishes, one on-site and up to two off-site microwave towers, an electrical substation, a BESS, and a network of unpaved service roadways. The proposed project area is approximately 578 ac (234 ha) in the Kahuku area on the northeastern portion of the Island of O'ahu, within the State of Hawai'i.

In addition to the proposed action of issuing the loan guarantee to Kahuku Wind Power LLC for the proposed facility, a No Action Alternative was also evaluated in the EA. Under the No Action Alternative, DOE would not issue the loan guarantee to Kahuku Wind Power LLC for the project. Without the DOE loan, it is unlikely that Kahuku Wind Power LLC would implement the project as currently planned. Thus, the No Action Alternative is that no wind power facility would be constructed at the project area.

The decision for DOE consideration presented in this EA is whether or not to approve the loan guarantee for the proposed Kahuku Wind Power facility. Prior to submitting its application, Kahuku Wind Power LLC considered alternative sites, including two on O'ahu with reasonable potential for wind development, Ka'ena Point to the west of Kahuku and Kahe Ridge to the south. Kahuku Wind Power LLC determined that the proposed site was the most viable location for the proposed project based on the existing needs for renewable energy in Hawai'i, evaluation of wind resources on O'ahu, and a thorough consideration of alternative sites in the area.

Summary of Resource Areas Examined

The EA evaluates the environmental effects that could result from implementing the proposed action and No Action Alternative. Table S.1 provides a summary of the potential environmental consequences that could result from implementing the proposed action and from the No Action Alternative.

Table S.1 Summary of Impacts by Resource

Resource Area	No Action Alternative	Proposed Action
Climate	There would be no change in existing conditions and no impacts to climate.	Construction Period: Construction of the facility would result in slight emissions of CO_2; however, these would be temporary and of relatively low level. Operational Period: The proposed WTGs do not have the potential to affect temperature, rainfall, humidity, or most other meteorological parameters. Operation of the facility would result in slight emissions of CO_2; however, these would be of relatively low level, and the proposed project would more than offset these emissions by decreasing fossil fuel consumption and emission of greenhouse gases.

Resource Area	No Action Alternative	Proposed Action
Topography	There would be no change in existing conditions and no impacts to topography.	Construction Period: Grading would cause minor alterations of local topography, but would not alter major topographic features. Operational Period: Minor grading would occur on the project area to prevent ponding, but would not alter major topographic features.
Geology, Soils, and Geologic Hazards	There would be no change in existing conditions and no impacts to soils and geology.	Construction Period: Grading for new roads, WTG pads, and other project components would disturb approximately 67 acres of soils and cause alteration of shallow consolidated bedrock near the surface in some areas. No significant geologic resources are known or expected to occur in the project area, so no geologic impacts are expected. Best Management Practices (BMPs) would be employed to prevent and minimize soil erosion during construction. Operational Period: BMPs (including revegetation) would be employed to prevent and minimize soil erosion during operation.
Water Resources	There would be no change in existing conditions and no impacts to water resources.	Construction Period: Potential impacts to water resources have been avoided by proper siting of the individual WTGs, associated facilities, and roadways. The project would result in only slight increases in impervious surfaces (~26 acres); therefore, it would not significantly increase the volume of stormwater runoff leaving the project area. No components of the project would adversely affect the quantity or quality of water available in basal groundwater. BMPs and general construction management techniques would be implemented to minimize any potential impacts to receiving waters in the area. Operational Period: Same as above.
Air Quality	There would be no change in existing conditions and no impacts to air quality.	Construction Period: Construction of the proposed project would result in emission of low levels of air pollutants during earthmoving operations from vehicles traveling project roadways and vehicles traveling to and from the project area. Because these would be temporary and of relatively low level, impacts to air quality are expected to be minimal. Operational Period: Once operational, the proposed project would result in minor emissions of air pollutants due to staff and vendor vehicle trips, periodic use of cranes, and operation of the electrical substation and BESS equipment. These emissions would be very low and would not result in adverse long-term impacts to air quality. The project would indirectly benefit air quality by reducing air pollutants produced during fossil fuel consumption that would otherwise be used to produce conventional power.

Resource Area	No Action Alternative	Proposed Action
Noise	There would be no change in existing conditions and no impacts to noise.	Construction Period: Construction of the proposed project would produce short-term noise within the project area as a result of the operation of graders, excavators, trucks, and other heavy equipment. No noise-sensitive uses are located nearby. Reasonable and standard practices would be used to mitigate construction noise; however, if noise is expected to exceed the state's maximum permissible property line noise levels, a permit would be obtained from the State Department of Health (DOH). Operational Period: Sound from the proposed project is not expected to result in a significant impact on the surrounding community. The agricultural areas closest to the proposed Kahuku Wind Power facility (such as Ki'i Road Farms) would experience the greatest increase in ambient sound, up to 3 dB, but this change in sound is not a perceptible difference to most listeners and the total sound level would still be well below the DOH limit.
Scenic Resources	There would be no change in existing conditions and no impacts to scenic resources.	Construction Period: During construction, visible components of the project would include construction equipment, transport and assembly of facility parts, and temporary dust and smoke from construction vehicles. The contractor would be required to minimize fugitive dust in accordance with applicable law, and the other visible activities during construction would be minor and temporary in nature. Operational Period: The WTGs would introduce a new vertical element into the landscape. However, the proposed project is expected to complement the rural atmosphere and agricultural character of the area. From many of the vantage points, WTGs and associated facilities would be screened by vegetation, houses, or other physical features in the landscape.
Public Health and Safety	There would be no change in existing conditions and no impacts to public health and safety.	Construction Period: Construction would involve the use, transportation, or storage of small amounts of several hazardous materials that require special handling and storage. These would be identified, along with measures for containment and spill prevention, in a Spill Prevention, Countermeasure, and Control (SPCC) Plan. The risk of harm would be minimized by requiring the contractor to follow BMPs. The batteries that would be delivered are considered non-hazardous. Operational Period: Operation of the facility would require on-site use and storage of several materials that require special handling including common lubricants, petroleum products, or other chemical products cleaning products. The SPCC Plan and Kahuku Wind Power Site Safety Plan, including BMPs, would minimize the risk of harm. The potential for the project to result in impacts from intentionally destructive acts is negligible.

Resource Area	No Action Alternative	Proposed Action
Land Use	There would be no change in existing conditions and no impacts to land use.	Construction Period: The project would not limit access to other land served by the existing access road or interfere with other existing or potential uses of land in the vicinity. The proposed facility is compatible and consistent with federal, state, and county land use policies, plans, and regulations. Operational Period: Same as above.
Flora	There would be no change in existing conditions and no impacts to flora.	Construction Period: No state or federally listed threatened, endangered, or candidate plant species occur in the areas to be directly affected by construction. Vegetation in areas that would be disturbed consists of non-native species common throughout O‘ahu and the main Hawaiian Islands. Operational Period: Mechanical methods would be used to clear vegetation in some areas during operation. Only non-native species are expected to establish in these areas; therefore, there would be no significant adverse impact on botanical resources.
Wildlife	There would be no change in existing conditions and no impacts to wildlife.	Construction Period: The impact on non-listed wildlife species would be minor. Incidental take may occur as a result of listed species colliding with the WTGs, equipment, vehicles, and other proposed facilities. The seven federally listed species that could be impacted include: Hawaiian stilt, Hawaiian coot, Hawaiian duck, Hawaiian moorhen, Newell’s shearwater, Hawaiian petrel, and Hawaiian hoary bat. The only state listed species that could be impacted is the Hawaiian short-eared owl or pueo. The proposed project includes measures to avoid, minimize, and mitigate take of these species as outlined in the Habitat Conservation Plan (HCP). Operational Period: Impacts during operation are roughly the same as above, except that the WTGs would have greater potential to affect listed species once they begin operating than they would during the construction period (when the rotors are not turning). The proposed project includes measures to avoid, minimize, and mitigate take of these species during operation as outlined in the HCP.
Socioeconomic Characters	There would be no change in existing conditions and no impacts to Socioeconomic conditions.	Construction Period: Construction of the proposed facility would employ an average of 15 to 20 people per day. No adverse impacts are anticipated. Operational Period: The project is not expected to result in new residents moving to the area due to increased energy availability and would therefore not be considered growth inducing. Operation would result in employing a regular staff of four to five people and generating ongoing expenditures for materials and outside service. No disproportionate adverse health or environmental impacts would occur to any low-income or minority population.

Resource Area	No Action Alternative	Proposed Action
Historic, Cultural, and Archaeological Resources	There would be no change in existing conditions and no impacts to cultural resources.	Construction Period: No adverse impacts to Site 4707 are expected as a result of construction. The project would preserve the coral bluff areas and any associated cultural or historical resources located on and near the project area. If any archaeological deposits or human burials are encountered, the contractor would halt work and contact the State Historic Preservation Division. Operational Period: Given that the coral bluff areas are preserved, the project would have no potential to negatively impact archaeological or historic sites or cultural resources in the project area. The project would not preclude or limit access to the area by cultural practitioners beyond existing conditions.
Utilities and Public Services	There would be no change in existing conditions and no impacts to utilities and public services.	Construction Period: The project has little potential to adversely affect utilities and public services during construction. It would generate a maximum of 40 one-way vehicle trips daily, 80 oversized equipment delivery trips, and 100 one-way cement truck trips. Minor traffic delays could result during transport of large parts and components to the project area, but the increase would not be sufficient to have a measurable effect on the level of service. Operational Period: The proposed project would place no additional burden on public services. It would consume only small amounts of electrical power, while generating potentially 30 MW of power. All of the water needed for the facility would be obtained by an existing well located on an adjacent site, and an on-site septic tank system would be constructed to handle wastewater. Operation would generate 10 one-way vehicle trips per day.
Cumulative Impacts	There would be no cumulative impacts.	The cumulative contribution of impacts that the proposed action would make on the various environmental resources is expected to be minor.

TABLE OF CONTENTS

SUMMARY i
CHAPTER 1: PURPOSE AND NEED 1
1.1 Purpose and Need for Action 1
1.2 Background 2
1.3 Scope of This Environmental Assessment 2
CHAPTER 2: PROPOSED ACTION AND ALTERNATIVES 5
2.1 Proposed Action 5
2.1.1 Wind Turbine Generator (WTG) Sites 7
2.1.2 Meteorological Monitoring Tower 8
2.1.3 Base Yard 9
2.1.4 Operations and Maintenance (O&M) Building 10
2.1.5 Microwave Dishes and Towers 10
2.1.6 Electrical System Components 13
2.1.6.1 Electrical Collection System 13
2.1.6.2 Electrical Substation 13
2.1.6.3 Battery Energy Storage System (BESS) 14
2.1.7 Road Network 15
2.1.8 Project Schedule and Timeline 16
2.1.9 Permits and Authorizations 16
2.2 No Action Alternative 16
2.3 Alternatives Considered But Eliminated 17
2.3.1 Alternate Project Locations 17
2.3.2 Alternative Site Layouts 17
CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS 19
CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS 19
3.1 Introduction 19
3.2 Climate 19
3.2.1 Current Climatic Conditions 19
3.2.1.1 Potential Impacts of the Proposed Action 19
3.2.1.2 Potential Impacts of the No Action Alternative 19
3.2.2 Global Climate Change 19
3.2.2.1 Potential Impacts of the Proposed Action 20
3.2.2.2 Potential Impacts of the No Action Alternative 21
3.3 Topography 21
3.3.1 Potential Impacts of the Proposed Action 21
3.3.2 Potential Impacts of the No Action Alternative 21
3.4 Geology, Soils, and Geologic Hazards 21
3.4.1 Potential Impacts of the Proposed Action 23

3.4.2 Potential Impacts of the No Action Alternative 26
3.5 Water Resources 27
3.5.1 Regulatory Framework 27
3.5.2 Surface Water 27
3.5.2.1 Potential Impacts of the Proposed Action 28
3.5.2.2 Potential Impacts of the No Action Alternative 30
3.5.3 Flooding 30
3.5.3.1 Potential Impacts of the Proposed Action 31
3.5.3.2 Potential Impacts of the No Action Alternative 31
3.5.4 Groundwater 31
3.5.4.1 Potential Impacts of the Proposed Action 32
3.5.4.2 Potential Impacts of the No Action Alternative 32
3.6 Air Quality 33
3.6.1 Regulatory Framework 33
3.6.2 Regional and Local Air Quality 33
3.6.2.1 Potential Impacts of the Proposed Action 33
3.6.2.2 Potential Impacts of the No Action Alternative 36
3.7 Noise 36
3.7.1 Regulatory Framework 36
3.7.2 Ambient Sound Levels 38
3.7.2.1 Potential Impacts of the Proposed Action 42
3.7.2.2 Potential Impacts of the No Action Alternative 49
3.8 Scenic Resources 49
3.8.1 Potential Impacts of the Proposed Action 50
3.8.2 Potential Impacts of the No Action Alternative 63
3.9 Public and Occupational Health and Safety 63
3.9.1 Regulatory Framework 63
3.9.2 Existing Safety Hazards 63
3.9.2.1 Potential Impacts of the Proposed Action 64
3.9.2.2 Potential Impacts of the No Action Alternative 66
3.10 Land Use 66
3.10.1 Existing, Past, and Future Land Uses 66
3.10.1.1 Applicable Land Use Policies, Plans, and Regulations 68
3.10.1.2 Potential Impacts of the Proposed Action 70
3.10.1.3 Potential Impacts of the No Action Alternative 70
3.11 Flora 71
3.11.1 Regulatory Framework 71
3.11.2 Previous Surveys and Description of Flora 71
3.11.2.1 Potential Impacts of the Proposed Action 74
3.11.2.1 Potential Impacts of the No Action Alternative 75
3.12 Wildlife 75

3.12.1 Regulatory Framework 75
3.12.2 Previous Wildlife Surveys 78
3.12.3 Non- Listed Species 80
3.12.3.1 Potential Impacts of the Proposed Action 88
3.12.3.2 Potential Impacts of the No Action Alternative 89
3.12.4 Listed Species 89
Newell's Shearwater 90
Hawaiian Petrel 91
Hawaiian Duck 91
Hawaiian Stilt 92
Hawaiian Coot 93
Hawaiian Moorhen 93
Hawaiian Short-eared Owl 94
Hawaiian Hoary Bat 95
3.12.4.1 Potential Impacts of the Proposed Action 95
Newell's Shearwater 100
Hawaiian Petrel 103
Hawaiian Duck Hybrids 105
Pure Hawaiian Ducks 106
Hawaiian Stilt 107
Hawaiian Coot 108
Hawaiian Moorhen 109
Hawaiian Short-eared Owl 110
Hawaiian Hoary Bat 112
3.12.4.2 Potential Impacts of the No Action Alternative 113
3.13 Socioeconomic 113
3.13.1 Social and Economic Environment 113
3.13.1.1 Potential Impacts of the Proposed Action 114
3.13.1.2 Potential Impacts of the No Action Alternative 115
3.13.2 Environmental Justice 115
3.13.2.1 Potential Impacts of the Proposed Action 116
3.13.2.2 Potential Impacts of the No Action Alternative 117
3.14 Historic, Archaeological, and Cultural Resources 117
3.14.1 Regulatory Framework 117
3.14.2 Pre-Contact and Historical Context 117
3.14.3 Previous Archaeological Research and Historic Sites 118
3.14.3.1 Potential Impacts of the Proposed Action 121
3.14.3.2 Potential Impacts of the No Action Alternative 122
3.15 Utilities and Public Services 122
3.15.1 Energy 122
3.15.1.1 Potential Impacts of the Proposed Action 124
3.15.1.2 Potential Impacts of the No Action Alternative 124
3.15.2 Police Services 124

3.15.2.1 Potential Impacts of the Proposed Action 124
3.15.2.2 Potential Impacts of the No Action Alternative 125
3.15.3 Fire Protection 125
3.15.3.1 Potential Impacts of the Proposed Action 125
3.15.3.2 Potential Impacts of the No Action Alternative 125
3.15.4 Hospitals 125
3.15.4.1 Potential Impacts of the Proposed Action 125
3.15.4.2 Potential Impacts of the No Action Alternative 125
3.15.5 Airports 125
3.15.5.1 Potential Impacts of the Proposed Action 125
3.15.5.2 Potential Impacts of the No Action Alternative 126
3.15.6 Water Supply 126
3.15.6.1 Potential Impacts of the Proposed Action 126
3.15.6.2 Potential Impacts of the No Action Alternative 126
3.15.7 Wastewater 126
3.15.7.1 Potential Impacts of the Proposed Action 127
3.15.7.2 Potential Impacts of the No Action Alternative 127
3.15.8 Solid Waste 127
3.15.8.1 Potential Impacts of the Proposed Action 127
3.15.8.2 Potential Impacts of the No Action Alternative 127
3.15.9 Parks and Recreation 127
3.15.9.1 Potential Impacts of the Proposed Action 127
3.15.9.2 Potential Impacts of the No Action Alternative 128
3.15.10 Roadways 128
3.15.10.1 Potential Impacts of the Proposed Action 128
3.15.10.2 Potential Impacts of the No Action Alternative 129
3.16 Cumulative Impacts 129
3.16.1 Climate and Global Climate Change 130
3.16.2 Noise 131
3.16.3 Scenic Resources 131
3.16.4 Wildlife 131
3.16.4.1 Non- Listed Species 131
3.16.4.2 Listed Species 131
CHAPTER 4: LIST OF PREPARERS 135
CHAPTER 5: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONTACTED 136
CHAPTER 6: LITERATURE CITED 137

LIST OF TABLES

Table 2-1. Area disturbed and developed by the proposed Kahuku Wind Power facility. 15

Table 3-1. Soil types and characteristics within the Kahuku Wind Power project area based on classifications from Foote et al. (1972). 25

Table 3-2. Potential pollutants from construction activities and Best Management Practices. 26

Table 3-3. Construction emissions for criteria pollutants (tons per year). 34

Table 3-4. Operation emissions for criteria pollutants (tons per year). 36

Table 3-5. Maximum permissible sound levels in dBA. 37

Table 3-6. Ambient sound measurement results. 40

Table 3-7. Predicted Wind Turbine Sound Levels at Selected Sites. 45

Table 3-8. Predicted Wind Turbine and Existing Ambient Sound Levels in the Vicinity of Kahuku Wind Power. 49

Table 3-9. Components of the Xtreme Powercell. 65

Table 3-10. Native Hawaiian plants observed in the project area. 72

Table 3-11. Birds detected on and adjacent to Kahuku Wind Power project area during point count and radar surveys. 81

Table 3-12. Migratory waterfowl observed on the nearby James Campbell NWR. 84

Table 3-13. Migratory shorebirds observed on the nearby James Campbell NWR. 85

Table 3-14. Federally or state listed species with potential to be impacted by the Kahuku Wind Power project. 90

Table 3-15. Summary of estimated and requested authorized take of covered species at the Kahuku Wind Power facility. 97

Table 3-16. Proposed mitigation for the covered species: Lower, Baseline and Higher Take Scenarios... 98

Table 3-17. Population figures for selected areas. 114

Table 3-18. Existing and potential (P) wind energy facilities throughout the State. 123

Table 3-19. Take authorizations for the covered species on O‘ahu through Safe Harbor Agreements. ... 132

LIST OF FIGURES

Figure 1-1. Vicinity map. 4

Figure 2-1. Kahuku Wind Power layout. 6

Figure 2-2. Clipper Liberty™ WTG key components. 7

Figure 2-3. Unguyed met tower, approximately 262.5 ft (80 m) tall, similar to the one proposed for the Kahuku Wind Power facility. 9

Figure 2-4. Kahuku Wind Power base yard. 11

Figure 2-5. Locations of off-site microwave towers. 12
Figure 2-6. Bi-polar plates (left) and finished PowerCell (right). 15
Figure 3-1. Soil types within the Kahuku Wind Power project area. 24
Figure 3-2. Jurisdictional waters at the Kahuku Wind Power project area. 29
Figure 3-3. Typical dBA values of common indoor and outdoor noise sources from DLAA, Ltd. (2009). 38
Figure 3-4. Ambient sound measurement locations. 41
Figure 3-5. Typical Sound Levels from Construction Equipment. 44
Figure 3-6. Predicted sound level contours and area contours for the surrounding communities. 47
Figure 3-7. Predicted sound level contours and area contours for the project area. 48
Figure 3-8. Number of turbines within the line-of-sight. 52
Figure 3-9. Photo rendering of Kahana Bay and BYU. 53
Figure 3-10. Photo renderings of Mālaekahana State Recreation Park Entrance and Kahuku Village. 54
Figure 3-11. Photo renderings of Kahuku Golf Course and Pu‘uluana Street Senior Housing Area. 55
Figure 3-12. Photo renderings of Kahuku Superette and Kahuku High School Football Field. 56
Figure 3-13. Photo renderings of Kahuku Hospital and Kamehameha Highway near Romy’s Shrimp Truck. 57
Figure 3-14. Photo renderings of Kamehameha Highway Northwest of Romy’s Shrimp Truck and Kamehameha Highway outside of the Army Training Area entrance gate. 58
Figure 3-15. Photo renderings of Kamehameha Highway east of the Turtle Bay Resort entrance and Army Training Area. 59
Figure 3-16. Photo renderings of Turtle Bay Resort and Kawela Bay. 60
Figure 3-17. Photo rendering of Sunset Beach. 61
Figure 3-18. State of Hawai‘i Land Use District Boundaries. 69
Figure 3-19. Avian point count stations and Anabat™ locations. 79
Figure 3-20. Breakdown of the racial composition of the Kahuku CDP. 116
Figure 3-21. Area of potential effects (APE) consisting of 230 acres. 120

LIST OF APPENDICES

Appendix A. Comparison of Kahuku Wind Power project design with the USFWS Interim Voluntary Guidelines for Wind Projects

Appendix B. First Wind Kahuku Wind Farm Jurisdictional Wetland Determination Study

Appendix C. Environmental Noise Assessment

Appendix D. Applicable Land Use Policies, Plans, and Regulations

Appendix E. Biological Resources Surveys

Appendix F. Plant Species List at Flying R Ranch

Appendix G. Kahuku Wind Power Wildlife Monitoring Report and Fatality Estimates for Waterbirds and Bats (October 2007 - April 2008)

Appendix H. Results of Endangered Seabird and Hawaiian Hoary Bat Surveys on Northern O‘ahu Island, Hawai‘i (October 2007 and July 2008)

Appendix I. Wildlife Education and Observation Program

Appendix J. Wildlife Casualty Monitoring Protocol

Appendix K. Expanded Discussion of Impacts to Listed Wildlife

Appendix L. Historical, Cultural, and Archaeological Resources Survey

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
AG	Attorney General
ALISH	Agricultural Lands of Importance to the State of Hawaii
APE	area of potential effects
BA	biological assessment
BCR	Bird Conservation Region
BESS	Battery Energy Storage System
BLNR	Board of Land and Natural Resources
BMPs	Best Management Practices
BO	biological opinion
CAA	Clean Air Act
CADNA	Computer Aided Noise Abatement
CDP	Census Designated Place
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CUP-M	Conditional Use Permit-Minor
CWA	Clean Water Act
CZM	Coastal Zone Management
DBEDT	Department of Business, Economic Development, and Tourism
DLNR	Department of Land and Natural Resources
DOE	U.S. Department of Energy
DOFAW	Department of Forestry and Wildlife
DOH	Department of Health
DOR	Department of Transportation
DPP	Department of Planning and Permitting
EA	Environmental Assessment

EF	emission factors
EHSD	Environmental Health Service Division
EIS	environmental impact statement
EPA	Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
EPO	Environmental Planning Office
ESA	Endangered Species Act
ESRC	Endangered Species Recovery Committee
FAA	Federal Aviation Administration
FCB	firing circuit board
FIRM	Flood Insurance Rate Maps
FONSI	Finding of No Significant Impact
HAR	Hawaii Administrative Rule
HC	hydrocarbons
HCP	Habitat Conservation Plan
HECO	Hawaiian Electric Company
Hg	mercury
HIOSH	Hawaii Occupational Safety and Health
HRS	Hawai‘i Revised Statutes
IGBT	Insulated-Gate Bi-polar Transistor
IPCC	Intergovernmental Panel on Climate Change
IRS	Interconnection Requirement Study
ITL	Incidental Take License
kV	kilovolt
KWP	Kaheawa Wind Power
MARAMA	Mid-Atlantic Regional Air Management Association
MBTA	Migratory Bird Treaty Act
mg/l Cl^-	milligrams per liter chloride
MOU	Memorandum of Understanding
MW	megawatt
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_X	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	operations and maintenance
O_3	ozone
OHA	Office of Hawaiian Affairs
OSHA	Occupational Safety and Health Administration
OWP	Oahu Wind Partners LLC
Phase I ESA	Phase I Environmental Site Assessment
PLC	programmable logic controller
PM_{10}	particulate matter smaller than 10 microns
$PM_{2.5}$	particulate matter smaller than 2.5 microns
PPA	Power Purchasing Agreement

RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendment Reauthorization Act
SCADA	Supervisory Command and Data Acquisition
SHA	Safe Harbor Agreement
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Officer
SMA	Special Management Areas
SO_2	sulfur dioxide
SO_X	sulfur oxides
SPCC	Spill Prevention, Countermeasure, and Control
TMK	Tax Map Key
TSCA	Toxic Substances Control Act
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WTG	wind turbine generator

CHAPTER 1: PURPOSE AND NEED

1.1 Purpose and Need for Action

The proposed action evaluated by the U.S. Department of Energy (DOE) in this environmental assessment (EA) is the issuance of a $117 million loan guarantee to Kahuku Wind Power LLC to support construction of the proposed 30 megawatt (MW) Kahuku Wind Power facility in Kahuku, O‘ahu, Hawai‘i. The proposed facility would consist of 12 Clipper Liberty™ 2.5-MW wind turbine generators (WTGs), an operations and maintenance (O&M) building, one permanent unguyed meteorological (met) tower, one on-site and up to two off-site microwave towers, an electrical substation, a Battery Energy Storage System (BESS), and a network of unpaved service roadways. A full description of the proposed project is provided in Section 2.2.

The Energy Policy Act of 2005 (EPAct 2005) established a federal loan guarantee program for eligible energy projects in the U.S. that employ innovative energy technologies. Title XVII of the EPAct 2005 authorizes the Secretary of Energy to issue loan guarantees to eligible projects that “(1) avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases; and (2) employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued” (42 USC 16513). The two principal goals of the loan guarantee program are to encourage commercial use in the U.S. of new or significantly improved energy-related technologies and to achieve substantial environmental benefits. The purpose and need for agency action is to comply with DOE’s mandate under EPAct 2005 by selecting eligible projects that meet the goals of the Act. DOE is using the National Environmental Policy Act (NEPA) process to assist in determining whether to issue a loan guarantee to Kahuku Wind Power LLC to support the proposed project.

Kahuku Wind Power LLC is proposing to integrate installation of Xtreme Power’s (“Xtreme”) BESS and the Clipper Liberty™ WTGs, two new or significantly improved technologies compared to commercial technologies currently available in the U.S. These technologies will reduce the variability of the power output from wind generation and provide power quality support to the local utility on a low-voltage transmission-distribution line. Successful integration of the new and improved technologies proposed at the Kahuku Wind Power facility has the potential to serve as a model for other renewable energy opportunities in Hawai‘i and elsewhere in the U.S, particularly in regions with isolated power grids with minimal electric utility infrastructure.

Xtreme’s BESS technology has never been used before in a MW-scale utility application. The BESS for the proposed project is designed as the first technology of its kind that will enable safe operation on a 46-kilovolt (kV) electric distribution line which directly serves consumer loads. The BESS buffers highly variable wind power and achieves grid stability by managing the change in output of WTGs and the change in total output of the facility. The Xtreme BESS absorbs or generates power to limit change of wind output to less than 1 MW per minute. Compared to all currently available energy storage and power management solutions, the BESS enables more efficient use of existing large-scale power generation and distribution resources, improving overall grid operations.

The Clipper Liberty™ WTG provides a significant improvement over existing WTG technology as it combines the advantages of a multiple gear box, permanent magnet, and synchronous generator in a design not available from other wind turbine manufacturers. The Clipper Liberty™ turbines are capable of extracting more energy than smaller turbines, while at the same time using a lighter weight drive train. This allows for a lighter weight crane for lifting the turbine and results in a lower cost of energy production.

The proposed Kahuku Wind Power facility would reduce the need for fossil based fuel, thereby significantly reducing greenhouse gas emissions and other pollutants that are harmful to the environment and human health. The 30 MW of power potentially generated by the proposed facility would be able to eliminate the use of approximately 154,550 barrels of oil annually that would otherwise be used to produce conventional power. Eliminating the consumption of this amount of oil would in turn reduce emissions of the following air pollutants:

- carbon dioxide (CO_2): 159 million lbs (72.4 million kg) annually and 3.2 billion lbs (1.4 billion kg) over the life of the project;
- sulfur dioxide (SO_2): 330 thousand lbs (149.8 thousand kg) annually and 6.6 million lbs (2.7 million kg) over the life of the project;
- nitrogen oxides (NO_X): 237 thousand lbs (107 thousand kg) annually and 4.7 million lbs (2.1 million kg) the life of the project; and
- mercury (Hg): 1.5 lbs (0.7 kg) annually and 30 lbs (13.6 kg) over the life of the project.

Additionally, the BESS should reduce the need for on-line reserve capacity (spinning reserves) on the electricity grid, which would allow existing fossil fuel plants to run more efficiently, further reducing fossil fuel use and the resulting emissions. Therefore, the proposed Kahuku Wind Power facility would contribute to the avoidance and reduction of air pollutants and anthropogenic emissions of greenhouse gases, as required by EPAct 2005.

1.2 Background

EPAct 2005 established a federal loan guarantee program for eligible energy projects that employ innovative technologies. The two principal goals of the program are to encourage commercial use in the United States of new or significantly improved energy related technologies and to achieve substantial environmental benefits. DOE believes that commercial use of these technologies would help sustain and promote economic growth, produce a more stable and secure energy supply and economy for the United States, and improve the environment. DOE published a Final Rule that establishes the policies, procedures, and requirements for the loan guarantee program (10 Code of Federal Regulations [CFR] Part 609). In June 2008, DOE issued a solicitation announcement inviting interested parties to submit proposals for projects that employ energy efficiency, renewable energy, and advanced transmission and distribution technologies that constitute New or Significantly Improved Technologies (as defined in 10 CFR Part 609). Kahuku Wind Power LLC submitted an application to DOE for a loan guarantee in February 2009.

On November 13, 2009, DOE made a formal determination that an EA was the appropriate level of environmental review for the proposed action and sent a notification letter to the Hawaii Office of Environmental Quality Control. The letter described the proposed action and stated that a draft EA would be sent to the state for review. On February 26, 2010, DOE sent the draft EA to the Hawaii Office of Environmental Quality Control. The draft EA was also posted on the Loan Guarantee Program Office website and a notice of availability was published in the Honolulu *Advertiser* and the Honolulu *Star Bulletin*.

1.3 Scope of This Environmental Assessment

This Environmental Assessment (EA) presents information on the potential impacts associated with guaranteeing a loan to Kahuku Wind Power LLC and covers the construction and operation of the Kahuku Wind Power facility. DOE has prepared this EA to comply with the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality (CEQ) regulations implementing NEPA

(40 CFR Parts 1500−1508), and DOE NEPA Implementing Procedures (10 CFR 1021). If no significant impacts are identified during preparation of this EA, DOE would issue a Finding of No Significant Impact (FONSI). If potentially significant impacts are identified, DOE would prepare an environmental impact statement (EIS).

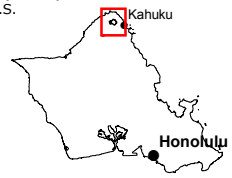
This EA: (1) describes the affected environment relevant to the impacts of the proposed action and No Action Alternative; (2) describes the proposed action; (3) analyzes environmental impacts associated with the proposed action and No Action Alternative; and (4) identifies and characterizes cumulative impacts that could result from the proposed action in relation to other ongoing or proposed activities within the surrounding area.[1]

[1] Throughout this document, Hawaiian words and place names are spelled according to Pukui et al. (1974) and Pukui and Elbert (1971).

Legend

Project Parcels

Key Map
N.T.S.



Source: USGS - Kahuku Quad

Vicinity Map

N

2,000 1,000 0 2,000
Feet

1,000 500 0 1,000
Meters

Figure 1-1

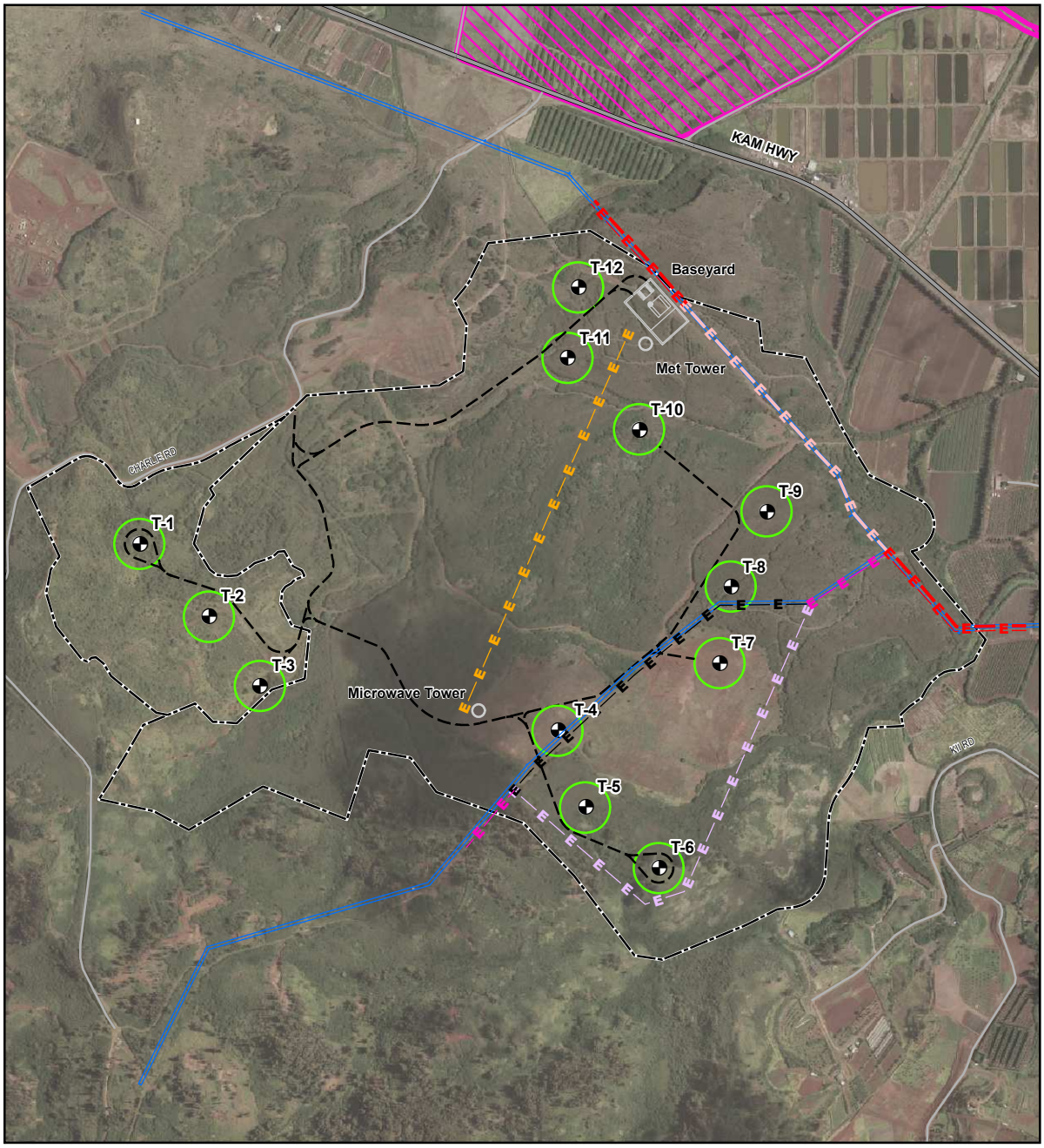
CHAPTER 2: PROPOSED ACTION AND ALTERNATIVES

This chapter provides information on the proposed Kahuku Wind Power facility and discusses the proposed action and No Action Alternative. Alternatives considered, but not analyzed are also briefly mentioned.

2.1 Proposed Action

DOE's proposed action is to issue a $117 million loan guarantee to Kahuku Wind Power LLC to support construction of the proposed 30 MW Kahuku Wind Power facility in Kahuku, O‘ahu, Hawai‘i. Kahuku Wind Power LLC is a subsidiary of First Wind, a Boston-based wind energy generation firm, and was created for the express purpose of developing a new wind generation facility in Kahuku, O‘ahu.

The proposed facility would consist of 12 Clipper Liberty™ 2.5-MW WTGs, an O&M building, one permanent unguyed met tower, seven microwave dishes, one on-site and up to two off-site microwave towers, an electrical substation, a BESS, and a network of unpaved service roadways. The proposed location for the Kahuku Wind Power facility is on approximately 578 ac (234 ha) in the community of Kahuku in the Ko‘olauloa District on the northeastern portion of O‘ahu. First Wind secured rights to the project area from Continental Pacific, LLC, a large agricultural developer. Approximately 70 ac (28 ha) of the project area is leased from Continental Pacific, LLC and the remainder was purchased by Kahuku Wind Power LLC in May 2007. The project area includes two parcels (Tax Map Key (TMK) 5-6-005:007 and 5-6-5:014) located roughly 0.2 mi (0.3 km) mauka (inland) of Kamehameha Highway, 1.25 mi (2 km) northwest of Kahuku Town, and 1.2 mi (2 km) southeast of the entrance to Turtle Bay Resort (Figure 1-1). The project area is accessible via Charlie Road off Kamehameha Highway. It is bounded on the east by pasture and agricultural lands along the Kamehameha Highway and on the west and south by agricultural land owned by the State of Hawai‘i. The north and northwestern portions abut a ti (*Cordyline fruticosa*) plantation and a training facility for the Union of Operating Engineers. The southwest portion of the project area is bordered by federal land including the U.S. Army Kahuku Training Range. The James Campbell National Wildlife Refuge (NWR) lies nearby to the east (makai or seaward) of Kamehameha Highway. The two off-site microwave tower sites are located in the Waialua District on the northern portion of O‘ahu (see Section 2.1.5).



Legend

- Turbines
- Project Parcel
- 200' Radius Turbine Setback
- Towers
- Baseyard
- Proposed Roads
- HECO Easement
- James Campbell NWR

OVHD Lines

- 46kV & 11kV - Existing
- 46kV - Existing
- 11kV - Existing
- 11kV - Existing to be Relocated
- 23kV - Proposed

Data Sources: State of Hawaii GIS; City and County of Honolulu; USGS
Aerial Source: State of Hawaii GIS;
Site Plan Source: M&E Pacific Inc.

Kahuku Wind Power Layout

Figure 2-1

N

800 400 0 800
Feet

400 200 0 400
Meters

The proposed facility would consist of the following components:

2.1.1 Wind Turbine Generator (WTG) Sites

The facility would include 12 Liberty™ 2.5-MW WTGs manufactured by Clipper Windpower. The WTGs would be arranged in four arrays of three WTGs each (Figure 2-1). Figure 2-2 shows the Clipper Liberty™ turbine and its key components. Each of the 12 turbine sites would consist of a turbine pad, a pad-mounted transformer, a power distribution panel, a turbine tower, a turbine rotor, a nacelle, and a gravel access drive and appropriate buffer area. Each turbine site would encompass roughly 1.78 ac (0.72 ha) in size. An additional 1.30 ac (0.53 ha) surrounding each turbine site would be temporarily disturbed during construction and revegetated following completion of the turbine components.

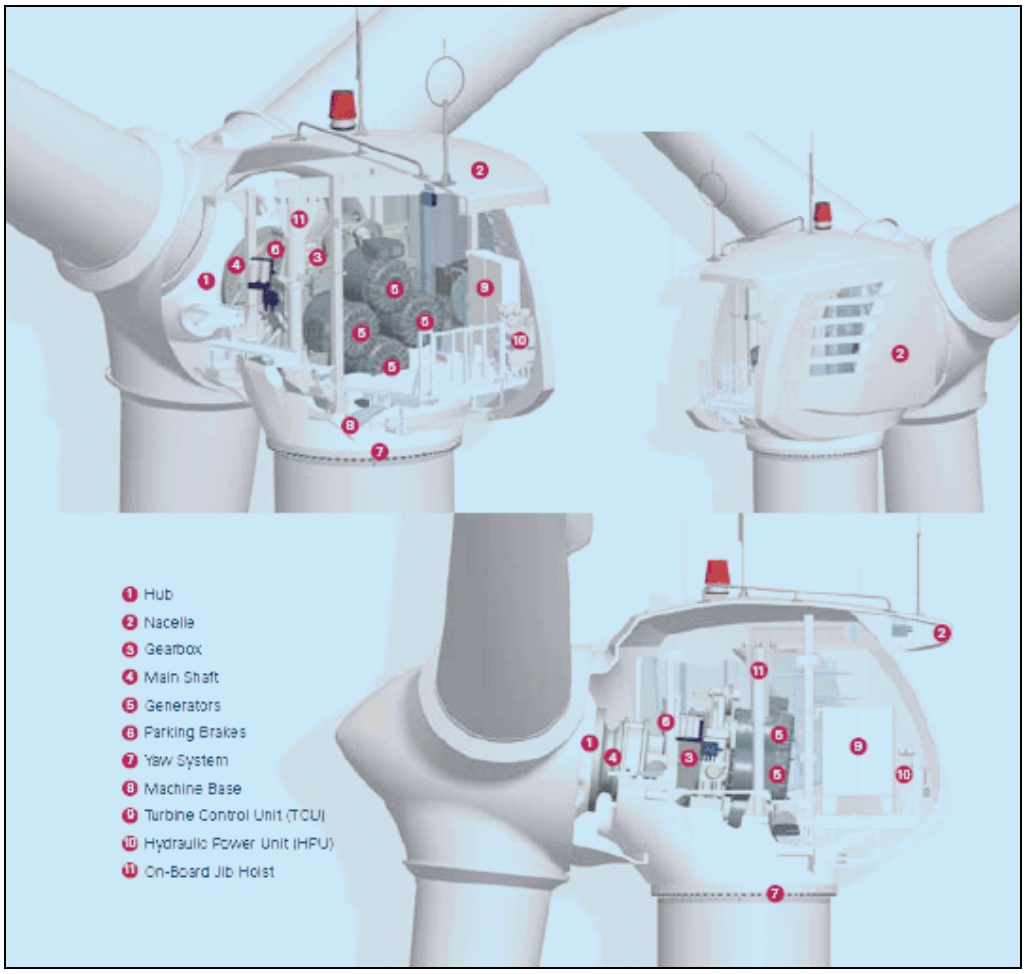


Figure 2-2. Clipper Liberty™ WTG key components.

- Rotor: The rotor of the WTG has three blades and a diameter of 314 ft (96 m). The speed of the rotor varies from 9.6 to 15.5 revolutions per minute depending on the wind speed.

- Nacelle: The nacelle is a housing that contains a gearbox, main shaft, four generators, and brake. Access to the nacelle is provided via a 6 by 12 ft (1.8 by 3.6 m) door.

- Tower: The conical- tubular steel turbine towers proposed for the project are approximately 262 ft (80 m) in height. Thus, the maximum height of the turbines from tower base to highest blade tip would be 420 ft (127 m). The base of the turbine tower would be 14 ft (4.4 m) in diameter. A buffer of at least 450 ft (137 m) would be provided between any turbine tower and the property boundary.

- Pad-mounted Transformers: The pad-mounted transformers would each have a base of 4 ft by 6 ft (1.2 by 1.8 m) and a height of approximately 6 ft.

- Power Distribution Panel: The power distribution panels would have a base of approximately 1 ft by 3 ft (0.3 by 0.9 m).

- Gravel and Buffer Area: A 315-ft (96-m) diameter buffer area would be provided around each turbine foundation. A buffer zone of 30 ft (9 m) of graveled surface would extend out from the tower in all directions, and a 30-ft wide graveled drive would lead from the access road through the buffer zone to the tower itself. No other construction or secondary land usage would be allowed inside the 315 ft buffer zone.

2.1.2 Meteorological Monitoring Tower

Meteorological (met) monitoring towers are tall tubular or lattice towers that contain sensors to measure wind speed and direction at a site (Figure 2-3). These towers can be secured to the ground with tensioned cable referred to as guy wires (guyed met tower) or free standing without the use of guy wires (unguyed met tower).

Figure 2-3. Unguyed met tower, approximately 262.5 ft (80 m) tall, similar to the one proposed for the Kahuku Wind Power facility.

Three temporary met towers were installed on the property in October 2007 in order to collect wind resource data. Two met towers were dismantled in early December 2008 and currently only one temporary met tower remains in the project area. Prior to construction, three temporary met towers would be present on site for a period of up to four months for power-curve testing[2] and dismantled prior to the erection of the WTGs. All temporary met towers would be guyed and approximately 262 ft (80 m) tall. One permanent unguyed met tower would be erected during construction and remain for the duration of the project. This permanent met tower would be approximately 262 ft tall, with a concrete foundation approximately 625 ft^2 (58 m^2) in area.

2.1.3 Base Yard

The base yard would be a 460 by 290 ft (140 x 88 m) fenced area located in the northern portion of the project area. The base yard would contain three structures – the O&M building, BESS enclosure, and the electrical substation (Figure 2-4). Concrete foundations would be required for the three structures, as

[2] Power curve testing is a process by which the future performance of individual turbines is predicted by correlating the overall wind measurements at the site over a year or more to temporary met towers erected at specific turbine sites for a shorter time period, usually on the order of 2-4 months.

described in Sections 2.1.4 and 2.1.6. Any area within the fence not covered by concrete would be covered with gravel to minimize erosion and surface runoff. During construction of the base yard, an additional 2.1 ac (0.85 ha) outside of the base yard would be disturbed but revegetated once construction is complete.

2.1.4 Operations and Maintenance (O&M) Building

The proposed project would also include construction of a single-story, 7,000 ft^2 (650 m^2) O&M building to house operation personnel, wind generating facility controls, maintenance equipment, and spare parts. This building would have a maximum height of 29.25 ft (8.8 m) and would be located in the base yard area. A dirt and gravel parking area for the O&M building would be provided for at least 14 vehicles (Figure 2-4).

2.1.5 Microwave Dishes and Towers

Once complete, the facility would be incorporated into the Hawaiian Electric Company's (HECO) power grid, and Kahuku Wind Power LLC would be required to provide secure high-speed communications between Kahuku Wind Power and HECO's system on O'ahu. The microwave communication system would involve the placement of seven microwave dishes at several locations (both on and off-site) between the project area and the two HECO electrical substations located at Wahiawa and Waialua. Seven locations would be utilized for the placement of microwave dishes. The placement of one microwave dish would be either at an existing tower or on a new tower. If placed on a new tower, as evaluated in this EA, two microwave dishes would require the construction of new towers off-site, two would be within the project area (one of which would require the construction of a new tower), and three would be co-located on existing communications towers. In total, the proposed project would involve building up to three new microwave towers. All microwave towers would be lattice type, either three-leg or four-leg with concrete footings. Dish antennas, approximately 6 ft (1.8 m) in diameter, would be mounted horizontally on the towers.

One of the three towers would be built on-site for transmitting data from the facility to HECO substations. This tower would be approximately 30 ft (9.1 m) tall and built on a concrete foundation approximately 144 ft^2 (13.5 m^2) in area.

Two other towers would be erected off-site. The proposed location for the off-site "Waialua Substation" microwave tower is the HECO Waialua Substation at 66-011 Waialua Beach Road in a rural residential area in Hale'iwa. This site is roughly 11.1 mi (17.8 km) from the Kahuku project area. This tower would be approximately 60 ft (18 m) in height and built on a concrete foundation approximately 169 ft^2 (16 m^2) in area.

The second new microwave tower (if the dish is not co-located on an existing tower) would be located on agricultural land at "Flying R Ranch" in Waialua. This site is owned by Waialua Ranch Partners. The Flying R Ranch site is located 13.6 mi (21.9 km) southwest of the Kahuku project area and 2.6 mi (4.2 km) southwest of the Waialua microwave tower site. The height of the Flying R Ranch tower would be approximately 40 ft (12 m). Similar to the Waialua microwave tower, this tower would be built on a 169 ft^2 concrete foundation. Approximately 1,000 linear ft (305 m) of overhead cable, supported on wooden poles approximately 50 ft (15 m) high, would be required to transmit electricity from the nearest existing HECO electrical distribution line to the proposed Flying R Ranch microwave tower.

The locations of the proposed off-site microwave towers are shown in Figure 2-5.

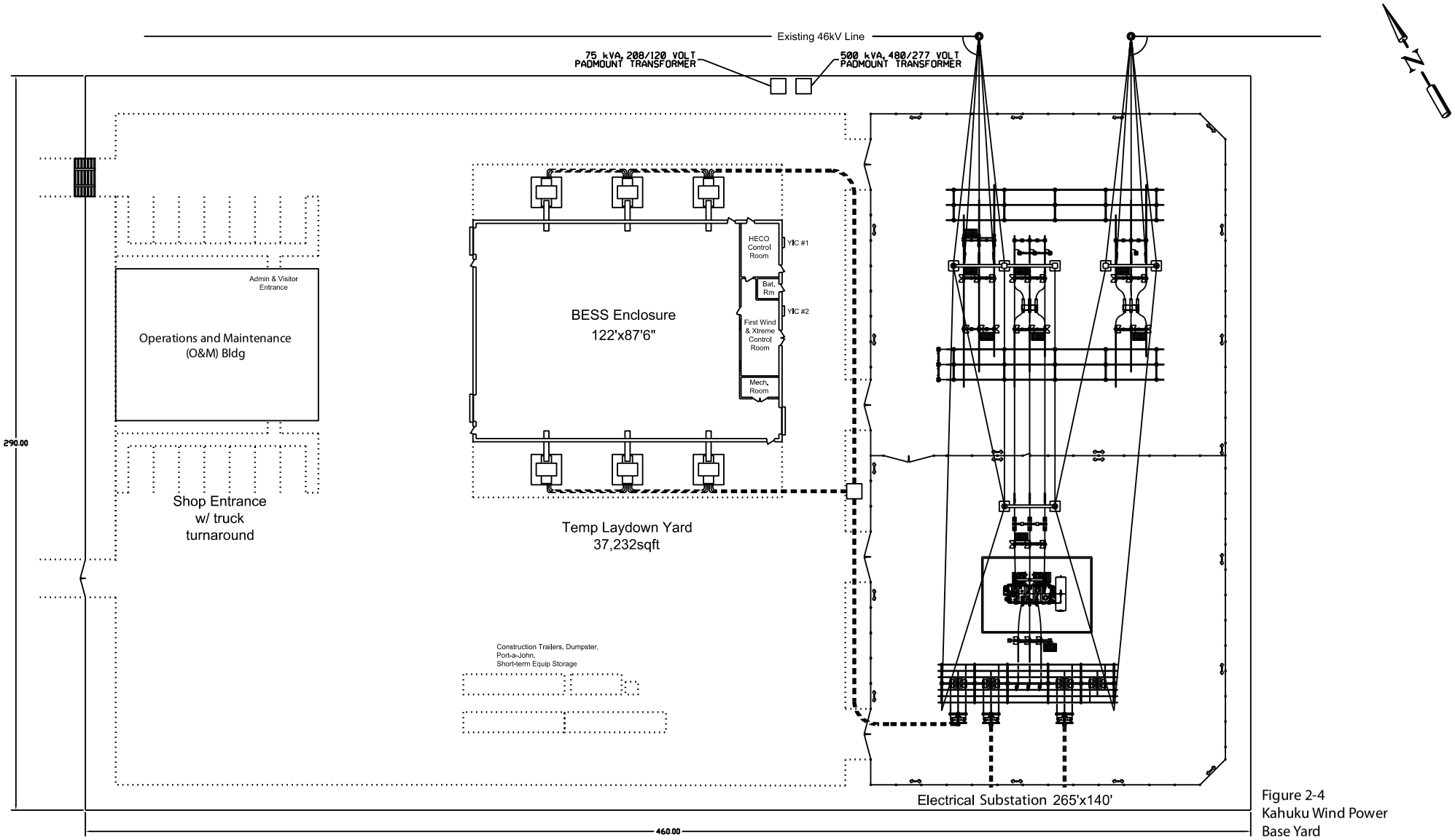
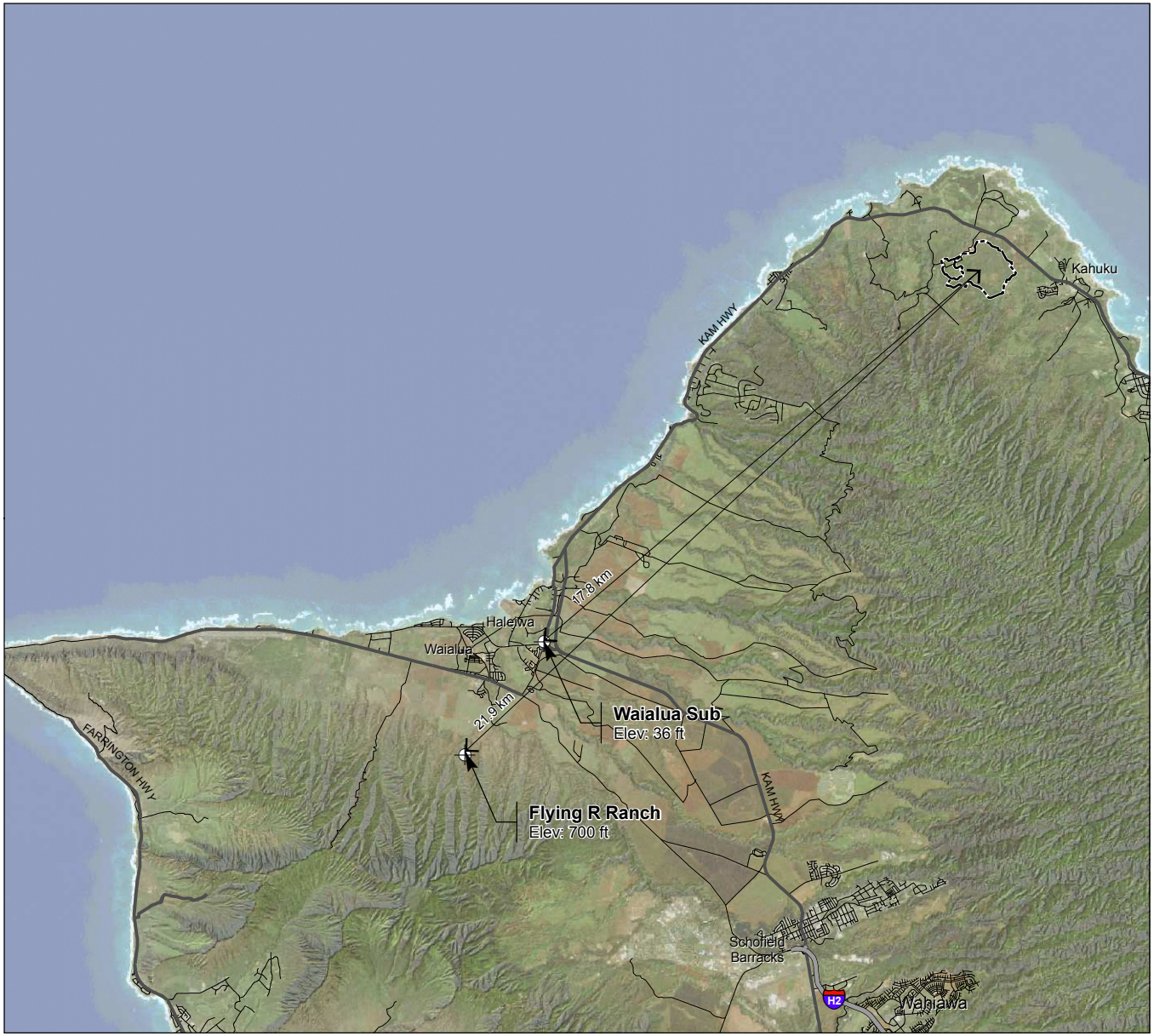


Figure 2-4
Kahuku Wind Power
Base Yard

713402_001.dgn Model 8/5/2009 4:24:03 PM



Legend

- Microwave Towers
- Kahuku Wind Power Site
- Distance (km) to Kahuku Wind Power Site

Source(s):
Tower Locations - Harris Stratex Networks
Image - LANDSAT
Roads - State of Hawaii GIS
TMK Boundary - City and County of Honolulu

N

2 1 0 2
Miles

4 2 0 4
Kilometers

Locations of Off-site Microwave Towers

Figure 2-5

2.1.6 Electrical System Components

2.1.6.1 Electrical Collection System

Electrical power generated by the WTGs would be transformed and collected through a network of underground and overhead collection circuits. The pad-mounted transformers located at the base of each WTG would increase the voltage of electricity generated by each WTG to 23-kV. Kahuku Wind Power LLC would install an underground and overhead collection system to bring electrical output from the pad-mounted transformers at each WTG to the electrical substation. The collection system would consist of two underground collection circuits and one 23-kV overhead collection circuit. The underground collection cables would total approximately 11,000 linear ft (3,353 m) and would be buried in trenches approximately 3.0 ft (0.9 m) wide and 4.0 ft (1.2 m) deep, then backfilled and returned to pre-construction elevations. Disturbed areas would be revegetated following excavation and burying of cables.

The overhead segment of the collection system would bring electrical output from the furthest six WTGs to the substation. This segment is overhead rather than underground because of the difficult terrain of the area and the presence of Kalaeokahipa Gulch, which is subject to discretionary U.S. Army Corps of Engineers jurisdiction (see Section 3.5.2). The overhead cable would be approximately 3,000 linear ft (914 m) and would be supported on approximately 15 new wooden utility poles roughly 45 ft (14 m) in height.

No new transmission lines would be constructed as part of the project; however, HECO would relocate an existing 11-kV electrical distribution line toward the southwestern boundary of the project area to accommodate construction of the WTGs. The existing line is 2,937 linear ft (895 m) long and the relocated line would be approximately 4,217 linear ft (1,286 m) long, approximately 1,280 linear ft (390 m) longer than the existing line. Similar to the existing line, the relocated line would be supported on wooden poles. The relocated distribution line would be cleared of vegetation to a width of approximately 15 ft (4.5 m).

2.1.6.2 Electrical Substation

An electrical substation would be constructed to transform the voltage from the on-site collection system and facilitate the interconnection to the existing HECO electrical transmission line. The electrical substation would feed electricity into an existing 46-kV HECO electrical transmission line that crosses the northeastern portion of the project area to the north of the base yard (Figure 2-4). The electrical substation would consist of four main structures: 1) a control building; 2) a 34-kV column/recloser; 3) a transformer; and 4) an "A" frame/circuit breaker. Each is described below. The entire substation would be fenced within a 37,100 ft^2 (3,450 m^2) area located within the fenced base yard. Depending on HECO's requirements, however, these dimensions could be much smaller.

- Control Building: The control building would be 14 by 20 ft (4.3 by 6.1 m) at the base and approximately 15 ft (4.6 m) tall.

- 34-kV column/recloser: The 34-kV column/recloser would stand approximately 24.5 ft (7.5 m) tall, and have a base of 15 by 32 ft (4.6 by 9.6 m).

- Transformer: The transformer would be approximately 11 ft (3.4 m) tall, and have a base of approximately 11 by 16 ft (3.4 by 4.9 m).

- "A" frame/circuit breaker: The "A" frame and circuit breaker structure would stand approximately 52 ft (15.8 m) tall, and have a base of 12 by 36 ft (3.7 by 11 m).

2.1.6.3 Battery Energy Storage System (BESS)

Due to fluctuations in power output from existing wind farms on other islands, HECO has imposed power output requirements for the Kahuku Wind Power project. The BESS would enable large amounts of energy to be stored, managed, controlled, and fed into the HECO electrical transmission line as needed. Thus, this system would buffer the high variability of wind power and maintain grid stability.

Kahuku Wind Power LLC is proposing to use a BESS device provided by Xtreme. This system absorbs or generates power to limit the change of wind output to less than 1 MW per minute, enabling more efficient use of existing large-scale power generation and distribution resources.

The proposed BESS enclosure would be built immediately adjacent to the substation within the base yard area (Figure 2-4). It would consist of a 10,675 ft^2 (992 m^2) building roughly 25 ft (7.6 m) high to house the components of the 15 MW Xtreme BESS and the HECO Control Room. The BESS consists of three key components: 1) PowerCells, 2) power electronics, and 3) a control system.

- PowerCell: The PowerCell product is an advanced dry cell battery based on innovative lead acid battery chemistry. Each PowerCell is a 12 volt, 1kWhr building block roughly 5 x 5 x 30 inches (13 x 13 x 76 cm). The BESS building would house ten 1.5 MW/1 MWhr channels; each channel consists of a 1.5 MW inverter/charger and 1 MWhr rack of PowerCells (15 MW storage matrix assembled from a total of 10,000 PowerCells). The PowerCell achieves significant electrochemical efficiencies through the use of bi-polar plates comprised of coextruded wire woven into a bi-grid mesh and coated with active material paste. The bi-polar plates are stacked inside the PowerCell (Figure 2-6), surrounded with wax, and inserted into the PowerCell case to create the finished PowerCell (Figure 2-6).

- Power Electronics: The solid-state, industrial-grade power electronics module is capable of delivering 1.5 MWs at an operating efficiency of 95 to 98%. Xtreme's Insulated-Gate Bi-polar Transistor (IGBT) components can handle over 1 MW of power per device. The power electronics comprise a full four-quadrant system.

- Control System: The patented solid-state control system would enable power delivery with sub-cycle control at the MW level for effective power management. The system features three levels of control hierarchy: 1) real-time Supervisory Command and Data Acquisition (SCADA) control; 2) programmable logic controller (PLC); and 3) intelligent firing circuit board (FCB).

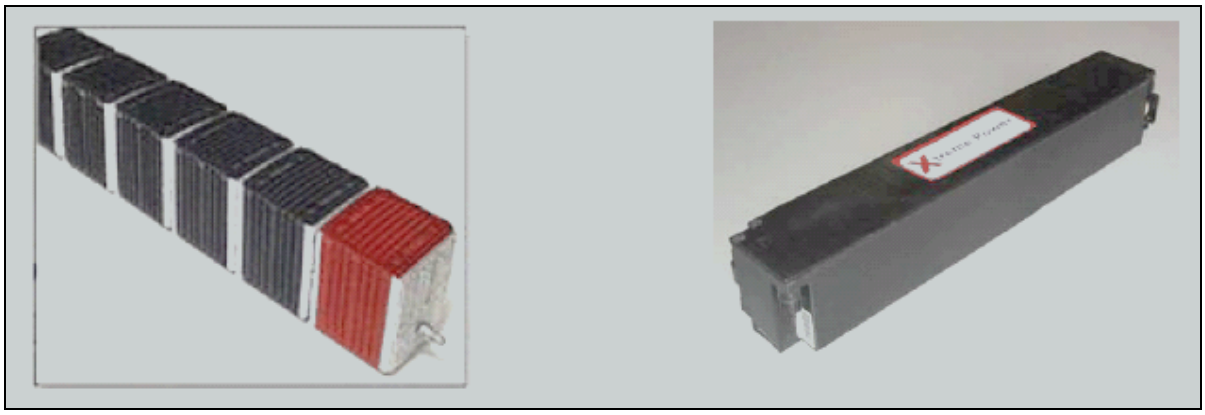


Figure 2-6. Bi-polar plates (left) and finished PowerCell (right).

2.1.7 Road Network

Approximately 1.25 mi (2 km) of existing unpaved roads in the project area would be expanded to about 3.0 mi (4.8 km) of improved but unpaved roads. The road network would provide access to the project area, each turbine location, and the base yard. The cleared and graded area for the proposed new access roads would be approximately 36 ft (11 m), with a 16 ft (5 m) wide gravel area and a 10 ft (3 m) wide shoulder on either side. The width of the roads is designed to accommodate large trucks and cranes. Individual spur roads would branch off from the main connector roads to each WTG site.

Construction of the proposed facility would disturb approximately 67 ac (27 ha) of land or approximately 11.5% of the project area; the remainder would remain undisturbed. The total "developed" area (or the total area that would contain structures, hardened surfaces, and associated setbacks) is anticipated to be roughly 32 ac (13 ha), or approximately 5.6% of the project area. Table 2-1 summarizes the area that would be disturbed and occupied by each of the major components of the proposed project.

Table 2-1. Area disturbed and developed by the proposed Kahuku Wind Power facility.

Project Component	Approximate Area	
	Disturbed	Developed
12 WTG Foundations & Pads[1]	36.90 ac (14.93 ha)	21.36 ac (8.64 ha)
Trenching for Underground Electrical Cables[2]	0.76 ac (0.31 ha)	0
Permanent Unguyed Met Tower	0.13 ac (0.05 ha)	0.014 ac (0.006 ha)
Base Yard Area (O&M Building, BESS Enclosure, Electrical Substation)	5.00 ac (2.02 ha)	2.90 ac (1.17 ha)
On-Site Microwave Tower	0.02 ac (0.008 ha)	0.003 ac (0.001 ha)
Access Roads and Spur Roads	17.30 ac (7.00 ha)	7.60 ac (3.07 ha)
Relocated Distribution Line	1.50 ac (0.61 ha)	0.01 ac (0.004 ha)
Temporary Truck Turnaround and Temporary Staging Areas	5.00 ac (2.02 ha)	0
TOTAL	66.61 ac (26.96 ha)	31.89 (12.90 ha)

1) Each developed turbine site would be 1.78 ac (0.72 ha) in size.
2) Estimate based on 3.0 ft (0.9 m) wide trenches.

2.1.8 Project Schedule and Timeline

Construction of the Kahuku Wind Power facility is estimated to require six months. The turbines would likely be constructed in the fourth month and would be erected with the assistance of one large construction crane. It is expected that the crane would be on-site for approximately two weeks.

Once operational, Kahuku Wind Power LLC estimates that the proposed facility would have a lifespan of approximately 20 years. After this time period, Kahuku Wind Power LLC would arrange to either extend the life of the project or remove the facility components and remediate/stabilize the project area. Removal of the structures would generate waste that would be disposed of and/or recycled according to recycling technologies and markets and disposal regulations existing at the time of demolition or renovation.

2.1.9 Permits and Authorizations

The proposed project obtained a Conditional Use Permit-Minor (CUP-M) from the City and County of Honolulu's Department of Planning and Permitting (DPP) in January 2008. Due to proposed design modifications to the project, a new CUP was applied for in October 2009 and approved in December 2009. A Power Purchasing Agreement (PPA) was finalized with HECO in July 2009. Final grading permits were submitted to the City and County of Honolulu and building permits were submitted in January 2010. The Interconnection Requirement Study (IRS) drafted by HECO is expected to be finalized by January 31, 2010. This study addresses the transmission and distribution interactions between the proposed facility and HECO's system.

Based on information provided by Kahuku Wind Power LLC and informal consultation with the U.S. Fish and Wildlife Service (USFWS), DOE determined that the proposed project is likely to adversely affect seven federally listed threatened or endangered species and one state listed endangered species. DOE consulted with USFWS under Section 7 of the Endangered Species Act (ESA) to address the potential for construction and operation of the facility to adversely affect federally listed threatened and endangered species. Kahuku Wind Power LLC is in the final stages of obtaining an Incidental Take License (ITL) in accordance with Chapter 195-D, Hawai‘i Revised Statutes (HRS), which is issued by the Hawai‘i Department of Land and Natural Resources (DLNR). A detailed discussion of DOE's consultation with USFWS under Section 7 of ESA and Kahuku Wind Power LLC's consultation with DLNR in accordance with Chapter 195-D, HRS is contained in Section 3.12.

2.2 No Action Alternative

Under the No Action Alternative, DOE would not issue a loan guarantee for the proposed Kahuku Wind Power facility. Without the DOE loan, it is unlikely that Kahuku Wind Power LLC would implement the project as currently planned. Thus, the No Action Alternative is that no wind power facility would be constructed, and the Island of O‘ahu's energy needs would continue to be provided primarily by imported fossil fuels.

The decision for DOE consideration covered by this NEPA review is whether or not to approve the loan guarantee for the Kahuku Wind Power facility. Kahuku Wind Power LLC's decision process in selecting the Kahuku site is described in Section 2.3.1 and supported by state and local approvals (see Section 3.10.1.1 and 3.10.1.2, and Appendix D). Further, there are no unresolved conflicts concerning alternative uses of available resources associated with the project area that would suggest the need for other alternatives (40 CFR 1508.9(b)). Therefore, other than no action, there is no alternative to the proposed action considered in this NEPA review.

2.3 Alternatives Considered But Eliminated

2.3.1 Alternate Project Locations

The proposed project area was selected based on the existing needs for renewable energy in Hawai‘i, evaluation of wind resources on O‘ahu, and a thorough consideration of alternative sites in the area. While wind power is a commercially viable utility-scale renewable energy resource, O‘ahu’s wind resources, topography, and high land values make developing wind energy projects on the island a challenge. A recent report on renewable resources in Hawai‘i found that “with its high competition for land available for development and protected natural features, it is much more difficult to identify ideal sites for renewable energy projects on O‘ahu than on the other Hawaiian Islands. The best potential combination of land available for wind development and a strong, proven wind resource is found in the Kahuku area” (Global Energy Concepts LLC, December 2006). Kahuku was the location of several previous wind energy projects in the 1980s and early 1990s and has a well-documented wind regime. The area also benefits from existing electrical transmission lines and a community that is largely familiar with, and supportive of, wind energy generation.

This study also identified two other sites on O‘ahu with reasonable potential for wind development, Ka‘ena Point to the west of Kahuku and Kahe Ridge to the south. Ka‘ena Point was ruled out because it has limited transmission infrastructure and possesses important cultural significance and protected wildlife habitats. Ka‘ena Point also has one of the largest seabird colonies on the main Hawaiian Islands (DOFAW 2007). While none of the three nesting seabird species are endangered [Laysan albatross (*Phoebastria immutabilis*), wedge-tailed shearwater (*Puffinus pacificus*) and white-tailed tropicbird (*Phaethon lepturus*)], the construction of a wind facility close to large seasonal concentrations of these breeding seabirds is undesirable (Appendix A). Moreover, nine other species of seabirds, the native pueo (*Asio flammeus sandwichensis*), and numerous migratory birds are regularly seen in the area and may be vulnerable to collisions with wind facility infrastructure.

Kahe Ridge was previously proposed as the site of a wind facility by HECO, but the project was cancelled in 2005 when the Mayor of Honolulu announced that permits would not be issued for the project based on concerns expressed at public meetings. Consequently, both Ka‘ena Point and Kahe Ridge were discounted as potential sites for the proposed project.

Once Kahuku was identified as the most viable location for the proposed project, Kahuku Wind Power LLC evaluated undeveloped land in and around Kahuku proximate to existing transmission infrastructure. A potential site in Pūpūkea-Paumalū, to the southwest of the proposed project area, was eliminated after it was determined that access to the site would be difficult, gaining site control for the amount of land necessary for a utility-scale wind energy project was improbable, and the site was bordered by a satellite communications facility on one side and a conservation trust on the other. Additionally, undeveloped lands to the west and south of this site are controlled by the U.S. Army and regularly used for aircraft maneuvering and parachute training exercises. After careful consideration and elimination of these alternate sites, Kahuku Wind Power LLC selected the proposed project area and purchased the property to facilitate the planning and permitting of the Kahuku Wind Power facility.

2.3.2 Alternative Site Layouts

Kahuku Wind Power LLC determined the optimum configuration for the turbine layout based on meteorological data collection and analysis of the wind resource of the property over 12 months. Wind turbines are sited where they would produce the most energy given the area’s wind resource and topography. The initial configuration contemplated a layout consisting of two parallel rows of turbines set perpendicular to a presumed dominant northeasterly wind direction. However, after collecting and

analyzing the on-site meteorological equipment data, it was discovered that the predominant wind direction is more easterly than expected. Kahuku Wind Power LLC therefore adjusted the layout of the turbines to maximize their production from this wind profile.

A study of the on-site meteorological conditions was performed concurrently with avian surveys described in Section 3.12. Results from these surveys and avian impact modeling described in Section 3.12.2.1 provided Kahuku Wind Power LLC with an expectation that annual mortality rates of listed species with the proposed layout would be exceedingly low. Estimated mortality rates are on average from 0.03 to 0.4 individuals per species per year. Given these very low numbers and knowledge that risk of mortality cannot reach zero, Kahuku Wind Power LLC did not examine alternate turbine configurations with regard to their potential to further reduce the potential for avian and bat collisions.

CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 Introduction

This chapter describes the existing physical, biological, and socioeconomic conditions of the project area and the potential environmental effects that could result from implementation of the proposed action or No Action Alternative described in Chapter 2. A discussion of potential cumulative effects is also provided in this Chapter.

3.2 Climate

3.2.1 Current Climatic Conditions

The climate of the Hawaiian Islands varies little throughout the year, with only minor periods of diurnal and seasonal variability. Generally, temperatures during the summer season (May through September) are warm, conditions are dry, and persistent trade winds originate from the northeast. The winter season (October through April) is characterized by cooler temperatures, higher precipitation, and less equable winds (Juvik and Juvik 1998).

Local climatic conditions at the project area are characteristic of lowland areas on the windward side of O‘ahu, with relatively constant temperatures and persistent northeast trade winds. Annual temperatures range from approximately 68.9 to 80.8°F (20.5 to 27.1°C) and annual precipitation is between 37.88 and 40.86 inches (96.2 and 103.8 cm) (NOAA 2002, DBEDT 2008a). Due to its location on the northern corner of O‘ahu, Kahuku is considered a high wind energy site (Lau and Mink 2006). Northeasterly trade winds are present nearly 90% of the year in Kahuku and the southerly Kona winds are present approximately 10% of the year (Smith, Young & Assoc. 1990).

Climatic conditions at the two off-site microwave tower areas are generally similar to conditions in Kahuku. Hale‘iwa has an average annual rainfall of approximately 28 inches (71 cm) and an average temperature of 70°F (21°C) (Thompson 2005). The Flying R Ranch area experiences a higher average annual rainfall, with approximately 39 inches (99 cm) (Giambelluca et al. 1986). Both areas experience persistent northeast trade winds during most of the year.

3.2.1.1 Potential Impacts of the Proposed Action

WTGs of the type and number that are proposed at Kahuku 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, the WTGs do have the potential to slightly affect certain aspects of the local wind regime; however, Kahuku Wind Power would extract only a small percentage of the wind energy at elevations above ground level, and no existing or proposed uses in the area would be affected by minor changes in wind speed and/or velocity.

3.2.1.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, there would be no change from the existing conditions.

3.2.2 Global Climate Change

Global temperatures on the Earth’s surface have increased by an average of 1.33°F (0.74°C) over the last 100 years; this warming trend has accelerated within the last 50 years, increasing by 0.23°F (0.13°C) each decade (Solomon et al. 2007). An increase in the average temperature of the Earth may produce changes

in sea levels, rainfall patterns, and intensity and frequency of extreme weather events. Global mean sea levels are currently rising at twice the average rate recorded during the 20th century (3 mm/yr instead of 1.6 mm/yr). Collectively, these effects are referred to as "climate change" (National Energy Information Center 2008).

According to the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC), global climate change is very likely due to anthropogenic greenhouse gas concentrations (IPCC 2007). Greenhouse gases, which include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), are chemical compounds in the Earth's atmosphere that trap heat. Of these gases, CO_2 is recognized by the IPCC as the primary greenhouse gas affecting climate change (IPCC 2007). Present atmospheric concentrations of CO_2 are believed to be higher than at any time in at least the last 650,000 years, primarily as a result of combustion of fossil fuels (IPCC 2007). It is also very likely that observed increases in CH_4 are also partially due to fossil fuel use (IPCC 2007).

The maritime location of the Hawaiian Islands makes the archipelago relatively well buffered climatically (Benning et al. 2002). However, climatic changes have been documented throughout the state. Average air temperature increases of 0.3196°F (0.1776°C) per decade have been recorded in Hawai'i (Giambelluca et al. 2008), with higher elevations warming faster than lower elevations. Tide gauges at sea level at the Honolulu Harbor estimate that sea level has risen at 1.4 ± 0.3 mm/year over the past century (Caccamise et al. 2005). Some estimates project that a 3.3 ft (1 m) rise in sea level is possible by the end of the century for Hawai'i (Fletcher 2009). Sea surface temperatures near the islands have been increasing recently, showing an average 0.72°F (0.4°C) rise between 1957 and 1987 (Giambelluca et al. 1996). Temperatures are expected to rise at least another 2.7 to 3.6°F (1.5 – 2°C) by the end of the century (IPCC 2007). Global increase in sea surface temperatures has been associated with causing more intense hurricanes in the Pacific and Atlantic (Webster et. al 2005, U.S. Climate Change Science Program 2009) and could result in higher peak wind speeds and heavier rainfall (IPCC 2007).

Climate change also has the potential to impact a phenomenon known as the trade wind inversion layer. In Hawai'i, descending air in the Hadley cell warms as it is compressed, while moist air at the surface progressively cools as it rises. Where rising and sinking air meet, a layer is formed (the trade wind inversion layer) in which warm air overlies cool air (Juvik and Juvik 1998). Typically, this layer occurs between 5,000 and 10,000 ft (1,500 and 3,000 m); however, climate change may raise or lower the altitude at which the trade wind inversion layer currently occurs (Pounds et al. 1999, Still et al. 1999). The formation of the trade wind inversion strongly influences climate by altering precipitation inputs from mist and fog drip (Miller 2008, Benning et al. 2002). Thus, changes in the inversion layer can result in hydrological and ecological changes (Giambelluca and Nullet 1991). Studies show the tradewind inversion layer has already responded substantially to past climate changes (Benning et al. 2002).

3.2.2.1 Potential Impacts of the Proposed Action

The proposed Kahuku Wind Power project is expected to have a beneficial impact on the climate by decreasing fossil fuel consumption and decreasing emission of greenhouse gases. The proposed project would eliminate the use of approximately 154,550 barrels of oil annually that would otherwise be used to produce conventional power. Eliminating the consumption of this amount of oil would reduce emissions of CO_2 and nitrogen oxides (NO_X) by approximately 159.6 million pounds (72.4 million kg) and 237.7 thousand pounds (107.8 thousand kg) per year, respectively.

The primary greenhouse gas contribution from the proposed project would be from CO_2 produced by burning fossil fuels during the short-term construction phase. A summary of estimated emissions during construction and operation of the project is provided in Section 3.6.2.1. Although construction and operation of the facility would result in some emissions of CO_2 (employee trips, transporting materials,

etc.), reductions that would result from replacing fossil fuel-generated power with wind-generated power produced by the proposed project would more than offset these emissions.

3.2.2.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, there would be no change from the existing conditions. Global climate change benefits from reduced emissions of greenhouse gases and other air pollutants would not occur if the facility were not constructed and operated.

3.3 Topography

The topography of O‘ahu is characterized by a broad central plateau bounded by the Ko‘olau Mountains to the east and the Wai‘anae Mountains to the west. The mountain ranges are roughly parallel and oriented on a northwest to southeast axis. Both mountain ranges have tall, steep slopes as a result of erosion from wind, rain, and sea (Moore 1964, Polhemus 2007).

The project area is located on a small plateau lying above low coastal terraces (Hunt and DeCarlo 2000) near Kahuku Point. The seaward edge of the plateau consists of lithified sand from ancient coastal dunes that are now eroded and sculpted by the wind. Inland of the plateau, the land slopes upward into hills and gullies (Hobdy 2007). Incised hillsides present in the project area generally increase in elevation to the west. Elevation of the project area ranges from approximately 40 ft (12 m) above mean sea level on the eastern edge to approximately 525 ft (161 m) on the western side. The average elevation is roughly 218 ft (67 m). Highly weathered, remnant limestone reef escarpments are found along the northern edge of the project area. No other notable topographic features are present. Three intermittent gulches and gullies formed by soil excavation and other activities cut across the area.

The Waialua Substation off-site microwave tower site is located on relatively flat terrain at an approximately 26 ft (8 m) elevation. The Flying R Ranch microwave tower site is located at 700 ft (213 m) elevation roughly 2.3 mi (3.7 km) from Kamaohanui summit. The site slopes roughly 30 degrees in the northwest direction.

3.3.1 Potential Impacts of the Proposed Action

Grading would be required for the turbine pads, internal access roads, and substation associated with the proposed facility. Additional minor grading would occur on the property to prevent ponding. This grading would cause minor alterations of local topography, but no alteration of major topographic features. Therefore, it is not expected that the proposed alterations to the site would significantly affect the natural topography.

No grading is proposed at the Waialua Substation microwave tower site. Approximately 1,600 ft^2 (149 m^2) would be graded at the Flying R Ranch site; however, this is not expected to substantially alter the topography of the area.

3.3.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, no adverse impacts to the existing topography would be expected.

3.4 Geology, Soils, and Geologic Hazards

The Hawaiian Islands continue to be formed by a series of volcanic eruptions that have occurred at various hotspots beneath the Earth’s crust. As the tectonic plate supporting the islands has slowly drifted

northwestward, magma has welled up from fixed spots creating, in conjunction with subsidence and erosion, a linear chain of islands. O‘ahu, the third largest island in the Hawaiian archipelago, was created by several geological processes. These include shield-building volcanism, subsidence, weathering, erosion, sedimentation, and rejuvenated volcanism (Hunt 1996). O‘ahu is mostly composed of the heavily eroded remnants of two large Pliocene shield volcanoes - Wai‘anae and Ko‘olau (Juvik and Juvik 1998). The extinct Ko‘olau Volcano, which formed about 2.2 to 2.5 million years ago, is comprised of shield lavas, referred to as Ko‘olau Basalt, as well as rejuvenated stages, termed the Honolulu Volcanics (Juvik and Juvik 1998, Lau and Mink 2006).

The proposed project area is located at the foot of the Ko‘olau Mountains. Eroded shield volcanoes, such as the Ko‘olau Volcano, typically have dike complexes of basaltic material associated with active rift zones that extend vertically into the lava flows, inhibiting normal groundwater flow (Hunt 1996). The majority of the project area is underlain by Ko‘olau Basalt lava flows that were active 1.8 to 3 million years ago. A narrow strip of alluvial sand and gravel runs through roughly the middle of the project area. Older dune deposits, as well as lagoon and reef deposits (limestone and mudstone), are present near the seaward (makai) boundary of the property (Belt Collins Hawai‘i Ltd. 2007a).

Coral reefs now exposed as escarpments in the northern portion of the project area formed during a time when the ocean was at a higher level. The coral reef escarpments are pockmarked with shallow overhangs and small caves due to erosion. Consultation meetings and presentations with the public highlighted the rich history of these escarpments. In response to community concerns, Kahuku Wind Power has committed to preserve the coral escarpments located on the project area, as well as to document the mo‘olelo (stories, legends) concerning these areas. Sixty-ft (18-m) buffer areas would be placed around these coral escarpment areas. No other unique or unusual geologic resources or conditions are known to occur on-site.

The Waialua Substation microwave tower site is situated within the Waialua-Hale‘iwa coastal plain, a narrow plain along O‘ahu’s northern coastline that was formed by lava flows from the Ko‘olau and Wai‘anae Mountain Ranges (Stearns 1985). The Flying R Ranch site is located on the northern portion of the Wai‘anae Mountain Range. No unique or unusual geologic resources or conditions are known to occur at either of the off-site microwave tower sites.

Various soil types have developed throughout the Island of O‘ahu as the basaltic lavas and volcanic ash from the volcanoes have weathered and decomposed (Juvik and Juvik 1998). Soils on the Island of O‘ahu were classified and defined by the U.S. Department of Agriculture (USDA) Soil Conservation Service and Natural Resource Conservation Service (NRCS) (Foote et al. 1972). Soil types and features identified by the NRCS in the project area are summarized in Table 3-1 and shown in Figure 3-1. According to the NRCS National Hydric Soils List, none of the soils in the project area is considered hydric.

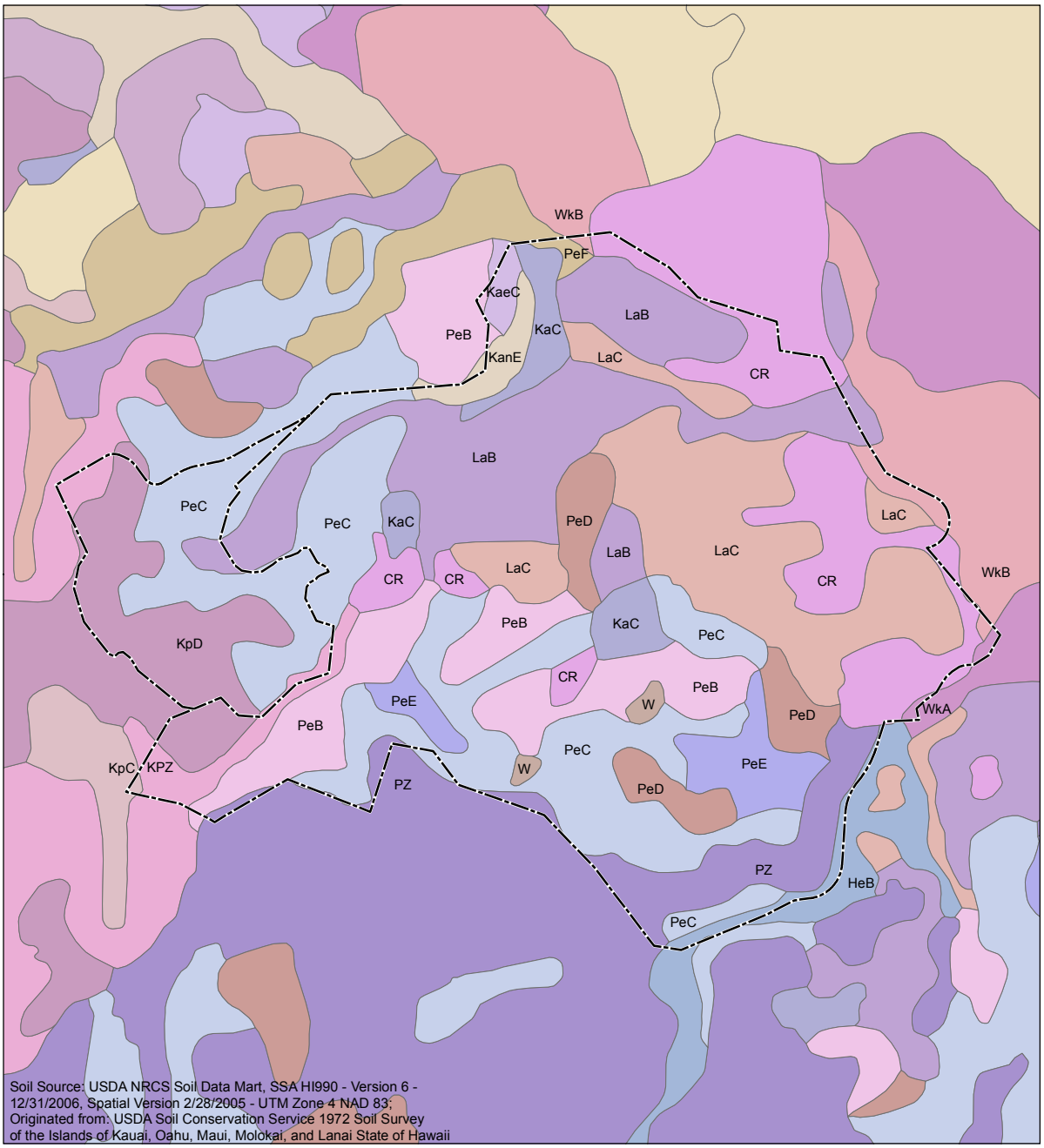
Soils on-site generally consist of well-drained silty clay soils that developed in old alluvium and colluvium derived from basic igneous rock. Only a thin layer of friable, red soil material is present within the cracks, crevices, and depressions of the coral outcrop. A narrow strip of alluvial sand and gravel underlies a portion of the property, roughly bisecting the middle of the project area. Large areas of the property are devoid of topsoil due to erosion associated with past land uses, such as sugar cultivation, grazing, and soil excavation. Between 1987 and 1991, approximately 47 ac (19 ha) of soil was excavated from portions of the site for use as fill material for the Arnold Palmer Golf Course at the Turtle Bay Resort (Belt Collins Hawai‘i Ltd. 2007a). Kahuku Wind Power LLC is a member of the O‘ahu Soil and Water Conservation District, and is working with the NRCS to develop a conservation plan for the property to manage soil erosion.

Sites proposed for the off-site microwave towers are located on disturbed soils or existing asphalt pavement. The soils at the Waialua Substation site are classified as Waialua silty clay, 0 to 3% slopes. While these soils presumably underlie the site, the entire parcel is covered in asphalt pavement or gravel. The soils in the Flying Ranch site are classified as Kemo‘o silty clay, 12 to 20% slopes.

3.4.1 Potential Impacts of the Proposed Action

No significant impacts to geological resources or conditions are expected to occur as a result of the proposed action. Grading for new roads, WTG pads, and other project components would cause shallow alteration of bedrock (i.e. occur on or near the surface of the ground) in some areas. The coral reef exposures would be protected and avoided. No significant geologic resources are known or expected to occur in the project area, so geologic alterations are expected to be minor.

Approximately 32 ac (13 ha) of ground would be disturbed by construction of the proposed project (Table 2-1). Temporary construction activities would include establishment of an on-site construction staging and stockpiling area approximately 1.72 ac (0.69 ha) in area, which would be surfaced with gravel to minimize erosion. Grading/scraping would impact soils in the disturbed areas and expose the areas to increased erosion hazard. Kahuku Wind Power LLC also intends to grade some low-lying areas of the project area during construction to improve drainage and prevent standing water from collecting after heavy rain (see Section 3.5.3).



Soil Type

- CR, Coral outcrop
- HeB, Haleiwa silty clay, 2 to 6 percent slopes
- KPZ, Kemoo-Badland complex
- KaC, Kaena clay, 6 to 12 percent slopes
- KaeC, Kaena stony clay, 6 to 12 percent slopes
- KanE, Kaena very stony clay, 10 to 35 percent slopes
- KpC, Kemoo silty clay, 6 to 12 percent slopes
- KpD, Kemoo silty clay, 12 to 20 percent slopes
- LaB, Lahaina silty clay, 3 to 7 percent slopes
- LaC, Lahaina silty clay, 7 to 15 percent slopes
- PZ, Paumalu-Badland complex
- PeB, Paumalu silty clay, 3 to 8 percent slopes
- PeC, Paumalu silty clay, 8-15 percent slopes
- PeD, Paumalu silty clay, 15 to 25 percent slopes
- PeE, Paumalu silty clay, 25 to 40 percent slopes
- PeF, Paumalu silty clay, 40 to 70 percent slopes
- W, Water > 40 acres
- WkA, Waialua silty clay, 0 to 3 percent slopes
- WkB, Waialua silty clay, 3 to 8 percent slopes

Figure 3-1

Soil Types within the Kahuku Wind Power Project Area

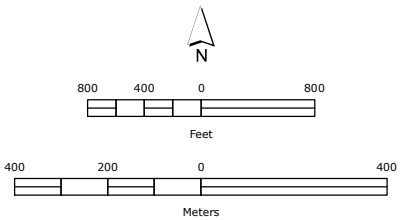


Table 3-1. Soil types and characteristics within the Kahuku Wind Power project area based on classifications from Foote et al. (1972).

Soil Type	Slopes	Key Characteristics	Site Coverage
Paumalū silty clay	8-15%	Permeability moderately rapid; runoff slow to medium; erosion slight to moderate	22.25%
Lahaina silty clay	3-7%	Permeability moderate; runoff: slow; erosion slight.	15.70%
Lahaina silty clay	7-15%	Permeability moderate; runoff medium; erosion moderate.	14.55%
Coral Outcrop	--	--	10.08%
Paumalū silty clay	3-8%	Permeability moderately rapid; runoff slow; erosion slight	8.92%
Kemoʻo silty clay	12-20%	Permeability moderate/moderately rapid; runoff medium; erosion moderate.	6.75%
Paumalū-badland complex	--	Permeability moderately rapid; runoff medium to rapid; erosion moderate to severe.	4.88%
Paumalū silty clay	15-25%	Permeability moderately rapid; runoff medium; erosion moderate.	4.11%
Paumalū silty clay	25-40%	Permeability moderately rapid; runoff medium to rapid; erosion moderate to severe.	3.32%
Kaʻena clay	6-12%	Permeability slow; runoff: slow to medium; erosion slight to moderate.	3.17%
Kemoo-badland complex	--	Permeability moderate/moderately rapid; runoff medium to rapid; erosion moderate to severe.	2.25%
Kaʻena very stony clay	10-35%	Permeability slow; runoff medium to rapid; erosion moderate to severe.	1.15%
Haleʻiwa silty clay	2-6%	Permeability moderate; runoff slow; erosion slight.	0.71%
Waialua silty clay	3-8%	Permeability moderate; runoff: slow; erosion slight.	0.70%
Kaʻena stony clay	6-12%	Permeability slow; runoff slow to medium; erosion slight to moderate.	0.53%
Water > 40 ac	--	--	0.43%
Paumalū silty clay	40-70%	Permeability moderately rapid; runoff rapid; erosion severe.	0.28%

Soil Type	Slopes	Key Characteristics	Site Coverage
Waialua silty clay	0-3%	Permeability moderate; runoff: slow; erosion slight.	0.19%
Kemo‘o silty clay	6-12%	Permeability moderate/moderately rapid; runoff medium; erosion: slight to moderate.	0.05%

All surface alterations associated with the proposed project would comply with applicable construction codes for erosion and sedimentation control during the construction process. Best Management Practices (BMPs) would be employed to prevent and minimize soil erosion during construction and operation of the proposed project. The BMPs are outlined in Table 3-2. Permanent soil stabilization (i.e., graveling or re-planting/re-seeding of vegetation) would occur in temporarily disturbed areas as soon as practical after final grading. Impacts to soils are expected to be minor because of the use of the BMPs and revegetation of temporarily disturbed areas.

3.4.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, no impacts to geologic features or soils would be expected.

Table 3-2. Potential pollutants from construction activities and Best Management Practices.

Pollutant	Source/Activity	BMP
Soil/ Sediment/ Rock	Excavation, grading, stockpiles, runoff from watering for dust	Silt fences, protection of stockpiles, natural vegetation, sand bags, construction entrance stabilization, temporary soil stabilization, geotextile mats (internal access road slopes), avoid excess dust by 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 and disposal, compaction and swales, containment pallets
Concrete Wash Water	Pouring of WTG foundations	Containment in wash water pits, silt fences
Equipment and Vehicle Wash Water	Cleaning construction equipment	Containment berms around equipment washing area, off-site vehicle washing
Sanitary Waste	Portable toilets or septic tank	Sanitary/septic waste management
Source: Department of Environmental Services, City and County of Honolulu (1999).		

3.5 Water Resources

3.5.1 Regulatory Framework

The Clean Water Act (CWA), formerly known as the Federal Water Pollution Control Act, is the primary statute governing water pollution and water quality in wetlands or other waters subject to U.S. Army Corps of Engineers (USACE) jurisdiction. Section 404 of the CWA regulates the discharge of dredged or fill material into jurisdictional waters of the United States. The USACE is authorized to issue permits for the discharge of dredged or fill materials into the waters of the United States at specified disposal sites.

Executive Order 11990 requires federal agencies to ensure their actions minimize the destruction, loss or degradation of wetlands. In carrying out their actions, each agency shall preserve and enhance the natural and beneficial values of wetlands.

Executive Order 11988 directs federal agencies to take actions to reduce the risk of flood loss, minimize flood impacts on human safety, health and welfare, and restore and preserve floodplain natural and beneficial values. The Executive Order is designed to preserve and restore the natural and beneficial values that floodplains provide.

The Wild and Scenic Rivers Act (16 USC 1271 et seq.) was created to identify and preserve rivers that possess outstanding scenic, recreational, geologic, fish and wildlife, historic, and cultural attributes. Rivers designated under this Act are protected to enhance the value(s) for which they were designated. There are no rivers designated under this Act in the State of Hawai‘i; therefore, the Wild and Scenic Rivers Act is not applicable to the proposed project.

3.5.2 Surface Water

Stream flow and other hydrologic processes in Hawai‘i are influenced by the climatic and geological features of the area, including rainfall and wind patterns. The majority of the perennial streams on O‘ahu (84%) are located in the windward Ko‘olau Mountains which produce a larger amount of orographic precipitation compared to the leeward side (Polhemus 2007). Permeable underlying rock may also cause some streams on O‘ahu to have lengthy dry reaches under natural conditions. Streams in the Kahuku area are considered to be naturally intermittent (Polhemus et al. 1992) and are typically short and steep, with permeable upland soils creating rapid infiltration into the Ko‘olau aquifer. As a result, streams in the lowland areas have periods of high peak floods and little base flow (Hunt and De Carlo 2000).

Three intermittent streams occur on portions of the project area- Ohia‘ai Gulch, Kalaeokahipa Gulch, and an unnamed headwater tributary to James Campbell NWR (Smith, Young & Assoc. 1990). Ohia‘ai Gulch drains along the eastern boundary of the property and is referred to as Ki‘i Ditch at lower elevation. Kalaeokahipa Gulch transverses the northwestern portion of the project area. The unnamed headwater tributary to James Campbell NWR parallels Nudist Camp Road, which is makai of Kamehameha Highway (Figure 3-2). These three streams are the primary drainage areas within the Ki‘i watershed, in which to proposed project lies. The Ki‘i watershed is approximately 3,968 acres (1,606 ha) in area (DAR 2008). Various other smaller drainage gulches occur within the watershed on the lowland area makai of the proposed Kahuku Wind Power facility.

In the late 1970s, USFWS Division of Ecological Services biologists used U.S. Geological Survey (USGS) 7.5-minute quadrangle maps and georectified orthophotos to spot check and map wetlands in Hawai‘i as a part of the National Wetlands Inventory (NWI) Program (Cowardin et al. 1979). According to the Cowardin classification schema, three wetlands occur within the project area: Ohia‘ai Gulch/Ki‘i Ditch, Kalaeokahipa Gulch, and the unnamed tributary to James Campbell NWR. All of these were

described by USFWS as being palustrine, forested, broad-leafed evergreen, seasonal (PFO3C) wetlands. A fourth wetland (Hoʻolapa Gulch) was identified outside of the project area in the lower reach of Ohiaʻai Gulch/Kiʻi Ditch. This wetland was described as palustrine, emergent, persistent, seasonally flooded, excavated.

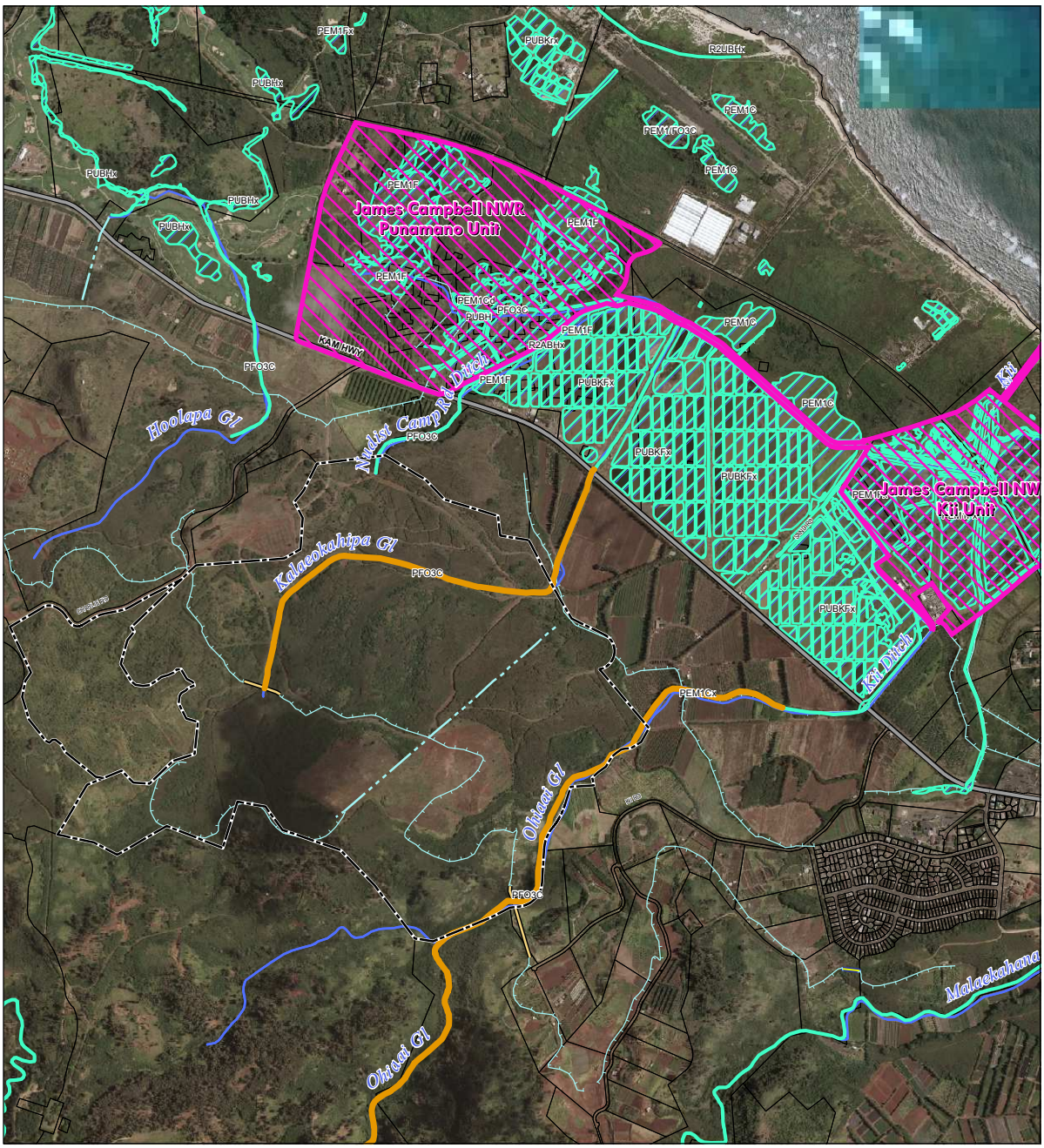
SWCA biologists conducted a wetland jurisdictional boundary determination in the project area to identify any wetlands or other waters subject to USACE jurisdiction under Section 404 of the CWA (Appendix B). No permanent surface water is present in the project area. Certain low-lying areas within the project area can temporarily hold ponded water after periods of extended heavy rainfall. Contrary to the NWI mapping, no wetlands meeting the three established criteria of hydrophytic vegetation, hydric soils, and water regime were found to occur within project area boundaries (SWCA 2008). Ohiaʻai and Kalaeokahipa gulches are subject to discretionary USACE jurisdiction because of their "significant nexus" to waters at James Campbell NWR (Figure 3-2). Thus, activities involving the discharge of dredge or fill materials into these waters would require a permit from the USACE.

No permanent surface water exists at any of the off-site microwave tower sites.

3.5.2.1 Potential Impacts of the Proposed Action

Potential impacts to water resources as a result of the project have been avoided by proper siting of the individual turbines, associated facilities, and roadways, and incorporation of BMPs into construction plans. Ohiaʻai Gulch, Kalaeokahipa Gulch, and the unnamed headwater tributary to James Campbell NWR are not proposed to be dredged or filled, and these waters lie outside the areas of the proposed facilities. Therefore, Kahuku Wind Power LLC does not need to obtain a CWA Section 404 permit.

The proposed action would result in only slight increases in impervious surfaces (approximately 26 ac). This represents less than 1% of the watershed that drains the area. Thus, the project would not significantly increase the volume of stormwater runoff leaving the project area. Localized topographic alterations resulting from site grading and the construction of building pads and roads would alter local drainage patterns and stormwater runoff pathways.



Legend

- Project Parcels
- TMK Parcels
- USFWS Wetland Inventory/ Cowardin Classification
- James Campbell National Wildlife Refuge
- Jurisdictional wetland based on significant nexus determination by ACOE Honolulu District

Hydrology

- AQUEDUCT
- DITCH OR CANAL
- FLUME
- SIPHON
- STREAM
- STREAM, UNDERPASS

Jurisdictional waters at the Kahuku Wind Power project area

Figure 3-2

N

800 400 0 800
Feet

400 200 0 400
Meters

Data Sources: State of Hawaii GIS; City and County of Honolulu; USGS

During construction, ground disturbance would have the potential to increase the level of sediment and other pollutants in stormwater runoff, which could change the water quality of receiving waters. The areas most likely to receive stormwater runoff would be Ohia‘ai Gulch, Kalaeokahipa Gulch, and the unnamed headwater tributary to James Campbell NWR. However, BMPs and general construction management techniques would be implemented (see Table 3-2) to minimize any impacts to these areas.

No grading is proposed at the Waialua microwave tower site and construction of this tower would not result in an increase in impervious surfaces. Grading at the Flying R Ranch site would be minor (approximately 1,600 ft^2), and construction of this tower would not result in a large increase in impervious surfaces (approximately 169 ft^2). Therefore, no impacts to surface water hydrology or stormwater runoff at any of these sites are anticipated.

Kahuku Wind Power LLC received a Notice of General Permit Coverage for construction-related stormwater runoff pursuant to National Pollutant Discharge Elimination System (NPDES) regulations. BMPs anticipated to be used for the project are identified in Table 3-2. In addition to these BMPs, the following general construction management techniques would be incorporated to reduce impacts to hydrology, drainage, and water features under the proposed action:

- Clearing and grubbing would be held to the minimum necessary for grading, access and equipment operation.
- Erosion and sediment control measures would be in place prior to initiating earth moving activities. Functionality would be maintained throughout the construction period.
- Construction would be sequenced to minimize the exposure time of the cleared surface area.
- Temporary soil stabilization measures would be used on disturbed areas remaining exposed for more than 30 days.
- Disturbed areas would be protected and stabilized prior to initiating new disturbance.
- Control measures (i.e., silt fences, sand bag barriers, sediment traps, geotextile mats, and other measures intended for soil/sediment trapping) would be inspected once a week during dry periods and repaired as necessary.
- Control measures (i.e., silt fences, sand bag barriers, sediment traps, geotextile mats, and other measures intended for soil/sediment trapping) would be inspected and repaired as needed within 24 hours after a rainfall event of 0.5 inch or greater over a 24-hour period. During periods of prolonged rainfall, daily inspection would occur, unless extended heavy rainfall makes access impossible or hazardous.
- Records for all inspections and repairs would be maintained on site.
- Permanent soil stabilization (i.e., graveling or re-planting of vegetation) would be applied as soon as practical after final grading.

Kahuku Wind Power LLC has joined the Windward O‘ahu Soil and Water Conservation District as an active member and would continue to work with the district on issues regarding on-site drainage.

3.5.2.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, no changes would occur to existing surface water conditions.

3.5.3 Flooding

Executive Order 11988 requires federal agencies to avoid adverse impacts to floodplains to the extent possible. Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency’s National Flood Insurance Program depict flood hazard areas through the state. The maps classify land

into four zones depending on the expectation of flood inundation and extent of investigation. The Kahuku Wind Power project area is entirely located in Flood Zone D where analysis of flood hazards has not been conducted and flood hazards are undetermined. The Flying R Ranch site is also located in an area identified as Flood Zone D. In general, because of topographic relief, potential for flooding at the Flying Ranch microwave tower site or in the project area, outside of the immediate vicinity of the gulches, appears to be very low. The Waialua Substation is located in Flood Zone X, outside the 100-year floodplain. Areas in Zone X have a 1% annual chance of sheet flow flooding where average depths are less than 1 ft (0.3).

Surface water generally drains from the southwest to northeast on the Kahuku Wind Power project area (Belt Collins Hawai‘i Ltd. 2007a). Areas of standing water may be found in localized areas following prolonged periods of heavy rainfall. These highly ephemeral features lack both hydric soils and hydrophilic vegetation; yet when present, they have been found on occasion to attract waterbirds. In order to minimize risk of avian collision mortality, Kahuku Wind Power LLC intends to grade the low-lying areas during construction to improve drainage and prevent standing water from collecting after heavy rain, thereby eliminating the potential to attract waterbirds to the project area.

3.5.3.1 Potential Impacts of the Proposed Action

The level of flood risk on the project area is unknown. The National Flood Insurance Program does not have any regulations for developments within Zone D; however, no structures would be located within areas know to collect water after heavy rain. Minor grading or alterations that would be conducted on-site to prevent areas of standing water are not anticipated to affect the natural topography and drainage beyond the immediate area of the work. Thus, flood hazard would not be increased as a result of the proposed project.

None of the proposed microwave tower sites would involve work that could affect flood hazard.

3.5.3.2 Potential Impacts of the No Action Alternative

Existing conditions would not be impacted if the facility was not constructed and operated.

3.5.4 Groundwater

O‘ahu has a vast amount of groundwater, which supplies most of the domestic water supply (Macdonald et al. 1983, Lau and Mink 2006). Groundwater in Kahuku is part of the Ko‘olauloa Aquifer system of the Windward Aquifer sector that extends from Punalu‘u Valley to Kahuku Point (Mink 1982). This aquifer primarily occurs as a basal freshwater lens in the dike-free Ko‘olau Basalt and overlying unconsolidated and consolidated sedimentary deposits. Salinity is less than 250 milligrams per liter chloride [mg/l Cl^-]. It is currently used for drinking water, but has a high vulnerability to contamination (Belt Collins Hawai‘i Ltd. 2007a).

Depth to groundwater in the project area is estimated to range from approximately 20 to 400 ft (6 to 122 m) below ground surface (Belt Collins Hawai‘i Ltd. 2007a). Regionally, groundwater moves from the volcanic-rock aquifers into the overlying sedimentary deposits and eventually discharges to the ocean. The precise direction of groundwater flow beneath the property is not known (Belt Collins Hawai‘i Ltd. 2007a). Mean annual groundwater recharge in the Ko‘olau region due to rainfall infiltration is approximately 3.8 million gallons per day; however, ground water flow through the area is anticipated to be higher due to inflow from the adjacent dike complex (Miller et al. 1999).

The off-site microwave towers are in the Waialua Aquifer system of the North Aquifer sector area. Sedimentary caprock in the aquifer confines water within a thick basal lens in the dike-free Ko‘olau Basalt. Groundwater in the region moves in a seaward direction and has been impacted by agricultural activities (Wilson Okamoto & Associates, Inc. 2000).

3.5.4.1 Potential Impacts of the Proposed Action

As stated previously, the proposed project would result in only slight increases in impervious surfaces. Because precipitation falling on these impervious surfaces would likely runoff to adjacent open lands where aquifer recharge would occur, the slight increase in impervious surfaces is not expected to measurably reduce potential for groundwater recharge.

Kahuku Wind Power LLC plans to tap an existing well located on an adjacent site for its water requirements (see Section 3.15.6). Given the nature of the proposed project and low number of people working on-site, water usage would be very low, and is not expected to adversely affect the amount of groundwater in the aquifer. Therefore, no components of the project would adversely affect the quantity of water available in basal groundwater.

Construction, operation, and decommissioning activities associated with the proposed action would require the use of some hazardous materials, although the variety and amounts of hazardous materials present during operation would be minimal. Types of hazardous materials to be used would include fuels (e.g., gasoline, diesel fuel), lubricants, cleaning solvents, and paints (see Section 3.9.2). With the implementation of the appropriate management practices discussed below, the adverse impacts of hazardous materials and wastes on groundwater are expected to be negligible to non-existent.

Prior to construction, Kahuku Wing Power LLC would prepare a Spill Prevention, Countermeasure, and Control (SPCC) Plan for the facility. The SPCC Plan would identify where hazardous materials and wastes are stored on-site, spill prevention measures to be implemented, training requirements, appropriate spill response actions for each material or waste, the locations of spill response kits on-site, a procedure for ensuring that the spill response kits are adequately stocked at all times, and procedures for making timely notifications to authorities. The plan would identify and address storage, use, transportation, and disposal of each hazardous material anticipated to be used in the project area. It would establish: inspection procedures; storage requirements; storage quantity limits; inventory control; nonhazardous product substitutes; disposition of excess materials; and material safety data sheets of hazardous materials. The SPCC would also identify requirements for notices to federal and local emergency response authorities and include emergency response plans.

Therefore, although groundwater in the project area has been identified with a high vulnerability to contamination, with the implementation of the measures outlined in the SPCC Plan, adverse impact of hazardous materials on groundwater is considered negligible.

3.5.4.2 Potential Impacts of the No Action Alternative

No change in existing groundwater conditions would occur if the facility was not constructed and operated.

3.6 Air Quality

3.6.1 Regulatory Framework

The Clean Air Act (CAA) authorizes the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS). These standards cover seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NO_X), ozone (O_3), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), sulfur oxides (SO_X), and lead (CFR Title 40, Part 50).

Air quality is also regulated by the State Department of Health (DOH), Clean Air Branch. HAR Title 11, Chapter 59 (Ambient Air Quality Standards) establishes ambient air quality standards for six of the air pollutants mentioned above (all but $PM_{2.5}$), as well as hydrogen sulfide (H_2S) (HAR, Chapter 59). These standards are monitored and enforced by the Clean Air Branch. Six DOH air quality monitoring stations are present on the Island of O‘ahu. The closest station to the project area is located in Pearl City, roughly 19.3 mi (31 km) to the south of the Kahuku project area and on the leeward side of the island. Criteria pollutant levels at this station were well below state and federal ambient air quality standards during 2007 (DOH Clean Air Branch 2008).

HAR Title 11, Chapter 60.1 (Air Pollution Control) states that “no person, including any public body, shall engage in any activity which causes air pollution or causes or allows the emission of any regulated or hazardous air pollutant without first securing approval in writing from the director” (§11-60.1-2). According to Chapter 60.1, Air Pollution Control Permits are required prior to constructing, reconstructing, modifying, or operating a stationary air pollution source. Certain air pollution sources are exempt from these requirements including vehicles, trucks, cranes, graders, loaders, etc (§11-60.1-62d). Stationary sources with potential emissions of less than 1.0 ton per year for each air pollutant are also exempt from Air Pollution Control Permit requirements. Due to the type of equipment anticipated for use during construction and operation of the project, and the low levels of emissions anticipated as described below, Kahuku Wind Power LLC is not applying for an Air Pollution Control Permit from the Clean Air Branch. However, if additional equipment is needed that requires an Air Pollution Control Permit, Kahuku Wind Power LLC would apply for a permit at that time.

3.6.2 Regional and Local Air Quality

Air quality in Hawai‘i is consistently among the best in the nation, and criteria pollutant levels remain well below state and federal ambient air quality standards (DOH Clean Air Branch 2008). Few significant sources of air pollution occur near the project area. The most significant is windblown dust that naturally arises when strong winds sweep across eroded or overgrazed areas. Other sources of airborne contaminants on or near the project area include vehicular emission on the nearby Kamehameha Highway and other roads, wildfires and anthropogenic fires, agricultural sources, and irregular natural volcanic emission from the Island of Hawai‘i. As Kahuku is on the northeast-facing side of O‘ahu, air in the region is continually refreshed by the persistent northeast tradewinds for much of the year.

3.6.2.1 Potential Impacts of the Proposed Action

The construction and operation (including monitoring) phases of the proposed project would result in emissions of low levels of air pollutants. These emissions would be temporary or infrequent, and would be generated primarily through combustion of gasoline and diesel fuel for construction and maintenance vehicles.

Construction Phase:

Potential air pollutants that may be emitted (depending on the equipment used) during the construction phase include hydrocarbons (HC), fugitive dust (PM_{10}), CO, NOx, SO_2, and CO_2. These pollutants would be released by equipment during earthmoving operations, by vehicles traveling project roadways, and by vehicles traveling to and from the project area. Emissions would primarily occur locally, intermittently, and at low levels. Expected construction emissions for criteria pollutants are summarized in Table 3-3.

Table 3-3. Construction emissions for criteria pollutants (tons per year).

Emission Source	HC	CO	NOx	SO_2	PM_{10}	CO_2
Construction Equipment Emissions[1]	0.2	0.9	2.1	0.1	0.2	259.1
Fugitive Road Dust[2]	-	-	-	-	3.1	-
Fugitive Construction Dust[3]	-	-	-	-	3.9	-
Vehicle Emissions[4]	0.2	2.0	0.8	-	-	219.9
Total	0.4	2.9	2.9	0.1	6.2	479.0

[1)] Construction emission factors (EF) were generated from the EPA NONROAD2008 model for the 2010 calendar year.

[2)] Based on EPA AP-42: Equations for vehicle fugitive dust on unpaved, industrial roads. Assumes 80% control by BMP implementation.

[3)] Fugitive dust based on 35 acres of land disturbance and EF from Mid-Atlantic Regional Air Management Association (MARAMA). Fugitive Dust-Construction Calculation Sheet, online at: http://www.marama.org/visibility/Calculation_Sheets/. MRI= Midwest Research Institute, Inventory of Agricultural Tiling, Unpaved Roads, Airstrips and construction Sites., prepared for the U.S. EPA, PB 238-929, Contract 68-02-1437.

[4)] Vehicle mission rates were generated using EPA MOBILE6.2 highway vehicle emission factor model. Fleet Characterization: 25 POVs commuting to work, assuming 50% are pickup trucks and 50% passenger cars, and 53 heavy duty diesel trucks.

Construction-related emissions would comply with HAR Title 11 Chapter 60.1 regarding air pollution control, specifically Section 11-60.1-33, regarding fugitive dust and the prohibition of visible dust emissions at property boundaries. In order to minimize any adverse effect on air quality, Kahuku Wind Power LLC would require construction contractors to adhere to the following measures:

- 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 (with no chemical additives) in sufficient quantities to minimize the amount of airborne dust leaving the site.
- Cover or continuously wet dirt stockpile areas (water with no chemical additives) containing more than 100 yards^3 (76.5 m^3) 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 revegetation, 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 (24 kph) or less.
- Cover all trucks hauling dirt, sand, soil, or other loose materials.

Because emissions during the construction phase would be temporary, relatively low level, and would be minimized by the measures stated above, construction of the project is not expected to result in appreciable degradation of air quality.

Operation Phase:

During operation (including environmental monitoring), there would be minor air emissions from staff and vendor vehicles. It is estimated that there would be a maximum of 10 one-way employee vehicle trips per day during operation. There would also be minor emissions from periodic use of cranes used for maintenance of the facility components. In addition to the maintenance equipment and vehicle emissions, operation of the electrical substation and BESS equipment would result in minor indirect emissions of greenhouse gases as a result of fossil fuel energy use for electricity. Expected operation emissions for criteria pollutants are summarized in Table 3-4.

Because vehicle usage in the area would be very low and emissions from operation of the facility would be minor, minimal adverse long-term impacts to air quality are anticipated to result from operation of the proposed project.

The proposed wind energy facility is expected to result in positive long-term impacts to regional air quality. The 30 MW of power potentially generated by the proposed facility would be able to eliminate the use of approximately 154,550 barrels of oil annually that would otherwise be used to produce conventional power. This in turn would reduce emissions of air pollutants; approximately 159.6 million pounds of CO_2 (79,800 tons), 330.3 thousand pounds of SO_2, 237.7 thousand pounds of NO_x, and 1.46 pounds of mercury per GWh per year.[3] Therefore, the proposed project has the potential to reduce the emission of major air pollutants that are products of generating electricity through combustion of fossil fuel. The proposed project would generate approximately 228.4 tons of CO_2 per year and potentially reduce approximately 79,800 tons of CO_2 per year, thus resulting in a net reduction of 79,571.6 tons or 159.1 million pounds per year of operation.

[3] These numbers are considered a conservative approximation, as the addition of the battery storage system should reduce the need for spinning reserves on the electricity grid, which would allow existing fossil fuel plants to run more efficiently, further reducing fuel use and emissions.

Table 3-4. Operation emissions for criteria pollutants (tons per year).

Emission Source	HC	CO	NOx	SO_2	PM_{10}	CO_2
Maintenance Equipment Emissions[1]	0.0007	0.0023	0.011	0.0003	0.0005	1.4
Vehicle Emissions[2]	0.3	2.9	0.2	-	-	148.6
Facility Electricity Usage[3]	-	-	-	-	-	78.4
Total	0.3007	2.9023	0.211	0.0003	0.0005	228.4

[1)] Assumes quarterly heavy overhaul/maintenance requiring 1 day of crane activity for 8 hours.

[2)] Same EF assumptions as above. Fleet characterization: 10 POVs commuting to work daily, assuming 50% are pickup trucks and 50% passenger cars, 1 weekly delivery truck for supplies, and 4 quarterly heavy duty diesel truck trips for maintenance.

[3)] Based on estimated fossil fuel use for the electrical substation and BESS equipment. Values estimated based on 14,400 kwh/month electricity usage.

3.6.2.2 Potential Impacts of the No Action Alternative

If the facility was not constructed and operated, no new emissions or changes in air quality over baseline conditions would occur as described above. The No Action Alternative would decrease the potential for replacing energy sources that burn fossil fuels and emit greenhouse gases with renewable wind power. The air quality benefits from reduced emissions of greenhouse gases and other air pollutants would not occur.

3.7 Noise

Noise is defined as any unwanted sound. Whether sound is perceived as a noise by a receiver depends on subjective factors, including the amplitude and duration of the sound (Rodgers and Manwell 2004). The frequency of a sound also greatly influences the ability of a receiver to hear a sound; people are generally more sensitive to certain higher frequency sounds than lower frequency sounds. The A-weighted sound level, or dBA, is the sound level measurement (in decibels) that accounts for this preferential response to frequency and provides some correlation with the sensitivity of the human ear to that sound. Typical dBA values of common indoor and outdoor noise sources are shown in Figure 3-3.

3.7.1 Regulatory Framework

The State of Hawai‘i regulates noise levels through the DOH regulations (HAR Title 11, Chapter 46). These regulations are also intended to protect public health and welfare, and to prevent significant degradation of the environment and quality of life. Maximum permissible sound levels are dependent on zoning designations and time of day (Table 3-5). The maximum permissible sound levels specified in the Community Noise Control Rule do not apply to any particular distance from a source (such as a WTG), but apply to sound levels at the property boundary (DLAA, Ltd. 2009).

Table 3-5. Maximum permissible sound levels in dBA.

Zoning Districts	Daytime (7AM to 10PM)	Nighttime (10PM to 7AM)
Class A (residential, conservation, preservation, public space, open space)	55	45
Class B (multi-family dwellings, apartment, business, commercial, hotel, resort)	60	50
Class C (agriculture, country, industrial, similar)	70	70
Source: HAR Title 11, Chapter 46, Community Noise Control.		

The proposed project would be subject to the Community Noise Control Rule. The project area is considered a Class C Zoning District; therefore, noises produced by the project cannot exceed 70 dBA[4] *at the project area property line*. Some adjacent residential properties are considered a Class A Zoning District; therefore, *at the property lines of these adjacent residences*, noise levels from the project cannot exceed 55 dBA during the daytime or 45 dBA during the nighttime (DLAA, Ltd. 2009).

[4] dBA is the sound level, in decibels, read from a standard sound-level meter using the "A-weighting network."

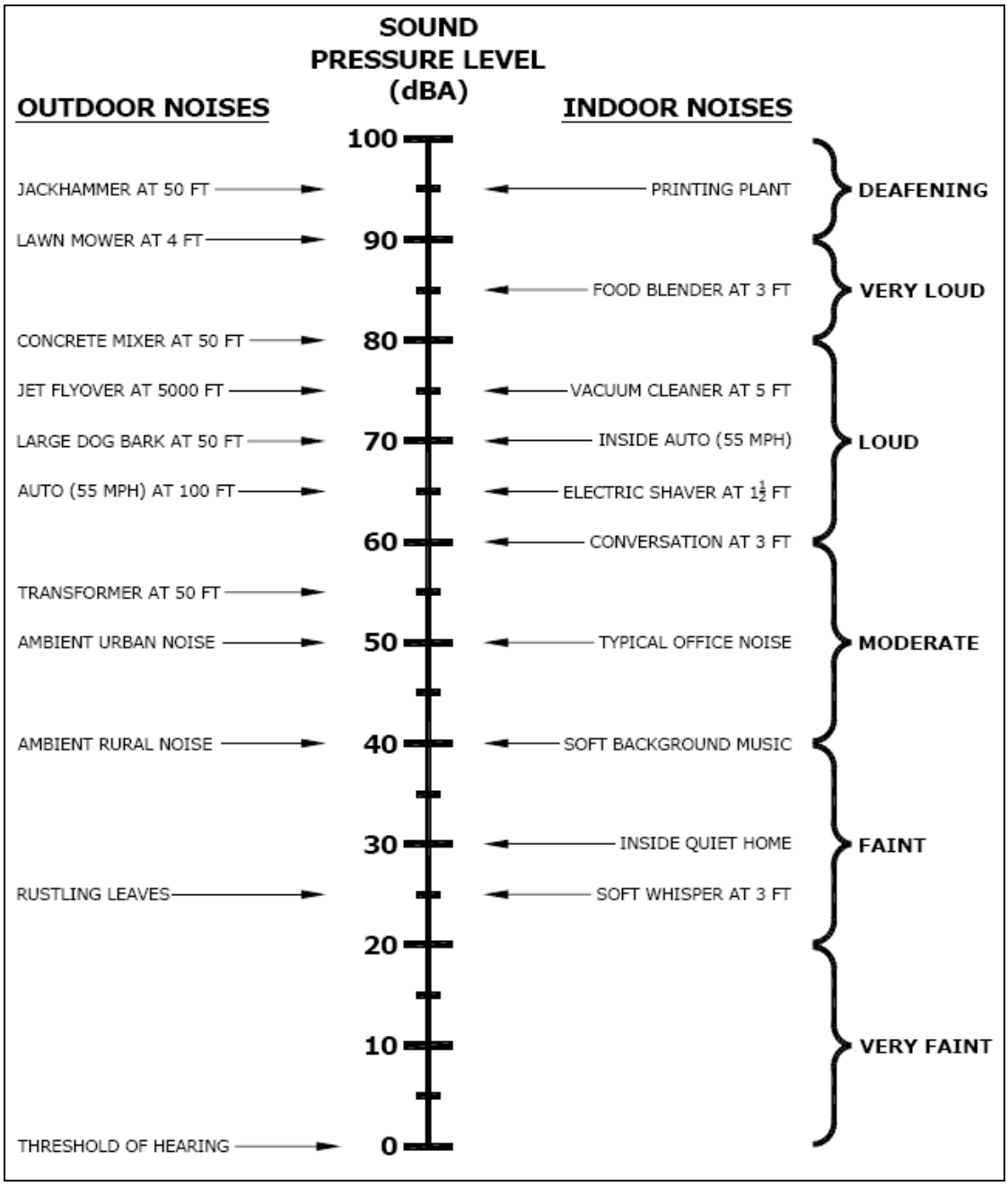


Figure 3-3. Typical dBA values of common indoor and outdoor noise sources from DLAA, Ltd. (2009).

3.7.2 Ambient Sound Levels

Ambient sound levels must be identified in order to determine whether sounds produced by the WTGs would be audible over background levels. Long-term ambient sound measurements were conducted by D.L. Adams Associates (DLAA), Ltd. in November and December 2008 in two regions - "Community" and "Property Line." The Community measurements were conducted at six locations in the communities of Kahuku and Kuilima, which lie adjacent to the project area. Property Line measurements were

conducted at six locations on or near the property lines of the proposed Kahuku Wind Power facility. All 12 measurement locations are shown in Figure 3-4.

Ambient sound measurement results are included in Table 3-6. The average calculated day-night level, L_{dn}, ranged from 46 to 60 dBA in the project area and 53 to 68 dBA in the surrounding communities (DLAA, Ltd. 2009). The measurements are fairly consistent for all locations indicating a generally uniform ambient sound environment throughout the project area. Contributing sound sources included wind, birds, occasional aircraft flyovers, community noises, landscaping or grading equipment, and vehicular traffic noise from Kamehameha Highway (DLAA, Ltd. 2009).

Table 3-6. Ambient sound measurement results.

Location	Daily Avg. Sound Level L_{eq} (Day)[1]	Daily Avg. Sound Level L_{eq} (Night)[2]	Daily Avg. Day-Night Level L_{dn}[3]
Community			
Turtle Bay Resort	50 - 58 dBA	44 - 55 dBA	53 - 61 dBA
Romy's Shrimp Trucks[4]	61 - 67 dBA	56 - 61 dBA	64 - 68 dBA
Kahuku Medical Center	48 - 55 dBA	47 - 52 dBA	54 - 59 dBA
Kahuku High School	46 - 59 dBA	46 - 53 dBA	53 - 60 dBA
Mauka Village	51 - 58 dBA	44 - 54 dBA	53 - 61 dBA
Ki'i Road Farms[5]	46 - 52 dBA	46 - 51 dBA	53 - 57 dBA
Property Line			
North Property Line	45 - 54 dBA	42 - 47 dBA	50 - 56 dBA
North East Property Line	44 - 55 dBA	40 - 53 dBA	47 - 60 dBA
East Property Line	44 - 53 dBA	41 - 44 dBA	48 - 53 dBA
South Property Line	50 - 60 dBA	41 - 48 dBA	50 - 60 dBA
West Property Line	42 - 54 dBA	38 - 44 dBA	47 - 52 dBA
Center of Property	42 - 54 dBA	39 - 43 dBA	46 - 54 dBA

1) L_{eq}(day) is an average of the hourly equivalent sound levels during the daytime hours only (between 7:00 am and 10:00 pm) within a 24-hour measurement period. The range represents the quietest and noisiest day measured within the 7-day measurement period.

2) L_{eq}(night) is an average of the hourly equivalent sound levels during the nighttime hours only (between 10:00 pm and 7:00 am) within a 24-hour measurement period. The range represents the quietest and noisiest night measured within the 7-day measurement period.

3) The L_{dn} represents the lowest and highest calculated average day-night level from the 7-day measurement period.

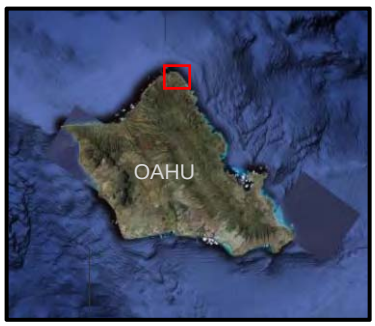
4) Romy's is a popular, commercial (stationary) shrimp truck vendor along Kamehameha Highway.

5) Peaks caused by overload or environmental conditions were removed from the average sound and day-night levels for the Ki'i Road location.

Source: DLLA Ltd. 2008.

LEGEND

C1	Turtle Bay Resort	P1	North Property Line
C2	Shrimp Trucks	P2	North East Property Line
C3	Kahuku Medical Center	P3	East Property Line
C4	Kahuku High School	P4	South Property Line
C5	Mauka Village	P5	West Property Line
C6	Kii Road Farms	P6	Center of Property



Sound Measurement Locations

Figure No
3-4

Date	Project No.	Drawn By
Sept 2009	08-26	DFD

Ambient sound measurements were not conducted at the off-site microwave towers because no additional noise is expected following construction. The Waialua site is located in a relatively quiet residential area; therefore, ambient noise levels are anticipated to be relatively low. Ambient sound levels at the Flying R Ranch are anticipated to be relatively low due to the lack of noise sources in the vicinity.

3.7.2.1 Potential Impacts of the Proposed Action

Construction Phase:

Construction of the proposed project would produce short-term noise within the project area due to the use of graders, excavators, bulldozers, cranes, cement trucks, haul trucks, compactors, and other heavy equipment. The actual noise levels produced during construction would be a function of the methods employed during each stage of the construction process (DLAA, Ltd. 2009). Typical sound levels produced by construction equipment are shown in Figure 3-5. Earth-moving equipment would probably be the loudest equipment used during construction.

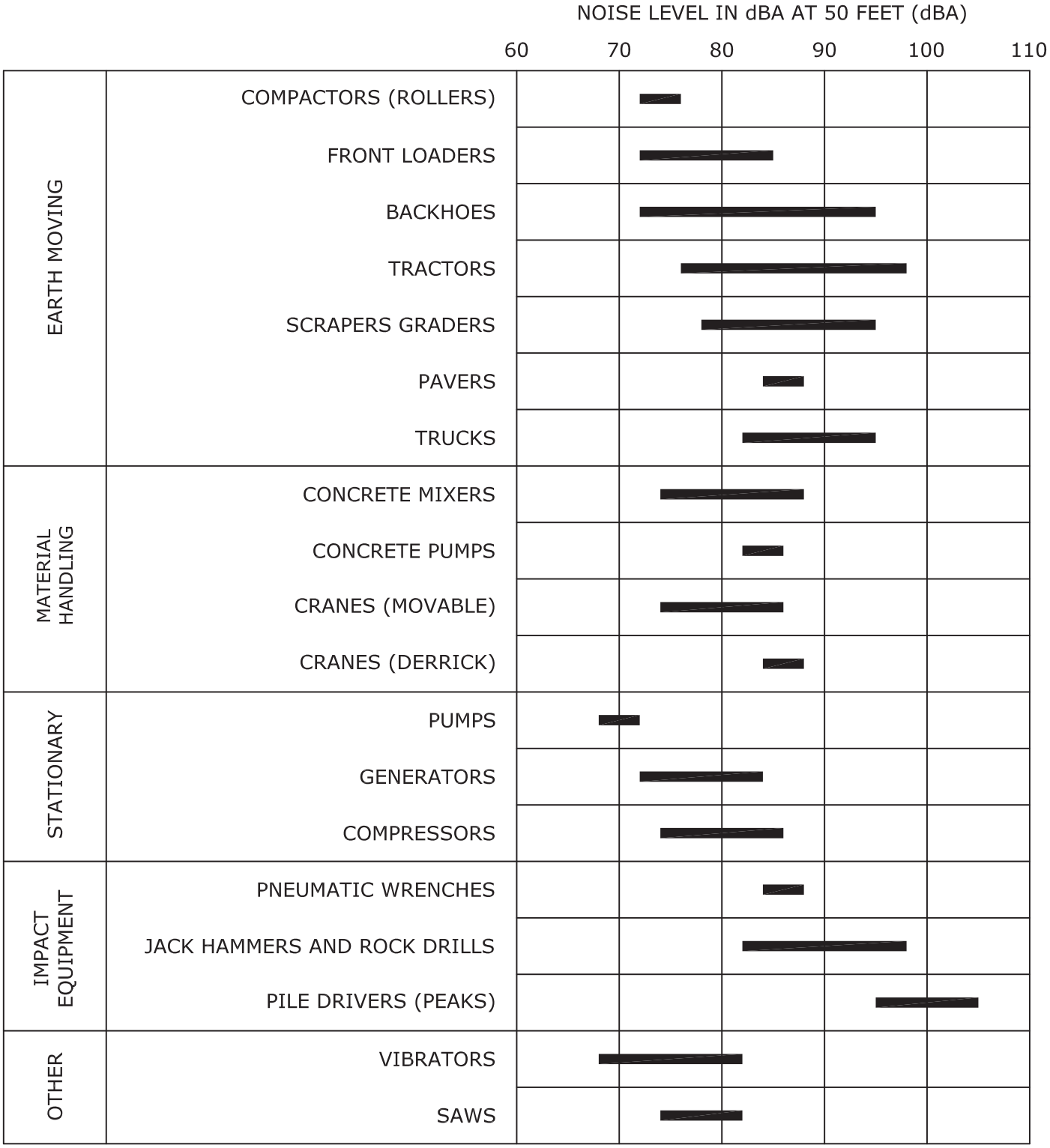
Kahuku Wind Power LLC would use reasonable and standard practices to mitigate construction noise, as needed, such as using mufflers on diesel and gasoline engines and using properly tuned and balanced machines. In cases where construction noise exceeds, or is expected to exceed the State's maximum permissible property line noise levels, a permit would be obtained from the State DOH to allow the operation of vehicles, cranes, construction equipment, and power tools that emit sound levels in excess of the "maximum permissible" levels (DLAA, Ltd. 2009). This permit provides restrictions on the time of day when construction activities may emit noise in excess of the maximum permissible sound levels, but does not restrict the amount of noise that can be generated. In order for the State DOH to issue a construction noise permit, the contractor would submit a noise permit application to the DOH that describes the construction activities for the proposed project. Prior to issuing the noise permit, the State DOH may require action by Kahuku Wind Power LLC to incorporate noise mitigation into the construction plan and/or it may require Kahuku Wind Power LLC to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise (DLAA, Ltd. 2009).

Operation Phase:

Following construction, the only project components expected to generate sound on a regular basis would be the WTGs. WTGs generate sound via various routes, both mechanical and aerodynamic. Wind turbines potentially produce four types of sound: broadband, tonal, low frequency (including infrasound), and impulsive. Sound emission from modern WTGs is dominated by the aerodynamic broadband type, which occurs as the revolving rotor blades encounter atmospheric turbulence, creating a rhythmical "swishing" sound. Tonal sounds are typically mechanical in origin, and are sounds that occur at discrete frequencies, such as a generator hum or other mechanical sound. Low frequency sound is the portion of broadband sound at the low end of the frequency spectrum, near the lower limit of human hearing. Low frequency sound can also include infrasound, which is defined as sound below the limit of human hearing (commonly known as vibration). Impulsive noise, or short acoustic impulses, can be caused by the interaction of wind turbine blades with disturbed air flowing around the tower of a downwind machine (Rogers and Manwell 2004, Pedersen and Waye 2007), although such machines are not typical of modern installations such as Kahuku, which use upwind-mounted rotor technology. As wind speed varies, lower or higher rotational speed of the turbines would typically result in lower or higher sound levels (van den Berg 2004).

The noise impact of the WTGs is dependent in part on the ambient sound levels. Assessments of the existing background sound levels help to determine whether wind turbine sound would be audible over

background sound levels. If ambient sound is high, wind turbine sound gets lost in the background (Rogers and Manwell 2004). Although increases over existing ambient noise levels can be measured, it is important to note that the public's perception of the noise impact (i.e. unwanted sound) of WTGs is in part a subjective determination. Due to the variation in the levels of individual tolerance for noise, there is no completely satisfactory way to measure the subjective impacts of noise that may result from the proposed facility (Rogers and Manwell 2004).



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

Typical Sound Levels from Construction Equipment

Kahuku Wind Farm

Not to Scale

Date	Project No.	Drawn By
September 2009	08-26	TRB

Figure No

3-5

DLAA, Ltd. (2009) used a computer software program (CADNA or Computer Aided Noise Abatement) to develop a sound propagation model of the project area and the vicinity to predict wind turbine sound at the property lines of the proposed project area and at nine locations in the surrounding community. The sound propagation model was based on the site plan, topographical data, sound data for similar wind turbines[5], and proprietary information provided by First Wind. The model assumes a scenario in which meteorological conditions, receiver height, and ground attenuation are favorable to sound propagation. A more detailed description of the model is provided in Appendix C.

The predicted sound levels at selected sites that are of specific interest regarding potential sound impacts are shown in Table 3-7. Figures 3-6 and 3-7 show the predicted sound level contours and area contours for the surrounding communities and the project area, respectively. Based on the predicted sound levels, Kahuku Wind Power would be compliant with the Community Noise Control Rule because the predicted wind turbine sound levels do not exceed the DOH maximum permissible sound limits at the property line or in the surrounding communities (DLAA, Ltd. 2009).

Table 3-7. Predicted Wind Turbine Sound Levels at Selected Sites.

Location	Distance[1]	Predicted Sound Level[2]	DOH Limit[3]
Turtle Bay Resort	10,000 ft (3,050 m)	< 33 dBA	50 dBA
Turtle Bay Entrance	6,500 ft (2,000 m)	33 dBA	50 dBA
Romy's Shrimp Trucks	2,110 ft (650 m)	48 dBA	50 dBA
Kahuku Medical Center	5,000 ft (1,500 m)	41 dBA	50 dBA
Kahuku High School	6,400 ft (1,950 m)	38 dBA	45 dBA
Mauka Village	4,300 ft (1,300 m)	42 dBA	45 dBA
Ki'i Road Farms	1,900 ft (600 m)	46 dBA	70 dBA
Marconi Area	4,900 ft (1,500 m)	40 dBA	70 dBA
Kupuna Housing	7,600 ft (2,300 m)	36 dBA	45 dBA
Site Property Lines	Varies	54-58 dBA	70 dBA

1) Approximate distance from indicated location to closest WTG.

2) The predicted sound levels are based on the conditions indicated above.

3) The DOH maximum permissible nighttime sound limits are based on the zoning of the indicated location.

[5] A complete sound power data report, per IEC 61400 requirements, is currently not available for the Clipper C96 turbines. It is expected that the sound data for the Clipper C96 turbines will be similar to the sound data that was estimated for use in the model. However, it is possible that the actual wind turbine sound data could vary slightly from the estimated sound data.

To determine if sound from the future WTGs would impact the adjacent properties and nearby neighborhoods, the results of the sound propagation model were compared to the existing ambient sound levels measured at the 12 ambient sound measurement locations. As shown in Table 3-8, WTGs at the proposed Kahuku Wind Power facility are expected to increase the ambient sound environment in the surrounding communities from 0 to 3 dB. A change in sound level of less than 3 dB is not a perceptible difference to most listeners (DLAA, Ltd. 2009). The agricultural areas closest to the proposed Kahuku Wind Power facility (such as Ki‘i Road Farms) would experience the greatest increase in ambient sound, up to 3 dB, but the total sound level would still be well below the DOH limit.

It is expected that the WTGs would not usually be audible in the surrounding communities over typical ambient sounds that occur throughout the day and night. On very quiet nights when the wind speed is not sufficient to drive the wind turbine, sound from the WTGs is expected to be minimal and not significant. However, a phenomenon is known to occur where local atmospheric and terrain conditions occasionally produce wind speeds sufficient to drive the wind turbines although the surrounding community experiences low wind speeds, and accordingly, low ambient sound levels. On these occasions, WTGs at Kahuku Wind Power may be audible in the neighboring community (DLAA, Ltd. 2009). However, because the WTGs would not be continually audible, the proposed project is not expected to significantly impact the adjacent properties or the surrounding area.

Kahuku Wind Farm

Kahuku, Oahu, Hawaii

Prepared for First Wind Energy, LLC

September 2009

Figure 3-6

Predicted Sound Level Contours for the Surrounding Communities

- = 25 dBA
- = 30 dBA
- = 35 dBA
- = 40 dBA
- = 45 dBA
- = 50 dBA
- = 55 dBA
- = 60 dBA

Kahuku Wind Farm

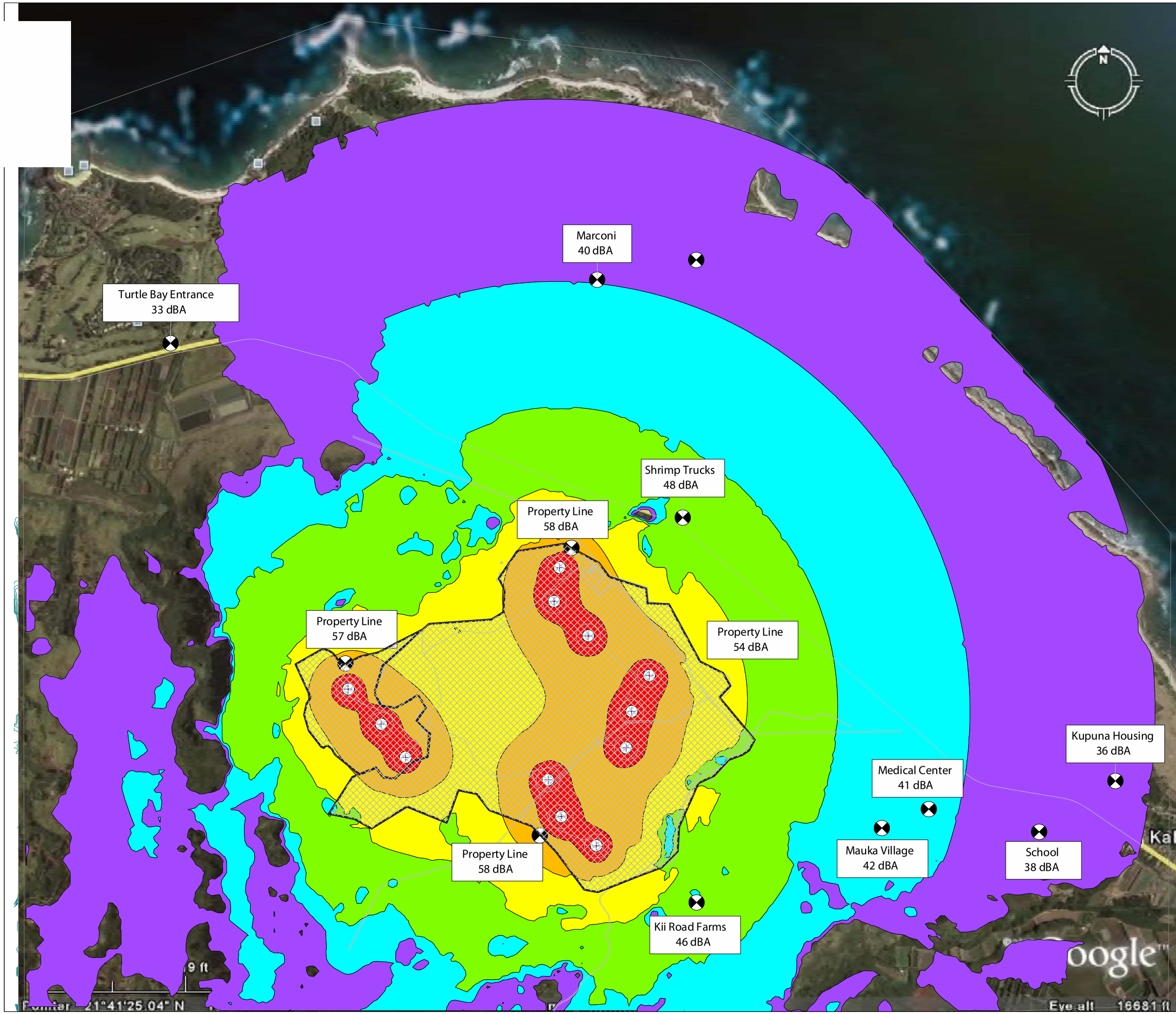
Kahuku, Oahu, Hawaii

Prepared for First Wind Energy, LLC

September 2009

Figure 3-7

Predicted Sound Level Area Contours for the Project Area



- > 35 dBA
- > 40 dBA
- > 45 dBA
- > 50 dBA
- > 55 dBA
- > 60 dBA

Table 3-8. Predicted Wind Turbine and Existing Ambient Sound Levels in the Vicinity of Kahuku Wind Power.

Location	DOH Limit	Predicted Sound Level	Measured Min. Average L_{eq}(Night)	Combined Sound Level[1]	Δ due to New WTGS[2]
Turtle Bay Resort	50 dBA	33 dBA	44 dBA	44 dBA	+ 0 dB
Romy's Shrimp Trucks	50 dBA	48 dBA	56 dBA	56 dBA	+ 0 dB
Kahuku Medical Center	50 dBA	41 dBA	47 dBA	48 dBA	+ 1 dB
Kahuku High School	45 dBA	38 dBA	46 dBA	47 dBA	+ 1 dB
Mauka Village	45 dBA	42 dBA	44 dBA	46 dBA	+ 2 dB
Ki'i Road Farms	70 dBA	46 dBA	46 dBA	49 dBA	+ 3 dB

[1)] Combined sound level is the logarithmic addition of the predicted sound level plus the measured ambient sound level.

[2)] The predicted change (in dB) due to wind turbines is the amount by which the ambient sound environment is expected to increase with the addition of the Kahuku Wind Power facility.

3.7.2.2 Potential Impacts of the No Action Alternative

If the facility was not constructed and operated, no change in existing noise conditions would occur in the project area.

3.8 Scenic Resources

A scenic viewshed is broadly defined as a vista visible from a human observation point. Any structure or emission that decreases the aesthetics of a scenic viewshed is considered to have an impact on scenic resources.

Most of the lands within and surrounding the project area are uninhabited former cane lands that have been more recently used for cattle grazing. Hence, the project area presents a rural and agricultural view from the surrounding Kahuku town and Kamehameha Highway with few man-made features on the hillsides. The closest non-agricultural land uses in the vicinity are residences in Kahuku town and Turtle Bay Resort, which are located 4,300 and 6,500 ft (1,300 and 2,000 m) away, respectively. Few vertical features are currently present in the area, including the 197 ft (60 m) tall temporary met towers and two HECO electrical transmission lines supported on 50 ft utility poles (one line crosses the northeastern portion of the project area and the other crosses the southwestern portion). These vertical features are not immediately visible from many vantage points.

The Kahuku Wind Power project area is not specifically identified as a scenic vista or viewshed in county or state plans or studies. The Ko'olau Loa Sustainable Communities Plan (1999) identifies the need to "preserve the region's rural character and its natural, cultural, scenic and agricultural resources." The

City and County of Honolulu's Coastal View Study (1987) identifies the importance of open spaces, as well as vegetation and agricultural uses in this portion of the island. These planning documents note the importance of preserving the rural character of the area by visually maintaining open spaces and viewsheds, low density development, and agricultural areas.

The location of the Waialua Substation site is not identified as a scenic vista or viewshed in county or state plans or studies. The entire Wai'anae Mountain Range, where the Flying R Ranch site is located, is identified as a scenic resource at several vantage points throughout the north shore of O'ahu (DPP 2000). The most prominent man-made structure in the vicinity of the Flying R Ranch site is a red and white lattice tower (owned by Crown Castle) over 100 ft (30 m) tall. Utility lines, supported on approximately 50 ft tall wooden utility poles, also occur throughout the landscape and immediately below the proposed tower site.

3.8.1 Potential Impacts of the Proposed Action

Belt Collins Hawai'i Ltd. conducted an initial view analysis of the wind energy project in September 2007, which encompassed land from the shoreline to 12 mi (20 km) mauka of the property boundary. The analysis produced computer simulated visualizations of the proposed project and identified line-of-sights using ESRI® ArcGIS™/ArcScene™ view analysis and viewshed mapping (Belt Collins Hawai'i Ltd. 2007b). In August 2009, an updated view analysis was performed to reflect the current turbine layout (Belt Collins Hawai'i Ltd. 2009). Figure 3-8 indicates the number of turbines within the line-of-sight from each 10 m^2 cell on the surface map, based on the updated analysis. Within the 12 mi study area, the number of turbines visible generally increases with distance from the project area.

Photoshop® renderings were also produced in which wind turbine images were overlaid on photos taken from 17 roadside locations. Only WTGs were used in the photo rendering because they are much taller and bulkier than the other structures associated with the project (i.e. overhead cable, utility poles, buildings) and thus are considered the most visible structures. Photo renderings were not revised for the current layout; however, the current layout is not expected to substantially affect the visibility depicted in the September 2007 renderings because many of the turbine locations remained essentially the same (Belt Collins Hawai'i Ltd. 2009).

In many of the photo renderings, turbines are not evident as they are screened by vegetation, houses, or other physical features in the landscape. The 17 photo renderings are shown in Figures 3-9 to 3-17, and each roadside location is briefly described below.

Location A, Kahana Bay: Some of the WTGs are slightly visible along the horizon; most are obscured by vegetation.

Location B, BYU: The WTGs in the photo rendering appear among the tree tops and are obscured by vegetation.

Location C, Mālaekahana State Recreation Park Entrance: The WTGs are visible, but screened by vegetation and the ridgeline.

Location D, Kahuku Village: Vegetation and houses screen the WTGs from this photo location.

Location E, Kahuku Golf Course Parking Lot: A clear view of the WTGs is provided from this perspective at an elevation of approximately 30 ft (9 m) overlooking the Pu'uluana Street Senior Housing area.

Location F, Pu‘uluana Street Senior Housing Area: The vegetation and houses screen some of the WTGs from this photo location.

Location G, Kahuku Superette: The vegetation and houses screen most the WTGs.

Location H, Kahuku High School Football Field: Some of the WTGs are obscured by the vegetation.

Location I, Kahuku Hospital: All the WTGs are clearly visible, although some are outside of the photo frame.

Location J, Kamehameha Highway near Romy’s Shrimp Truck: Few WTGs are visible because they are obscured by the 60- to 80-ft (18- to 24-m) tall trees located along Kamehameha Highway. Only three WTGs are slightly visible behind the group of trees in the center of the photo.

Location K, Kamehameha Highway Northwest of Romy’s Shrimp Truck: Trees obscure the visibility of the WTGs, although few of the WTG blades are visible between the tree line break in the center of the photo.

Location L, Kamehameha Highway outside of the Army Training Area entrance gate: This photo location presents a clear and close view of the WTGs. No vegetation obscures the visibility and the tips of the turbines blades protrude from behind the nearby hill.

Location M, Kamehameha Highway east of the Turtle Bay Resort entrance: Of the 12 WTGs, the row of turbines closest to Kamehameha Highway is visible from this photo location. The other seven WTGs are screened by the nearby hill located on the right side of the photo rendering.

Location N, Army Training Area: A clear view of WTGs is provided from this perspective.

Location O, Turtle Bay Resort: Because of the heavy landscaped vegetation around the resort, none of the WTGs are visible from this location.

Location P, Kawela Bay: No WTGs are visible from this location because they are screened by trees ranging from 60 to 80 ft in height.

Location Q, Sunset Beach: No turbines are visible from this location.

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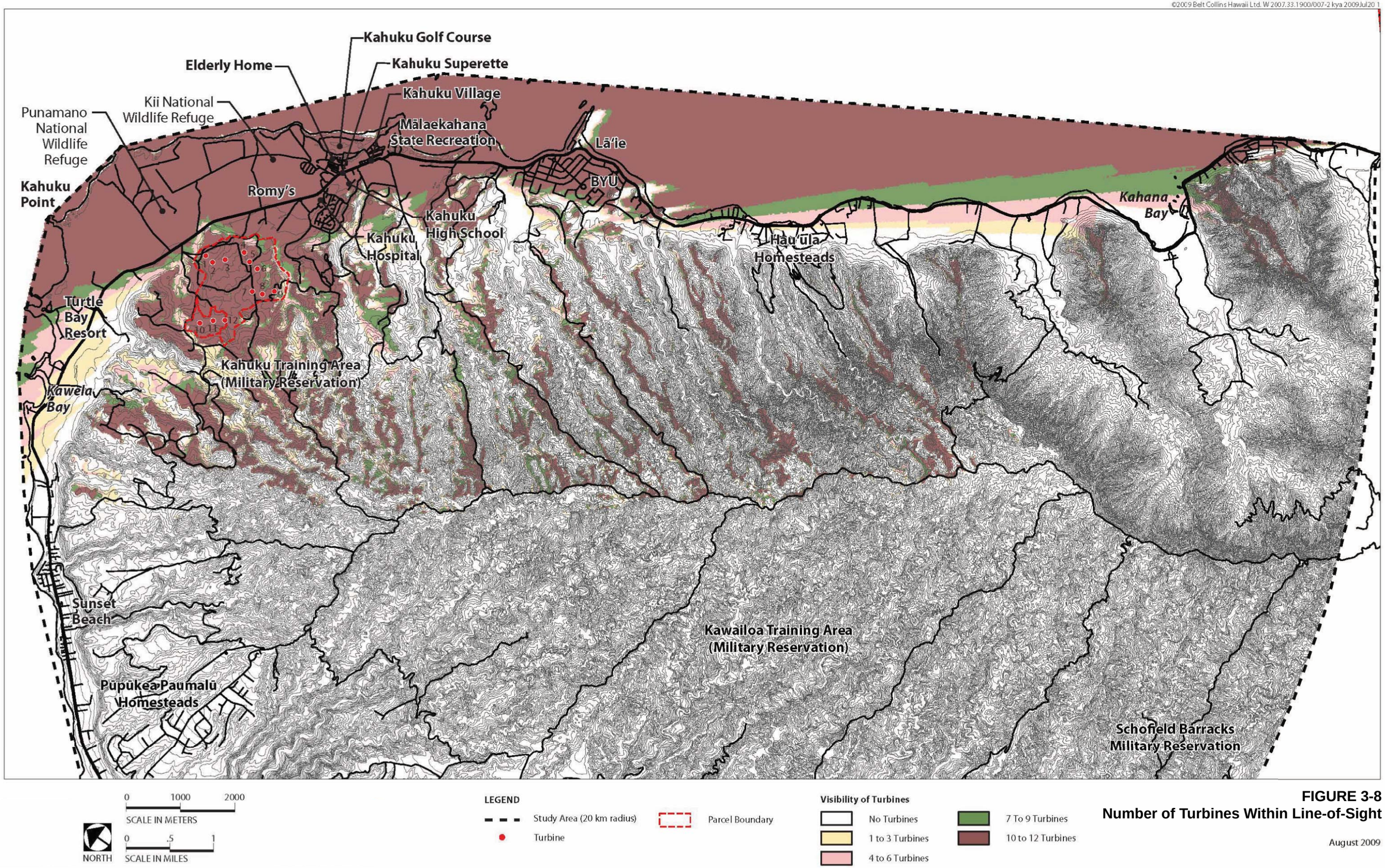


FIGURE 3-8
Number of Turbines Within Line-of-Sight

August 2009

© 2007 Belt Collins Hawaii Ltd.

Location A
VIEW FROM KAHANA BAY
Figure 3-9
Photo Rendering
September 2007

© 2007 Belt Collins Hawaii Ltd.

Location B
VIEW FROM BYU IN LA`IE
Figure 3-9
Photo Rendering
September 2007

©2007 Belt Collins Hawaii Ltd.

Location C
VIEW FROM MALAEKAHANA STATE RECREATION PARK
Figure 3-10
Photo Rendering
September 2007

©2007 Belt Collins Hawaii Ltd.

Location D
VIEW FROM KAHUKU VILLAGE
Figure 3-10
Photo Rendering
September 2007

Location E
VIEW FROM KAHUKU GOLF COURSE
Figure 3-11

Photo Rendering
September 2007

Location F
VIEW FROM PU`ULUANA STREET SENIOR HOUSING
Figure 3-11

Photo Rendering
September 2007

©2007 Bob Collins Hawaii Ltd

Location G
VIEW FROM KAHUKU SUPERETTE
Figure 3-12

Photo Rendering
September 2007

©2007 Bob Collins Hawaii Ltd

Location H
VIEW FROM KAHUKU HIGH SCHOOL FOOTBALL FIELD
Figure 3-12

Photo Rendering
September 2007

Location I
VIEW FROM KAHUKU HOSPITAL
Figure 3-13
Photo Rendering
September 2007

Location J
VIEW FROM KAMEHAMEHA HIGHWAY-ROMY'S SHRIMP TRUCK
Figure 3-13
Photo Rendering
September 2007

©2007 Belt Collins Hawaii Ltd.

Location K
VIEW FROM KAMEHAMEHA HIGHWAY NORTHWEST OF ROMY'S
Figure 3-14
Photo Rendering
September 2007

©2007 Belt Collins Hawaii Ltd.

Location L
VIEW FROM KAMEHAMEHA HIGHWAY-ARMY TRAINING AREA ENTRANCE GATE
Figure 3-14
Photo Rendering
September 2007

©2007 Bek Collins Hawaii Ltd.

Location M
VIEW FROM KAMEHAMEHA HIGHWAY-EAST OF TURTLE BAY RESORT
Figure 3-15
Photo Rendering
September 2007

©2007 Bek Collins Hawaii Ltd.

Location N
VIEW FROM ARMY TRAINING AREA
Figure 3-15
Photo Rendering
September 2007

©2007 Belt Collins Hawaii Ltd.

Location O
VIEW FROM TURTLE BAY RESORT
Figure 3-16
Photo Rendering
September 2007

© 2007 Belt Collins Hawaii Ltd.

Location P
VIEW FROM KAWELA BAY
Figure 3-16
Photo Rendering
September 2007

©2007 Belt Collins Hawaii Ltd.

Location Q
VIEW FROM SUNSET BEACH
Figure 3-17

Photo Rendering
September 2007

In summary, the proposed WTGs would be most visible at the following roadside locations considered in the view analysis: Kahuku Golf Course, Pu‘uluana Street Senior Housing area, Kahuku Hospital, along Kamehameha Highway outside of the Army Training Area entrance gate, Kamehameha Highway east of the Turtle Bay Resort entrance, and the U.S. Army Training Area. Therefore, individuals most likely to experience impacts to scenic viewsheds include recreational users at the Kahuku Golf Course, residents at the Pu‘uluana Street Senior Housing area, patients and workers at Kahuku Hospital, and employees at the U.S. Army Training Area.

Regarding views from residential areas near the proposed project area, there are residential homes around Kahuku Hospital, including Mauka Village. Figure 3-13 shows that WTGs are visible from the hospital; therefore, WTGs may also be visible from homes in that area. There are also residential homes and a park, Kahuku District Park, within a mile of Kahuku High School (Figure 3-12) from which WTGs may be visible. While Figure 3-8 shows that it is possible for 10 to 12 turbines to be visible from most of the town of Kahuku, which includes these and other residential areas, visibility of the WTGs would vary due to screening by vegetation and houses, as shown in the view from a roadside location in Kahuku Village (Figure 3-10, Location D).

In accordance with Federal Aviation Administration (FAA) aviation safety guidance, 8 of the 12 WTGs would be lit with medium intensity, synchronized red-flashing lights. All WTGs must be painted white to comply with FAA guidance (FAA 2009e).

In the past, WTGs were previously located on adjacent plots (0.6 to 0.7 mi or 1.0 to 1.1 km northwest of the proposed project area) for many years. However, these were removed over 20 years ago, so the proposed project would introduce a new vertical element into the landscape. However, relative to other potential projects (i.e. residential developments and projects with large buildings); the proposed project would complement the rural atmosphere and agricultural character of the area (USFWS 2007). The perception of these features would vary depending on the observer. While some individuals may prefer the setting as it now exists without the WTGs, others may find it an interesting or even aesthetic point of visual interest on the landscape (U.S. DOE 2009). Time of day, time of year, and weather conditions can also influence the appearance and perception of the WTGs.

Other components of the project not assessed by computer simulated visualizations (met tower, overhead cable, utility poles, buildings) may be visible from some public vantage points. The temporary and permanent met towers would also be lit with medium intensity, synchronized red-flashing lights (FAA 2009a, 2009b, 2009c, 2009d). However, once the WTGs are constructed and lighting installed, Kahuku Wind Power LLC may be able to turn off the light on the permanent met tower due to its proximity to the lighted turbines. To minimize visual impacts due to lighting, on-site operational lighting would be minimal and shielded. Because these components of the project would be few and relatively similar in height to other structures currently in the vicinity, they are not anticipated to have a noticeable impact to scenic resources.

A view analysis and photo renderings were not prepared for the Waialua Substation site. Structures of similar height (50-60 ft utility poles and traffic lights) already exist at the Waialua Substation and therefore the single proposed tower is not expected to adversely impact scenic resources.

As stated in Section 2.2, approximately 1,000 linear ft (305 m) of overhead cable, supported on wooden poles approximately 50 ft (15 m) high, would be required to transmit electricity from the nearest existing HECO electrical distribution line to the microwave tower at the Flying R Ranch. The area is visually dominated by the red and white lattice tower present in the vicinity of the site. The proposed Flying R Ranch microwave tower would be painted green to blend with the landscape and would be similar in height to the surrounding vegetation. In addition, views of the proposed Flying R Ranch tower and utility

poles from public vantage points would be screened by ridgelines and vegetation. Therefore, the impact of the proposed Flying R Ranch tower on scenic resources would be minimal.

3.8.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, there would be no change in the visual setting and no impact on scenic resources.

3.9 Public and Occupational Health and Safety

This section describes concerns related to the health and safety of the public and workers as a result of hazardous materials and conditions present during the construction and operation phases of the proposed project. Hazardous materials are defined as waste, or combination of wastes, which may cause, or significantly contribute to an increase in mortality, serious, irreversible, or incapacitating reversible illness, or a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

3.9.1 Regulatory Framework

Hazardous materials, substances, and waste are regulated by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), the Superfund Amendment Reauthorization Act (SARA), the Toxic Substances Control Act (TSCA), as well as other federal and state regulations. According to RCRA, all generators of hazardous waste must follow specific procedures for the treatment, storage, and disposal of hazardous wastes.

Occupational health and safety rights for both workers during the construction and operation phases of the facility are protected through the federal Occupational Safety and Health Act (29 USC 651 et seq.). Under this act, Congress created the Occupational Safety and Health Administration (OSHA), an agency of the U.S. Department of Labor. OSHA's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

Kahuku Wind Power LLC would comply with the above mentioned regulations, as well as other appropriate safety and security laws and regulations established by the Hawai‘i Occupational Safety and Health (HIOSH) Division, Department of Transportation (DOT), and EPA.

3.9.2 Existing Safety Hazards

A Phase I Environmental Site Assessment (Phase I) was conducted for the Kahuku Wind Power project area by Belt Collins Hawai‘i Ltd. (2007a) to identify the presence of recognized environmental conditions. This assessment consisted of a site reconnaissance, review of appropriate federal and State regulatory lists and databases, review of maps/photographs, and interviews with past and present owners.

The Phase I did not reveal evidence of recognized environmental contaminants or hazardous conditions on the property; however, there was insufficient information on several past on-site activities that are likely to have used petroleum products and/or hazardous substances. These activities include sugar cane and pineapple cultivation, earth moving, and military activities (Belt Collins Hawai‘i Ltd. 2007a).

No environmental contaminants or hazardous conditions are known to occur at the off-site microwave tower sites, although Phase I ESAs have not yet been conducted. Phase I ESAs would be completed as appropriate for financing and construction.

3.9.2.1 Potential Impacts of the Proposed Action

No hazardous substances or toxic waste would be generated or created by the construction or operation of the proposed facility. As discussed elsewhere in this report, small amounts of hazardous materials may be used during construction and operation of the project. A SPCC Plan would be prepared for the facility prior to beginning construction and operation. The SPCC would include procedures for handling and storing hazardous materials and other substances, procedures for preventing spills, 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.

Construction Phase:

Construction sites can be high-risk environments for workers. These areas offer many opportunities for falls, trips, impacts, exposure to hazardous materials, and other injuries. The disturbance of contaminated soils introduces an additional risk of hazardous material exposure, which could lead to various medical conditions depending upon the contaminant, the level of exposure, and the person being exposed. Construction of the facility would adhere to OSHA standards to maximize worker safety. No additional risks to worker safety are expected because no recognized environmental contaminants were identified in the project area.

Construction sites also have the potential to be high-risk environments for members of the general public who access the site unauthorized. The access road to the project area is gated and monitored by the Union of Operating Engineers for 24 hours each day; therefore, the risk of health and safety impacts to members of the general public would be minor.

During the construction phase, small amounts of several hazardous materials that require special handling and storage would be transported, used, and stored on-site. These may include such materials as gel-cell batteries, fuel, combustible liquid materials, chemicals, and paint. Risk of harm would be minimized by requiring the contractor to follow BMPs, 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.

The construction phase would include delivery and placement of 10,000 Xtreme PowerCell “dry-cell” batteries. According to an independent assessment of the battery technology, the battery would not leak, even if the case is cracked (hence the “dry-cell” designation). The battery is also reported as very robust and able to withstand severe shock and vibration (Kema, Inc 2009). According to the manufacturer, the batteries operate over a wide temperature range with no containment risk. The batteries are double encapsulated, encased in a thermal setting material and enclosed in an outer plastic case. The DOT classifies these batteries as non-hazardous material. The battery components are described in Table 3-9.

Table 3-9. Components of the Xtreme Powercell.

Material	% by Wt or Volume	CAS Number	Exposure Limits	
			OSHA[1]	ACGIH[2]
Lead and lead compounds	75	7439-92-1	0.05 mg/m3	0.15 mg/m3
Electrolyte	20	7664-93-9	1.0 mg/m3	1.0 mg/m3
Case Material (Polypropylene)/ Separator Paper / Glass Fiber	5	9003-07-0	N/A	

[1)] Occupational Safety and Health Administration.
[2)] American Conference of Governmental Industrial Hygienists.

Because the batteries do not leak even if the case is cracked, and the solid lead compounds are secured within the battery case, health and safety risks to employees and the public and impacts related to their use are expected to be negligible to none.

The Power Electronics and Control system would include a solid-state, industrial-grade power electronics module capable of delivering 1.5 MWs at an operating efficiency of 95 to 98%, and a solid-state control system for effective power management. The system features three levels of control hierarchy: 1) real-time Supervisory Command and Data Acquisition (SCADA) control; 2) programmable logic controller (PLC); and 3) intelligent firing circuit board (FCB). Installation and operation of the electronics and controls would not generate hazardous waste or health and safety risks to employees or to the public.

Operation Phase:

Operation of the facility would be performed in accordance with the Kahuku Wind Power Site Safety Plan. This plan would be modeled after the Kahuku Wind Power LLC Site Safety Plan (First Wind 2006) and include topics such as accident reporting, electrical safety, fall protection, and the use of personal protective equipment. This plan is expected to minimize impacts to workers' health and safety during operation. In addition, all operation activities would be carried out in compliance with OSHA requirements.

Routine operation and maintenance of the proposed facility would require the use of several materials that require special handling. These include common lubricants (e.g. gearbox oils, hydraulic fluids, insulating fluids), petroleum products, or other chemical products (e.g. oil-filled transformers, capacitors, batteries). Storage of containerized chemical products used for maintenance of the WTGs and substation would be limited, incidental, and contained to the on-site operations and maintenance building. Examples of these products include lubricating oils, aerosol lubricants, non-chlorinated dielectric solvents, and insect spray. Bulk quantities of petroleum products, pesticides, herbicides, fertilizer, or other products would not be stored on-site.

As stated above, 10,000 of the Xtreme PowerCell batteries would be in use at any given time. According to the manufacturer, the lifespan of a battery is expected to be approximately 10 years. Approximately 2 to 3%, or 200 to 300 spare batteries, would be stored on-site to replace those that fail or exceed their lifespan. Used batteries would be stored on-site prior to shipment back to the manufacturer for recycling in the State of Oklahoma. The DOT classifies these batteries as non-hazardous material. Kahuku Wind

Power LLC would be responsible for returning power cells to Xtreme for recycling. Roughly 85 to 95% of the battery is recyclable.

Accidental operational releases of hazardous materials would most likely emanate from one of the following: the O&M building, WTGs, or the substation and BESS enclosure. The O&M building would contain products/materials needed for routine operations and maintenance, including mineral oil, hydraulic oil, grease tubes, a waste oil container, and cleaner/degreaser. These items would be stored on a spill retentive skid or absorbent sheets. Diesel fuel would be stored in small containers outside the O&M building (Planning Solutions 2009).

Each WTG would contain potentially hazardous materials in the gear box (at the top of the WTG tower) and pad-mounted transformer (at the base of the WTG). The gear boxes would store hydraulic and lubricating oils, while the pad-mounted transformer would contain mineral oil. The electrical substation would also store mineral oil (Planning Solutions 2009).

Vegetation in the project area is likely to be controlled using mechanical methods; however, in the event that herbicides are used on-site, only herbicides that are registered with the EPA for the proposed use would be used. All herbicide applications would be carried out by licensed applicators in accordance with approved procedures and product labels.

Intentionally Destructive Acts:

DOE believes that the proposed facility presents an unlikely target for an intentionally destructive act and has an extremely low probability of attack. The access road to the project area is gated and access is controlled by the Union of Operating Engineers. All project facility buildings would be access controlled and all authorized personnel would be issued access key fobs to regulate entry into the facility. These measures would limit access and deter intruders.

The microwave towers are also considered very unlikely targets for acts of terrorism. The Waialua Substation site is located in a locked area. Access to the Flying R Ranch site is via a privately owned road that has several locked gates which are controlled by the landowner, Waialua Ranch Partners. The site is roughly 1.5 mi (2.4 km) from the nearest public road (Farrington Highway).

The potential for the proposed action to result in impacts from an intentionally destructive act is negligible.

3.9.2.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, there would be no impact on public and occupational health and safety and no change from existing conditions.

3.10 Land Use

3.10.1 Existing, Past, and Future Land Uses

The proposed project is located in the community of Kahuku in the Koʻolauloa District on the northeastern portion of Oʻahu. The project area encompasses two parcels (Tax Map Key 5-6-005:007 and 5-6-005:014), which are owned by Kahuku Wind Power LLC. This property is bounded on the northwest by Charlie Road, a paved access road off Kamehameha Highway. It is bounded on the east by pasture and agricultural lands along the Kamehameha Highway and on the west and south by agricultural land owned by the State of Hawaiʻi. The north and northwestern portions abut a ti plantation, which are leased

by a ti farmer. The Operating Engineers train students on operating and maintaining heavy equipment on lands to the west of the property. The Kahuku Training Area military reservation is south of the property (Belt Collins Hawai‘i Ltd. 2007a). Notable nearby land uses within the vicinity of the project area include: James Campbell NWR expansion area (0.2 mi or 0.3 km); Kuilima-owned golf courses (0.3 mi or 0.5 km); Romy’s Shrimp Truck (0.4 mi or 0.6 km); Kahuku High School (1.0 mi or 1.6 km); Kahuku Town (1.25 mi or 2 km); Turtle Bay Resort Entrance (1.2 mi or 2 km); and Mālaekahana State Recreation Park Entrance (2.5 mi or 4 km). The U.S. Army utilizes approximately 9,363 acres (3,789 ha) of mauka lands above the Turtle Bay Resort and Kahuku Town for military training (DPP 1999).

Past land uses have significantly impacted the property, resulting in a patchwork of invasive plant species throughout the project area and a large, barren spot that is missing topsoil. From the mid-1870s to 2005, the property was owned by The James Campbell Trust Estate (Campbell Estate). The property was used for sugar cane cultivation from the 1870s until 1971. FPI Commercial and Amorient Aquaculture were previous tenants of Campbell Estate during this time, using the land for aquaculture and subletting portions to farmers. Between 1987 and 1991, soil was excavated from portions of the project area for use as fill and topsoil material for the Arnold Palmer Golf Course at the Turtle Bay Resort (Belt Collins Hawai‘i Ltd. 2007a). Three previous wind power projects operated in the area (including on portions of the site) in the 1980s and 1990s, but have since been dismantled.

In August 2005, Continental Pacific, LLC, a large agricultural developer, bought the property from Aina Nui, which was a former entity of Campbell Estate. The property had several lessees including: one for cattle grazing, Operating Engineers, and Gunstock Ranch. Operating Engineers occupied the northwestern side of the property to train students on operating and maintaining heavy equipment (Belt Collins Hawai‘i Ltd. 2007a, Rechtman 2009). Kahuku Wind Power LLC purchased the property in May 2007, with the exception of approximately 70 ac (28 ha) that is leased from Continental Pacific, LLC.

All lands and waters in the State are classified into one of four districts: Agriculture, Rural, Conservation, or Urban (HRS Chapter 205). The project area and surrounding lands are in an Agricultural District (Figure 3-18). State Conservation District lands are mauka of the property and across Kamehameha Highway from the project area. The City and County of Honolulu zoning ordinance defines the project area as AG-1 Restrict Agricultural District. Adjoining land is also zoned AG-1 Restricted or AG-2 General.

According to the State Department of Agriculture’s Agricultural Lands of Importance to the State of Hawai‘i (ALISH) system, less than 60% (341 ac or 138 ha) of the agricultural areas on the project area is designated as Prime Farmland and 23% (134 ac or 54 ha) is defined as Other. Remaining areas are unclassified. Prime agricultural land is defined as land with soil temperature, soil pH, moisture supply, and growing season needed to produce high yields of crops when treated and managed according to modern farming methods. The Other designation refers to land that is important to agriculture, but lacks properties to be Prime or Unique; this land usually has slopes less than 35% and has been used or could be used for grazing. Wind energy facilities are permitted uses on agricultural areas, per HRS Chapter 205-4.5.

As described in Section 2.2, the Kahuku Wind Power facility would consist of 12 WTGs, an O&M building, one permanent unguyed met tower, one on-site and two off-site microwave towers, an electrical substation, a BESS, and a network of unpaved service roadways. Construction of the proposed facilities would disturb approximately 67 ac of the 578 ac project area (about 11.5%). Roughly 32 ac of the disturbed areas (about 5.6% of the project area) would contain structures, hardened surfaces, and associated setbacks (Table 2-1). The remainder would remain undisturbed. Kahuku Wind Power LLC is in the process of evaluating the possibility of complementary agricultural uses in the project area including community gardens, small plot farming, and grazing of livestock. However, no finalized plans

have been put in place nor have definite areas been designated for these secondary usages (Environet, Inc. 2009). Any such uses would be excluded from the 60-ft setbacks afforded the coral reef escarpments.

The Waialua Substation site is located within a rural residential area characterized by single-family homes. Agricultural, commercial, and light industrial uses occur in the vicinity. The site is within an Urban District zoned as R-5 Residential District. The site is entirely owned by HECO.

The Flying R Ranch site is owned by Waialua Ranch Partners. A single residence is located roughly 722 ft (220 m) from the proposed site. Privately owned pasture land and related structures occur in the vicinity. The nearest residential neighborhood is roughly over 1.1 mi (1.8 km) away. The site is accessed via a private road at the intersection of Kaukonahua Road and Farrington Highway. Flying R Ranch site is located in an Agricultural District and is zoned AG-1 Restricted. The ALISH system ranks the site as Other.

3.10.1.1 Applicable Land Use Policies, Plans, and Regulations

Federal, state, and county land use policies, plans, and regulations that are applicable to the proposed action are listed below. A complete description of these policies, plans, and regulations is provided in Appendix D. Other federal and state policies, plans, and regulations that apply to land use (such as the Federal Endangered Species Act, Migratory Bird Treaty Act, National Historic Preservation Act, and Clean Water Act) are discussed in their respective sections.

Federal

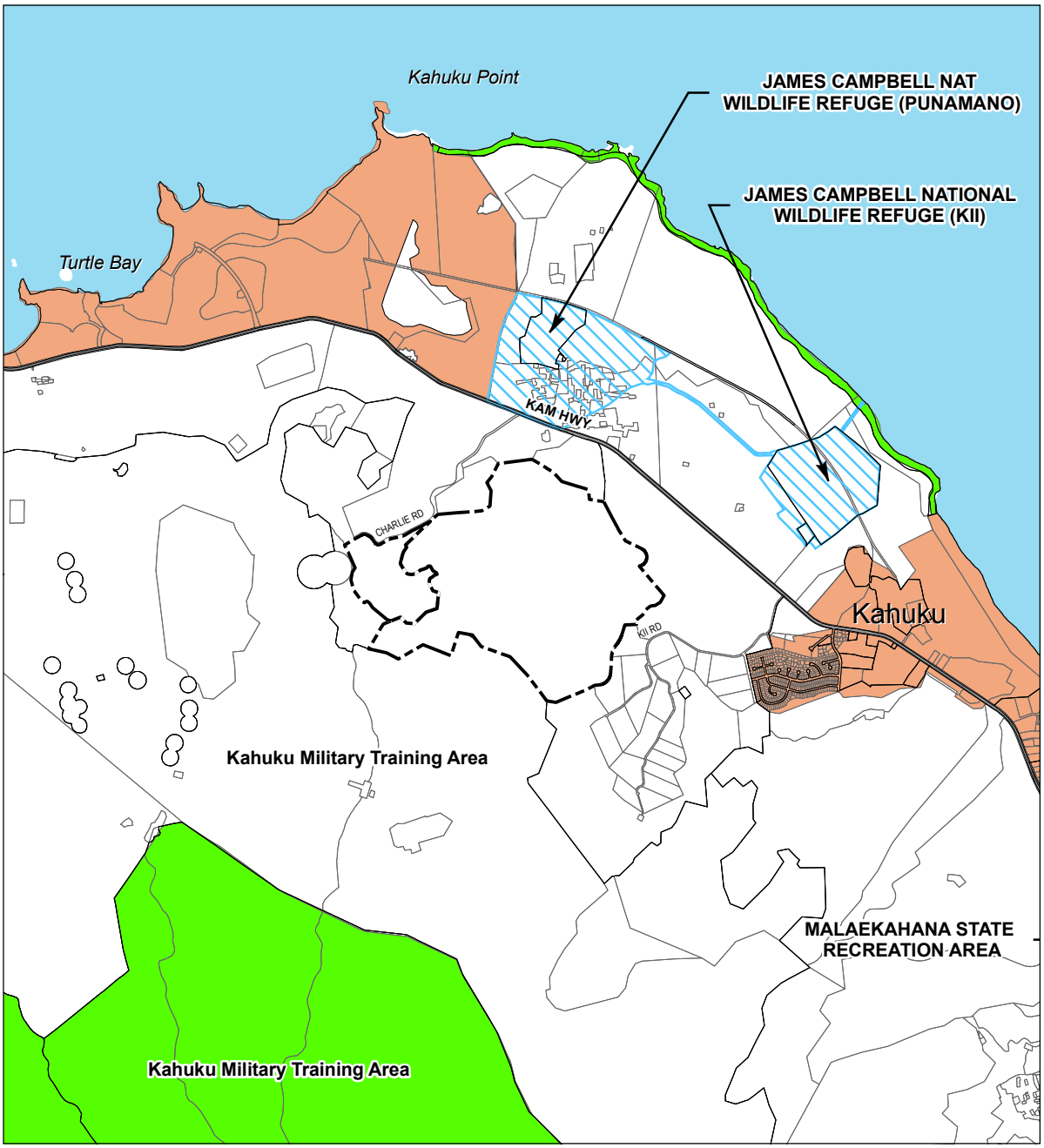
- National Environmental Policy Act (42 U.S.C. 4371 et seq.)
- Farmland Protection Policy Act (7 USC 4201)

State

- Hawai‘i State Plan
- Hawai‘i Revised Statutes, Chapter 195D
- Hawai‘i Revised Statutes, Chapter 343
- Hawai‘i Revised Statutes, Chapter 205
- Hawai‘i Agricultural Land Use Map
- University of Hawai‘i’s Land Study Bureau Detailed Land Classification
- State Department of Agriculture’s Agricultural Lands of Importance to the State of Hawai‘i
- Hawai‘i’s Coastal Zone Management (CZM) Program

County

- General Plan for the City and County of Honolulu
- Ko‘olau Loa Sustainable Communities Plan
- City and County of Honolulu Zoning



Legend

- Project Parcel
- James Campbell NWR
- TMK Parcels

State Land Use Districts

- Agricultural
- Conservation
- Urban
- Ocean

Data Sources: State of Hawaii GIS; City and County of Honolulu; USGS

State of Hawaii Land Use District Boundaries Map

Figure 3-18

N

2,000 1,000 0 2,000
Feet

1,000 500 0 1,000
Meters

3.10.1.2 Potential Impacts of the Proposed Action

The proposed facility would be located on highly disturbed land owned by Kahuku Wind Power LLC. 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 (Charlie Road). Discussions with personnel at the Kahuku Training Range and the Operating Engineers Union have indicated that the proposed wind generation facility would not have a negative impact on training activities on these parcels.

A wind energy project is an allowable use in areas zoned AG-1 Restricted with acquisition of a Conditional Use Permit (City and County of Honolulu, Land Use Ordinance, Chapter 21, Section 5.700). The proposed project obtained a Conditional Use Permit-Minor (CUP-M) from the City and County of Honolulu's Department of Planning and Permitting (DPP) in January 2008. Due to proposed design modifications to the project, a new CUP was applied for in October 2009 and approved in December 2009. Future potential agricultural uses in the project area would be evaluated to ensure that these uses are complementary with the wind facility. Also, the presence of Kahuku Wind Power is not likely to deter or encourage any future potential land uses in the area.

A Farmland Conversion Impact Rating form and supporting documentation were completed and submitted to NRCS. The rating that resulted from the NRCS evaluation did not exceed 160 points. According to the Farmland Protection Policy Act, sites with a rating less than 160 need no further consideration.

The Waialua Substation and Flying R Ranch sites would be leased from HECO and Waialua Ranch Partners, respectively. Both leases would be turned over from Kahuku Wind Power LLC to HECO after commissioning. The presence of the microwave towers would not limit access to other land served by the access roads and would not have a negative impact on adjacent land uses. In addition, the presence of the off-site microwave towers is not likely to deter or encourage any future potential land uses.

Hawai‘i's Coastal Zone Management (CZM) Program (HRS 205A-2) includes a permit system to control development within Special Management Areas (SMAs), which include lands within 300 ft (91 m) of the shoreline. The project area is not located within a SMA, nor do any of the possible off-site microwave tower locations. The proposed project does not involve the placement, erection, or removal of materials near the coastline and does not require a CZM Federal consistency determination because the type and scale of the action does not have the potential to affect coastal resources significantly.

Hawai‘i has environmental planning requirements outlined in Hawai‘i Revised Statutes, Chapter 343 (Environmental Impact Statements). Chapter 343 "establishes a system of environmental review [at the state and county levels] which shall ensure that environmental concerns are given appropriate consideration in decision making along economic and technical considerations" (§343-1). The only component of the proposed action that would trigger HRS Chapter 343 is the construction of a fence for predator control at a seabird colony on West Maui at Makamaka‘ole (see Section 3.12.4.1). Because Makamaka‘ole is situated on State land within a Conservation District, a State EA would be prepared prior to construction in accordance with Chapter 343 of HRS.

The proposed facility is compatible and consistent with these and the other above listed federal, state, and county land use plans and policies. See Appendix D for a complete discussion.

3.10.1.3 Potential Impacts of the No Action Alternative

If no construction would occur, there would be no change in existing land uses. However, it is possible the project area could ultimately be used for some other purpose if the facility is not constructed.

3.11 Flora

3.11.1 Regulatory Framework

Federal Endangered Species Act (16 U.S.C. 1531-1544).

Established in 1973, the Endangered Species Act (ESA) protects plants, fish, and wildlife that have been listed as threatened or endangered and conserves ecosystems on which the species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA. Section 7 of the ESA mandates that all actions of federal agencies support the purposes of the ESA and outlines procedures for federal agencies to follow when taking actions that may adversely affect federally threatened or endangered species or designated critical habitats. A more detailed discussion of this Act and its applicability to the project is provided in Section 3.12.1.

Hawai‘i Revised Statutes, Chapter 195D

The purpose of HRS, Chapter 195D is "to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems…" (§195D-1). Section 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by State statute (see Section 3.12.1).

Executive Order 13112

Executive Order 13112 was signed in 1999 to prevent the introduction of invasive species and provide for their control. According to this Executive Order, an invasive species is defined as "an alien species (a species that is not native to the region or area) whose introduction does or is likely to cause economic or environmental harm or harm to human health." The Executive Order was designed to enhance federal coordination and response to the complex and accelerating problem of invasive species (National Invasive Species Council 2005).

Hawai‘i Statute Chapter 152 Noxious Weed Control

HRS, Chapter 152 (Noxious Weed Control) prohibits the introduction or transport of "specific noxious weeds or their seeds or vegetative reproductive parts into any area designated pursuant to section 152-5 as free or reasonably free of those noxious weeds" (§152-3). The objectives of Hawai‘i Administrative Rules (HAR), Title 4, Chapter 68 are to implement the requirements of HRS Chapter 152, and to establish criteria for designation, control, or eradication of noxious weeds (§4-68-1). HAR, Title 4, Chapter 68 contains a list of plant species designated as noxious weeds by the Department of Agriculture for eradication or control purposes.

3.11.2 Previous Surveys and Description of Flora

Botanical surveys of the Kahuku Wind Power project area were conducted by Robert Hobdy in April 2007 and July 2009 (Appendix E). Hobdy walked a series of routes throughout the property and more intensively examined areas most likely to support native or rare plants (e.g., gullies and rocky outcrops). A supplemental wetland plant survey was conducted in the same area by SWCA botanists in June 2008 (SWCA 2008). Approximately 128 plant species were recorded during the survey by Hobdy in 2007 and an additional four species were found during the SWCA survey. In 2009, Hobdy recorded approximately 99 plant species in a 68.5 ac (27.7 ha) area within the project area. No state or federally listed endangered, threatened, or candidate plant species, nor species considered rare throughout the Hawaiian

Islands, were found in the project area by Hobdy or SWCA. No portion of the project area has been designated as critical habitat for any listed species.

The majority of the project area (about 80%) is covered with dense brush or trees and the abundant and common plants are not native to the Hawaiian Islands. In general, vegetated areas mostly support dense brush composed of koa haole (*Leucaena leucocephala*) trees with a mix of grasses and herbaceous plants in the understory. Cocklebur (*Xanthium strumarium*), allspice (*Pimenta dioica*), sourgrass (*Digitaria insularis*), kolomona (*Senna surratnesis*), pitted beardgrass (*Bothriochloa pertusa*), Chinese violet (*Asystasia gangetica*), Christmas berry (*Schinus terebinthifolius*), parasol leaf tree (*Macaranga tanarius*), common beggarticks (*Bidens alba*), sourbush (*Pluchea carolinensis*), lantana (*Lantana camara*), Jamaica vervain (*Stachytarpheta jamaicensis*), and pea aubergine (*Solanum torvum*) are some of the other common species through the area. A comparatively large clearing is present in the southwest portion of the project area where topsoil was removed for use on the aforementioned golf course, and other smaller open areas are scattered throughout.

Few native plant species exist on-site as a result of topsoil disturbance from sugar production and cattle grazing. Native species are generally located on rocky outcrops and on exposed ridge tops in the upper portion of the property (SWCA 2008). Twelve native plant species were identified in the project area, of which three are endemic to the Hawaiian Islands - ʻakia (*Wikstroemia oahuensis*), niʻaniʻau (*Nephrolepis exaltata* subsp. *hawaiiensis*), and kīlau (*Pteridium aquilinum* var. *decompositum*). Table 3-10 lists native plant species recorded in the project area by Hobdy (2007, 2009) and SWCA (2008).

Table 3-10. Native Hawaiian plants observed in the project area.

Scientific Name	Common, Hawaiian Name(s)	Status[1]	Abundance[2]
FERNS AND FERN ALLIES			
DENNSTAEDTIACEAE			
Pteridium aquilinum (L.) Kuhn var. *decompositum* (Gaudich.) R.M. Tryon	kīlau	E	Rare
LINDSAEACEAE			
Sphenomeris chinensis (L.) Maxon	palaʻā	I	Rare
NEPHROLEPIDACEAE			
Nephrolepis exaltata (L.) Schott subsp. hawaiiensis W.H.Wagner	niʻaniʻau	E	Rare
MONOCOTS			
POACEAE			
Chrysopogon aciculatus (Retz.) Trin.	piʻi piʻi	I	Uncommon
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili	I	Uncommon

Scientific Name	Common, Hawaiian Name(s)	Status[1]	Abundance[2]
DICOTS			
MENISPERMACEAE			
Cocculus orbiculatus (L.) DC	huehue	I	X
PIPERACEAE			
Peperomia blanda Kunth var floribunda (Miq.) H.Huber	‘ala‘ala wai nui	I	Rare
PLUMBAGINACEAE			
Plumbago zeylanica L.	‘ilie‘e	I	Rare
ROSACEAE			
Osteomeles anthyllidifolia (Sm.) Lindl.	‘ūlei	I	Rare
SOLANACEAE			
Solanum americanum Mill.	popolo	I	Rare
STERCULIACEAE			
Waltheria indica L.	‘uhaloa	I	Uncommon
THYMELAEACEAE			
Wikstroemia oahuensis (A. Gray) Rock	‘akia	E	Uncommon

(1) E= endemic (native only to Hawai‘i); I= indigenous (native to Hawai‘i and elsewhere).

(2) Common= widely scatted throughout the project area or locally abundant; uncommon= scattered sparsely throughout the project area or occurring in a few small patches; rare= only a few isolated individuals at the project area; X = observed by SWCA, but abundance not recorded.

The Waialua Substation tower would be located in a fenced area that is completely paved or covered in gravel. Landscaped areas are present outside of the fenced area.

SWCA conducted a botanical survey of the Flying R Ranch off-site microwave tower site in December 2009. State or federally listed endangered, threatened, or candidate plant species were not observed during the survey, nor were any species considered rare throughout the Hawaiian Islands (T. Thair/SWCA, personal observation). The area is dominated by non-native species including Java plum (*Syzygium cumini*), Guinea grass (*Urochloa maxima*), and maile honohono (*Ageratum conyzoides*). Only one native species (*Dodonea viscosa*) was observed in the vicinity, roughly 85 ft (26 m) from where the microwave tower foundation would be constructed. A complete list of the plant species documented at the Flying R Ranch site is included in Appendix F.

3.11.2.1 Potential Impacts of the Proposed Action

Construction Phase:

Under the proposed action, construction of the proposed project would have a minor impact on existing flora at the project area due to ground clearing. The proposed roads, construction activities, and regular operation of the facility would result in disturbance of approximately 32 ac (13 ha) of the project area. Acres of vegetation disturbed in the project area could be greater if the land is also allowed to be used for farming and other agricultural purposes.

No state or federally listed threatened, endangered, or candidate plant species have been documented at the Kahuku project area. Vegetation in areas that would be disturbed consists of non-native species common throughout O‘ahu and the main Hawaiian Islands. The few native species documented in the project area are generally located on rocky outcrops and on exposed ridge tops outside of areas proposed to be used for construction and are therefore not likely to be impacted by the proposed project. Due to the general condition of the habitat and the overall lack of native plant species in the project area, the proposed Kahuku Wind Power facility is not expected to have an adverse impact on botanical resources on O‘ahu.

Invasive plants, such as Christmas berry, lantana, and cocklebur, are widespread at the Kahuku Wind Power project area and in neighboring parcels. Due to the existing conditions of the project area, the potential for the project to result in an increase in the number or distribution of invasive plant species would be minor. Similarly, control measures are not expected to result in a significant decrease in the number or distribution of invasive plant species currently occurring in the project area. However, to minimize the potential for introducing new invasive plants to the project area, Kahuku Wind Power LLC would ensure that off-site sources of revegetation materials (seed mixes, gravel, mulches, etc.) are certified weed-free or inspected prior to transport to the project area. All areas that are hydroseeded would be monitored for six months after hydroseeding to ensure removal of any invasive plants that have established from seeds inadvertently introduced as part of the seed mixes.

Kahuku Wind Power LLC is not proposing to intentionally introduce or transport any invasive plant species, including species listed as noxious weeds by the Department of Agriculture. To avoid the unintentional introduction or transport of these species through soil and debris, all construction equipment and vehicles arriving from outside of the Island of O‘ahu would be washed prior to entering the project area. In addition, Kahuku Wind Power would ensure that construction materials arriving from outside of O‘ahu are washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful non-native species prior to transportation to the project area. Most inspection and cleaning activities would be conducted at a vacant 6.8 acre parcel immediately adjacent to the Barbers Point Harbor, which would be leased by Kahuku Wind Power LLC. Equipment and material arriving through Honolulu Harbor would be inspected and/or cleaned (as appropriate) at a designated location prior to entering the project area. Kahuku Wind Power LLC would document all inspection and cleaning activities using inspection forms. At the end of the construction period, areas impacted by construction of the project would be surveyed to ensure that no problematic and/or invasive species had established. Appropriate remedial actions would be undertaken in consultation with DLNR and USFWS (as appropriate) to facilitate containment or eradication of the target species as soon as reasonably possible.

Upon completion of earthwork, some portions of the project area that would be disturbed during construction would be revegetated. Areas suitable for stabilization by revegetation include cut and fill slopes and turbine pads. Kahuku Wind Power LLC intends to revegetate these areas by hydroseeding and/or outplanting suitable ground cover. The primary goal of the revegetation would be to immediately

stabilize soil and prevent erosion following construction. Native species may be re-introduced where feasible.

Vegetation that would be disturbed at the off-site microwave tower sites consists of non-native species common throughout O‘ahu and the main Hawaiian Islands. Due to the overall lack of native plant species at the off-site microwave tower sites, there would be no impacts to flora as a result of construction or operation of the two towers.

Operation Phase:

To improve searcher efficiency during monitoring of the WTGs and met tower, the previously disturbed turbine pads and a circular area under the met tower would be regularly cleared of vegetation using mechanical methods. Because non-native species are capable of quickly establishing in disturbed areas compared to native species, only non-native species currently present in the project area (primarily grasses and herbs) are expected to establish in these areas. Therefore, operation of the Kahuku Wind Power facility is not expected to have an adverse impact on botanical resources on O‘ahu.

3.11.2.1 Potential Impacts of the No Action Alternative

No changes in floristic conditions would occur in the project area in the short-term if the facility was not constructed (other than natural successive processes). Vegetation occurring on the property could be disturbed in the long-term if the land were to ultimately be used for some other purpose.

3.12 Wildlife

3.12.1 Regulatory Framework

Federal Endangered Species Act (16 U.S.C. 1531-1544).

Established in 1973, the ESA protects plants, fish, and wildlife that have been listed as threatened or endangered and conserves ecosystem in which the species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA. Section 7 of the ESA mandates that all actions of federal agencies support the purposes of the ESA and outlines procedures for federal agencies to follow when taking actions that may adversely affect federally threatened or endangered species or designated critical habitats.

“Take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct (50 CFR 17.3). “Harm” has been defined by USFWS to mean an act which actually kills or injures wildlife, and may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). “Harass” has been defined to mean an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (50 CFR 17.3). Because the proposed project involves a federal action, it is subject to Section 7 of the ESA.

Hawai‘i Revised Statutes, Chapter 195D

The purpose of HRS, Chapter 195D is “to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems…” (§195D-1). Section 195D-4 states that any endangered or threatened species of fish or

wildlife recognized by the ESA shall be so deemed by State statute. Like the ESA, the unauthorized "take" of such endangered or threatened species is prohibited [§195D-4(e)].

Under Section 195D-4(g), the Board of Land and Natural Resources (BLNR), after consultation with the State's Endangered Species Recovery Committee (ESRC), may issue a temporary license (subsequently referred to as an "ITL") to allow a take otherwise prohibited if the take is incidental to the carrying out of an otherwise lawful activity. In order to qualify for an ITL, an Applicant must implement a Habitat Conservation Plan (HCP). Section 195D-21 outlines the requirements of HCPs, which are similar to those in federal regulations. All HCPs and their actions authorized under the HCP should be designed to result in an overall net benefit to the threatened and endangered species in Hawai'i (Section 195D-30). Kahuku Wind Power LLC is in the final stages of obtaining an ITL and has an approved HCP, as described below.

Section 195D-25 also provides for the creation of the ESRC, which is composed of biological experts, representatives of relevant federal and state agencies (i.e. USFWS, USGS, DLNR), and appropriate governmental and non-governmental members to serve as a consultant to the DLNR and the BLNR on matters relating to endangered, threatened, proposed, and candidate species. ESRC reviews all applications for HCPs and makes recommendations to the DLNR and the BLNR on whether they should be approved, amended, or rejected.

Consultation Process with State and Federal Agencies

The USFWS has been consulted throughout the preparation of this EA and the HCP and has participated in meetings with the State Department of Forestry and Wildlife (DOFAW) and the ESRC. Consultation with USFWS regarding potential impacts to federally listed species began in January 2007 when Kahuku Wind Power LLC submitted a CUP Application to DPP for the proposed project. At that time, USFWS identified four federally listed waterbird species (Hawaiian coot, Hawaiian duck, Hawaiian stilt, and Hawaiian moorhen) that might be impacted as a result of construction and operation of the proposed project. USFWS recommended that DPP require Kahuku Wind Power LLC to consult with USFWS and DOFAW about these potential impacts as a condition of CUP approval (P. Leonard/USFWS, letter to City and County of Honolulu Department of Planning and Permitting, dated 7 January 2007). Three other federally listed species (Newell's shearwater, Hawaiian petrel, and Hawaiian hoary bat) and one state listed species (Hawaiian short-eared owl or pueo) were added to the consultation process as a result of wildlife surveys of the project area.

A USFWS representative holds a voting seat on the ESRC, and USFWS representatives have been involved in several meetings to discuss the HCP. Kahuku Wind Power LLC was introduced to ESRC in October 2008. An HCP pre-application was submitted to DOFAW in early November 2008, starting the formal HCP process. Because the HCP is a state document, the state is the lead agency for the permit and therefore takes the lead in all discussions regarding impacts and mitigation to listed species. However, throughout this process, DOFAW has been in consultation with USFWS and the ESRC. Kahuku Wind Power LLC received comments on the proposed project from DOFAW on November 24, 2008, providing guidance on take estimates with regards to unobserved take and indirect take. Concurrence was given on the species covered in the HCP. Further discussions about the project and development of mitigation options with DOFAW and USFWS occurred on December 4 and December 18, 2008, and DOFAW visited the project area on December 12, 2008 and February 17, 2010.

The draft HCP was reviewed by the ESRC during their meeting in July 2009. During this meeting, mitigation measures were refined and additional options were incorporated into the HCP based on the feedback received. The draft HCP was subsequently approved by BLNR for release for public review in August 2009. The public comment period extended from September 28 to November 23, with a public

meeting on November 4, 2009. Two comment letters on the draft HCP were received, one from Office of Hawaiian Affairs (OHA) and one from the state Attorney General (AG). No comments were received during the public meeting. The OHA comment expressed a need for reassurance that mitigation commitment should last the duration of the project, and the state AG asked for clarification on the Administrative Rules for the HCP as well as clarification on how mitigation sites were chosen. The USFWS also provided comments on the draft HCP on November 12, 2009. Comments were wide ranging. Key comments included: a request for a waterbird management plan; a formal letter of agreement with DOFAW for waterbird mitigation at Hamakua, a state managed wetland site; a request for discussion about climate change under Changed Circumstances; comments on monitoring procedures; and comments on HCP funding. In response to comments, Kahuku Wind Power LLC revised the HCP. The final HCP was approved by ESRC in February 2010 and by BLNR on March 11, 2010, and issuance of the ITL is expected in May or June of 2010.

DOE consulted with USFWS under Section 7 of the ESA to address the potential for construction and operation of the facility to adversely affect federally listed threatened and endangered species. DOE made a determination of "may affect, and is likely to adversely affect" for the federally listed species covered in the HCP. Under the direction of the USFWS, DOE submitted the HCP and a draft of this EA as the biological assessment (BA) to describe the expected impact that the proposed project would have on threatened and endangered species. USFWS issued a biological opinion (BO) on May 13, 2010. In the BO, USFWS determined that the proposed wind project would not jeopardize the survival and recovery of any federally listed threatened or endangered species and adopted the conservation measures in the HCP as the reasonable and prudent measures required to minimize incidental take.

In addition to the ESA consultation process, DOE provided USFWS, Pacific Islands Fish and Wildlife Office, with an opportunity to comment on the draft of this EA. USFWS responded with a request for additional information in the EA on measures to control invasive species from construction materials and on the benefits and potential impacts of mitigation measures for covered species required in the HCP. DOE added text to Sections 3.11.2.1 and 3.12.4.1 of the EA to address USFWS comments, which are included in Appendix K.

Migratory Bird Treaty Act (16 U.S.C. 703-712).

All native migratory birds of the United States are protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. 703-712 *et. seq.*). This act states that it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product. "Take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect (16 U.S.C. 703-712)." No process for authorizing incidental take of MBTA protected birds or providing permits is described in the MBTA (USFWS and NMFS 1996).

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, directs Federal agencies to take certain actions to further implement the Act. In 2006, DOE and USFWS signed a Memorandum of Understanding (MOU) regarding the implementation of Executive Order 13186. This MOU requires DOE to integrate migratory bird conservation principles, measures, and practices into DOE activities. The MOU also commits DOE to avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources.

In Hawai‘i, the requirements of the MTBA and Executive Order 13186 apply to all MTBA birds found within Bird Conservation Region (BCR) 67 (Hawai‘i). To avoid and minimize impacts to MBTA-protected species within BCR 67, Kahuku Wind Power LLC has incorporated design and operational

features based on the USFWS Interim Guidance on Avoiding and Minimizing Impacts to Wildlife from Wind Turbines (issued May 13, 2003). These guidelines contain materials to assist in evaluating possible wind power sites, wind turbine design and location, and pre- and post-construction research to identify and/or assess potential impacts to wildlife. Specific measures that have been adopted by Kahuku Wind Power LLC to avoid and minimize the potential for impacts to MBTA-protected species are discussed in Appendix A.

In addition to the measures contained in Appendix A, Kahuku Wind Power would ensure that all active nests of MBTA birds listed within BCR 67 are not disturbed, especially during the breeding season. The only MBTA bird within BCR 67 that has the potential to nest in the project area is the Hawaiian short-eared owl or pueo. If active pueo nests are found, Kahuku Wind Power LLC would not remove the nest until all birds, including young, have left the nest and are no longer using the nest. A protective buffer area would be established around the nest during clearing/construction activities.

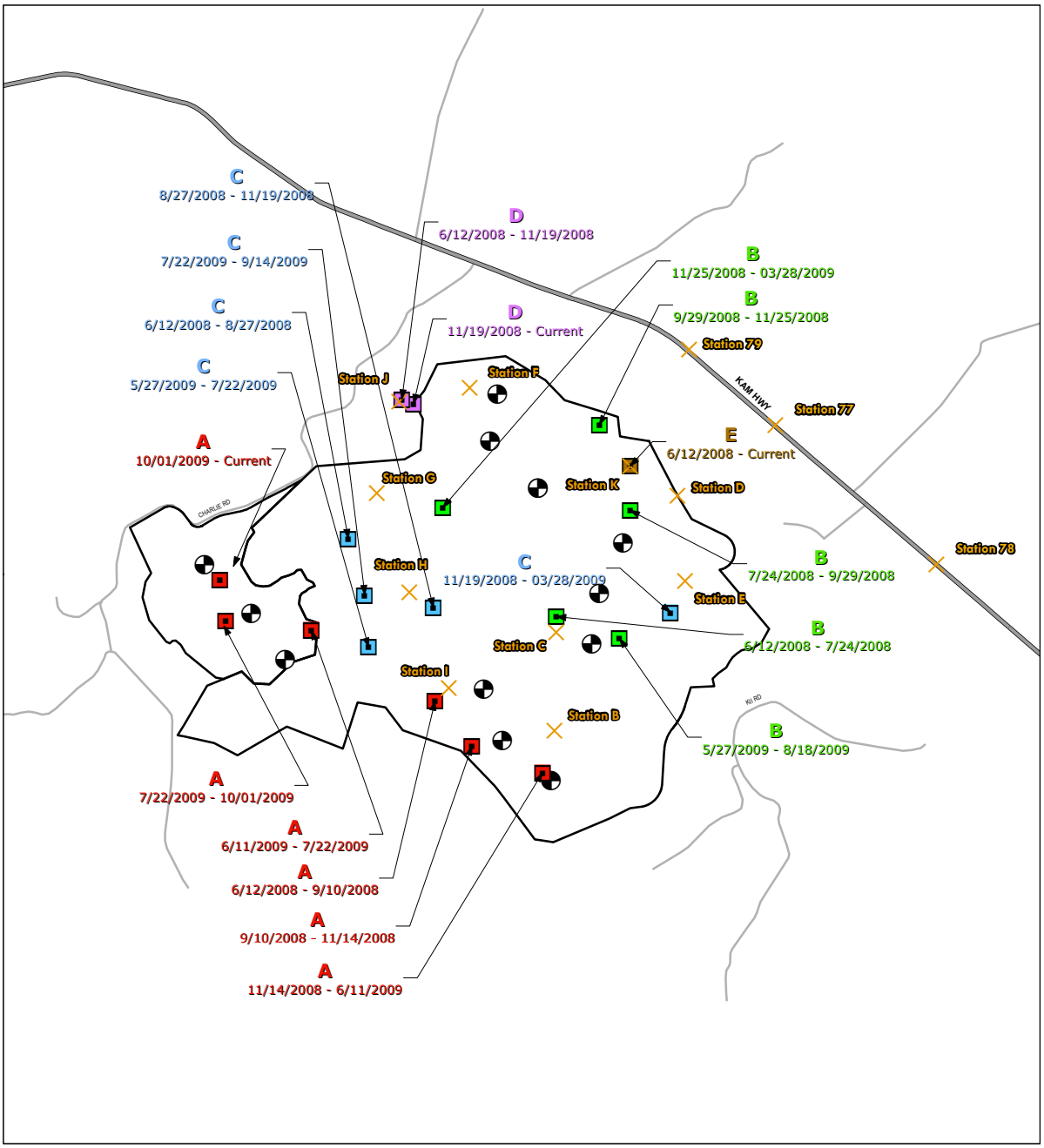
3.12.2 Previous Wildlife Surveys

Wildlife occurring on or flying over the project area has been investigated by Kahuku Wind Power LLC and its consultants through pedestrian surveys (Hobdy 2007, 2009), avian point count surveys (SWCA 2008; Appendix G), nocturnal radar surveys (Day and Cooper 2008; Appendix H), and the use of night vision equipment and bat detection devices (SWCA 2008). No other wildlife surveys are known to have been conducted on-site. The methodology and results of these wildlife investigations are discussed below.

Hobdy (2007) conducted a walk-through survey on the site using binoculars and listening to vocalizations. Species abundance and locations were noted, as well as observations of trails, tracks, scat and signs of feeding. An evening visit was made to record crepuscular activities and vocalizations for evidence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*).

Kahuku Wind Power LLC and SWCA biologists conducted avian point count surveys between October 2007 and December 2008 for a total of 65.3 observation hours. Point count surveys were conducted by Kahuku Wind Power LLC from October 2007 to May 2008, and by SWCA from June 2008 to December 2008 using identical methods. Ten point count stations were established on the site (Figure 3-19) and four to eight point count stations were surveyed during each session. Sessions were conducted in the morning (0600 – 1000 h), afternoon (1000 – 1400 h) and evening (1400 – 1800 h). Each point count lasted 20 minutes per station.

Three point counts were also conducted at adjacent wetlands located 1,640 to 3,280 ft (500 to 1,000 m) makai of the project area to describe the flight activity of endangered Hawaiian waterbirds due to the few observations recorded at the established on-site point count locations. This was an effort to gain a better understanding of the activity patterns of the endangered species covered by the HCP, particularly those known to occur at the nearby James Campbell NWR, as well as to document the arrival and activity patterns of non-listed migratory bird species. Endangered species known to occur at the NWR include Hawaiian duck (*Anas wyvilliana*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), and Hawaiian moorhen (*Gallinula chloropus sandvicensis*).



Legend

- Turbines
- Project Parcel
- Point Count Locations

Anabat Sensors

- A
- B
- C
- D
- E

Avian Point Count Stations and Anabat™ Locations

Figure 3-19

N

1,000 500 0 1,000
Feet

500 250 0 500
Meters

All passerines, owls (Strigiformes), and doves (Columbiformes) observed within a 656-ft (200-m) radius of a count location were recorded. Bird species aurally detected within a 200-m radius were also recorded. Waterbirds and seabirds, which are larger and more visible, were recorded out to a 1,312-ft (400-m) radius of the count station. Data recorded during surveys included time of day, bird species, size of flock, flight direction, flight altitude, distance of bird from observer, habitat, location (on-site or off-site), and sex and age of bird, if possible. Single occurrences of birds detected during surveys, whether individuals or flocks, are hereafter referred to in this document as "flights." Weather variables recorded were wind speed, wind direction, cloud cover, visibility, and precipitation. Mammals observed incidental to the bird surveys were also recorded during each point count survey.

Nocturnal radar surveys were conducted on-site in fall 2007 (five evenings, 1800-2100 h, October 16-20) and summer 2008 (eight evenings, 1800-2100h, and mornings, 0400-600h from 1-8 July) in an effort to identify seabirds that may potentially transit the Kahuku Wind Power project area during crepuscular and night periods (Cooper and Day 2008). The fall surveys coincided with the Hawaiian petrel (*Pterodroma sandwichensis*) and Newell's shearwater (*Puffinus auricularis newelli*) fledging periods and the summer surveys coincided with the post-hatching nestling care periods for both species.

Birds detected by the radar surveys included probable Newell's shearwater, Hawaiian short-eared owl, and barn owl (*Tyto alba*). These species were not detected on-site or overflying the project areas during the day. Criteria used to establish the detection of shearwaters/petrels were based on identifying targets on radar flying at airspeeds greater than 30 mi/h (48 km/h), of the appropriate size, flying inland or seaward only (not parallel to shore) and exhibiting directional flight. As discussed in Section 3.12.4, timing of radar detections was used to tentatively identify these birds as Newell's shearwaters rather than Hawaiian petrels. The Hawaiian short-eared owl was heard by the radar technicians and the barn owl visually sighted and identified.

During these surveys, a total of 24 bird species were observed on the Kahuku Wind Power project area, 19 of which are non-native to the Hawaiian Islands. Table 3-11 identifies all birds detected during the point count and radar surveys. Included in this table are scientific and common names of each species as standardized by the American Ornithologists' Union, status of each species on O'ahu, federal listing status, indication of whether the observed species is protected by the MBTA, and an indication of whether the species was detected on-site, off-site, or both.

Nocturnal visual surveys were also conducted twice a month from October 2007 to December 2008 for a total of 18 observation hours. Four to eight point counts were surveyed for 20 minutes each field session. The point count locations used were the same as bird point count locations. Night vision goggles (Kerif ITT PVS-7 F5001 Series) and infra-red spotlights (Brinkmann Q-beam Max Million III) were used and provided ability to detect bats out to a distance of 100 ft (30 m) from the observer. No bats were detected visually during these observations.

Five Anabat™ detectors (Titley Electronics, NSW, Australia) were deployed at various locations at Kahuku Wind Power beginning April 2008 to present (Figure 3-19) in an effort to detect the presence of bats by recording ultrasonic sounds emitted by bats during echolocation. Anabat™ detectors were moved monthly to new locations if no bat calls were detected during the previous month. A low but consistent level of bat activity was recorded at Anabat™ detectors throughout the year with a slight increase in activity from June to September (see Section 3.12.4 and Appendix G).

3.12.3 Non- Listed Species

Most non-federally or state listed wildlife species detected on and adjacent to the project area during general biological, point count, and radar surveys are not native to the Hawaiian Islands; however, non-

listed endemic and indigenous species also occur in the vicinity of the project area. Key avian species (i.e. waterbirds and seabirds) that occur in the vicinity of the Kahuku Wind Power project area are discussed below following discussion of the potential microwave tower sites.

Based on general observations, birds that frequent the Waialua Substation site are non-native species common to altered rural environments on O‘ahu. These include zebra dove, spotted dove, rock pigeon (*Columba livia*), common myna, Japanese white-eye, red-vented bulbul, red-whiskered bulbul, house finch, common waxbill, house sparrow, and Java sparrow (L. Ong/SWCA, pers. obs.).

Non-native birds are also common at the Flying R Ranch site. These include the common myna, zebra dove, spotted dove, Japanese white-eye, house finch, red-vented bulbul, Japanese bush warbler, peacock, red crested cardinal, Erckel’s francolin (*Francolinus erckelii*), and, possibly, barn owl (L. Ong/SWCA, pers. obs.). The only non-federally listed endemic bird that could potentially occur in the vicinity of the site is the pueo or Hawaiian short-eared owl. This species is listed as endangered by the State of Hawai‘i for O‘ahu.

Table 3-11. Birds detected on and adjacent to Kahuku Wind Power project area during point count and radar surveys.

Scientific Name	Common Name	Status[1]	Protection		Observed[3]	
			ESA[2]	MBTA	On-Site	Adjacent Wetlands
Puffinus auricularis newelli	Newell’s shearwater[4]	E	T	X	X (F)	
Fregata minor	great frigatebird	I		X	X (F)	X
Bubulcus ibis	cattle egret	NN		X	X	X
Anas sp.	Hawaiian (?) duck[5]	E	E	X	X (F)	X
Fulica alai	Hawaiian coot	E	E	X		X
Himantopus mexicanus knudseni	Hawaiian stilt	E	E	X	*	X
Phasianus colchicus	ring-necked pheasant	NN			X	X
Pluvialis fulva	Pacific golden-plover	V		X	X	X
Arenaria interpres	ruddy turnstone	V		X	X	X
Heteroscelus incanus	wandering tattler	V		X		X
Calidris alba	sanderling	V		X		X
Streptopelia chinensis	spotted dove	NN			X	X
Geopelia striata	zebra dove	NN			X	X

Scientific Name	Common Name	Status[1]	Protection		Observed[3]	
			ESA[2]	MBTA	On-Site	Adjacent Wetlands
Tyto alba	barn owl	NN		X	X	
Asio flammeus Sandwichensis	Hawaiian short-eared owl	E		X	X	
Pycnonotus cafer	red-vented bulbul	NN			X	X
Pycnonotus jocosus	red-whiskered bulbul	NN			X	
Cettia diphone	Japanese bush warbler	NN			X	
Copsychus malabaricus	white-rumped shama	NN			X	
Acridotheres tristis	common mynah	NN			X	X
Zosterops japonicus	Japanese white-eye	NN			X	
Cardinalis cardinalis	northern cardinal	NN		X	X	
Paroaria coronata	red-crested cardinal	NN			X	X
Carpodacus mexicanus	house finch	NN		X	X	X
Passer domesticus	house sparrow	NN			X	X
Estrilda astrild	common waxbill	NN			X	X
Padda oryzivora	Java sparrow	NN			X	
Lonchura cantans	African silverbill	NN			X	
Lonchura punctulata	nutmeg mannikin	NN			X	
Lonchura malacca	chestnut munia	NN			X	

1) E = endemic; I = indigenous, V = native visitor; NN = non-native permanent resident

2) E = federally endangered; T = federally threatened

3) X = Detected during surveys; F = only detected flying over site; * downed bird collected

4) Identification inferred from interpretation of radar data

5) All free-flying "Hawaiian" ducks on O'ahu appear to actually be Hawaiian duck x mallard (*Anas platyrhynchos*) duck hybrids

Herons and Egrets:

The indigenous black-crowned night-heron (*Nycticorax nycticorax*) is a cosmopolitan species resident on the main Hawaiian Islands (Pratt et al. 1987, Hawai‘i Audubon Society 2005). The black-crowned night-heron was identified as a species of “Moderate Concern” in *The North American Waterbird Conservation Plan* (Kushlan et al. 2002). Populations of species given this designation are declining with moderate threats or distribution, stable with known or potential threats and moderate to restricted distributions, or are relatively small with relatively restricted distributions. In Hawai‘i, this species is considered a nuisance by aquaculture farmers. A small concentration of this species occurs at the Ki‘i Unit of the James Campbell NWR because of the abundance of potential prey (e.g., crustaceans, insects, fish, and frogs) at the NWR and within nearby aquaculture farms (Mitchell at el. 2005). Between 2001 and 2006, an average of 13 birds was recorded per month at the Ki‘i Unit (USFWS, unpubl. data). No black-crowned night-herons were observed in the Kahuku Wind Power project area during any of the avian surveys and they are not expected to occur regularly on the site owing to a lack of suitable wetland habitat. Potential exists for individuals of this species to occasionally fly over the project area, especially the lower elevation makai portions.

The cattle egret was introduced to Hawai‘i from Florida for insect control in the mid 20th century and has become a widespread species across the main Hawaiian Islands. This species was identified as “Not Currently At Risk” in *The North American Waterbird Conservation Plan* (Kushlan et al. 2002). On O‘ahu, large concentrations of this species can be found at Pearl Harbor, Kane‘ohe Bay, and Kahuku. Cattle egrets eat a wide variety of prey including insects, spiders, frogs, prawns, mice, crayfish, and the young of native waterbirds (Pratt et al. 1987, Telfair 1994, Robinson et al. 1999, Brisbin et al. 2002, Engilis et al. 2002, Hawai‘i Audubon Society 2005, USFWS 2005a). Cattle egrets were observed regularly during the avian surveys at Kahuku Wind Power and accounted for approximately 17% (5.36 flocks/hr/point count) of all flights observed on site.

Seabirds:

The indigenous wedge-tailed shearwater (*Puffinus pacificus*) is common throughout the tropical and subtropical Pacific and Indian Oceans. Worldwide, over one million breeding pairs are believed to occur. The species was identified as of “Low Concern” in *The North American Waterbird Conservation Plan* (Kushlan et al. 2002). Populations of species designated of “Low Concern” are either stable with moderate threats and distribution, or are increasing or stable, but with known or potential threats and moderate to restricted distributions. The species is considered of least concern in the Pacific because of its wide distribution and population size (USFWS 2005b).

Over a quarter of the known population of this species (275,000 pairs) breeds in the Hawaiian Islands (Whitton 1997, USFWS 2005b). On O‘ahu, wedge-tailed shearwaters are known to nest at Ka‘ena Point, Mokapu Peninsula, Kūpikipiki‘ō Point, Mālaekahana State Recreation Area, and the Kahuku Golf Course. Wedge-tailed shearwaters also nest at five offshore State Seabird Sanctuaries around O‘ahu (Moku‘auia, Kīhewamoku, Pulemoku, Kukuiho‘olua, and Mokuālai) (Smith et al. 2002, Mitchell et al. 2005). To date, no wedge-tailed shearwaters have been seen flying over the Kahuku Wind Power project area. Wedge-tailed shearwaters typically excavate ground burrows for nesting, but will also nest on the ground surface (USFWS 2005b). The main threats to wedge-tailed shearwaters nesting on O‘ahu are predation by introduced mammalian predators and human disturbance by trampling burrows (Mitchell et al. 2005). Young birds are also threatened by disorientation from urban lighting. On the northern tip of O‘ahu, young shearwaters have been observed flying into lights while leaving their colonies in the late fall. A wedge-tailed shearwater rescue plan has been developed by the Turtle Bay Resort in the case that downed birds are found on resort grounds (Kusao & Kurahashi, Inc. 2003).

Laysan albatross (*Diomedea immutabilis*) have consistently been observed during bird surveys conducted by USFWS makai of the Kahuku Wind Power project area at the Ki‘i Unit of the James Campbell NWR (USFWS, unpubl. data). This species is considered of “High Concern” by the *Regional Seabird Conservation Plan* (USFWS 2005b) and *The North American Waterbird Conservation Plan* (Kushlan et al. 2002). Populations of species identified as “High Concern” are known or thought to be declining and have some other known or potential threats. Approximately 93% of the breeding pairs of Laysan albatross occur on Midway and Laysan Islands. Some albatrosses are known to nest at Ka‘ena Point and have attempted to nest at Dillingham Airfield, Kahuku Golf Course, and the Marine Corps Base Hawai‘i in Kane‘ohe on O‘ahu (USFWS 2005b). In the past, Laysan albatross have also attempted unsuccessfully to nest at Kahuku Point (E. VanderWerf, pers. comm.). This species typically nests on beaches and other low grounds generally near the ocean.

To date, no Laysan albatross have been seen flying over the Kahuku Wind Power project area. Potential for Laysan albatross to fly over the site appears to be extremely low because this species nests near water and otherwise stays at sea.

Other Birds:

For centuries, migratory ducks, geese, and other waterfowl have wintered on the Hawaiian Islands. Table 3-12 provides a list of migratory waterfowl that have been observed utilizing the James Campbell NWR. The indicated fulvous whistling-duck (*Dendrocygna bicolor*) established a small temporary breeding population at the refuge (Pratt et al. 1987, Hawai‘i Audubon Society 2005), but was last observed in December 2001 (USFWS 2002).

Table 3-12. Migratory waterfowl observed on the nearby James Campbell NWR.

Scientific Name	Common Name
Dendrocygna bicolor	fulvous whistling-duck
Anser albifrons	greater white-fronted goose
Chen caerulescens	snow goose
Branta bernicla	brant
Branta canadensis	Canada goose
Branta hutchinsii	cackling goose
Anas crecca	green-winged teal
Anas platyrhynchos	mallard
Anas acuta	northern pintail
Anas querquedula	garganey
Anas discors	blue-winged teal
Anas cyanoptera	cinnamon teal

Scientific Name	Common Name
Anas clypeata	northern shoveler
Anas strepera	gadwall
Anas penelope	Eurasian wigeon
Anas americana	American wigeon
Aythya valisineria	canvasback
Aythya americana	redhead
Aythya collaris	ring-necked duck
Aythya fuligula	tufted duck
Aythya marila	greater scaup
Aythya affinis	lesser scaup
Netta peposaca	rosy-billed pochard
Bucephala albeola	bufflehead
Mergus merganser	common merganser
Sources: USFWS (2003b), Pyle and Pyle (2009).	

James Campbell NWR is also an important wintering ground for shorebirds in the Hawaiian Islands (Engilis and Naughton 2004). Shorebirds primarily utilize wetlands and tidal flats; however, estuaries, grasslands, uplands, beaches, golf courses, and even urban rooftops are important habitats for some species (Engilis and Naughton 2004). The Island of O‘ahu offers the most diverse shorebird habitat of all the Hawaiian Islands. Threats to shorebirds in the Pacific region include habitat loss (urban, industrial, military, agricultural and recreational development), invasive non-native plants, non-native animals (which cause predation, disease, and competition), human disturbance, and environmental contaminants (Engilis and Naughton 2004). Species of shorebirds that have been observed at James Campbell NWR are listed in Table 3-13.

Table 3-13. Migratory shorebirds observed on the nearby James Campbell NWR.

Scientific Name	Common Name
Pluvialis squatarola	black-bellied plover
Pluvialis fulva	Pacific golden-plover
Charadrius semipalmatus	semipalmated plover
Charadrius vociferus	killdeer

Scientific Name	Common Name
Himantopus mexicanus knudseni	Hawaiian stilt
Actitis maclaria	spotted sandpiper
Tringa solitaria	solitary sandpiper
Heteroscelus brevipes	gray-tailed tattler
Heteorscelus incanus	wandering tattler
Tringa melanoleuca	greater yellowlegs
Tringa flavipes	lesser yellowlegs
Numenius phaeopus	whimbrel
Numenius tahitiensis	bristle-thighed curlew
Limosa limosa	black-tailed godwit
Limosa fedoa	marbled godwit
Arenaria interpres	ruddy turnstone
Calidris canutus	red knot
Calidris alba	sanderling
Calidris pusilla	semipalmated sandpiper
Calidris mauri	western sandpiper
Calidris ruficollis	red-necked stint
Calidris minutilla	least sandpiper
Calidris fuscicollis	white-rumped sandpiper
Calidris bairdii	Baird's sandpiper
Calidris melanotos	pectoral sandpiper
Calidris acuminata	sharp-tailed sandpiper
Calidris alpina	dunlin
Calidris ferruginea	curlew sandpiper
Calidris himantopus	stilt sandpiper
Tryngites subruficollis	buff-breasted sandpiper

Scientific Name	Common Name
Philomachus pugnax	ruff
Limnodromus griseus	short-billed dowitcher
Limnodromus scolopaceus	long-billed dowitcher
Gallinago sp.	snipe
Phalaropus tricolor	Wilson's phalarope
Phalaropus fulicaria	red phalarope
Source: USFWS, unpublished.	

The *U.S. Pacific Islands Regional Shorebird Conservation Plan* (Engilis and Naughton 2004) identifies three shorebird species of primary importance in Hawai'i: the Hawaiian stilt, Pacific golden-plover, and bristle-thighed curlew. The only permanent resident shorebird, the endemic Hawaiian stilt, is discussed in Section 3.12.4. Pacific golden-plovers are of primary importance because Hawai'i supports a substantial number during the winter (an estimated 15,000 to 20,000 individuals) and the bristle-thighed curlew is the only migratory species that winters exclusively in the Pacific (Engilis and Naughton 2004). The wandering tattler is considered a species of importance and the ruddy turnstone is considered a species of secondary importance (Engilis and Naughton 2004).

Pacific golden-plover and ruddy turnstone are the only two shorebirds that were detected utilizing the Kahuku Wind Power project area during the avian surveys conducted by Kahuku Wind Power LLC and SWCA. Data suggests that these birds start arriving in the vicinity of the proposed Kahuku Wind Power facility in September and most leave in May. Pacific golden-plovers were seen in flight more often than ruddy turnstones (0.57 vs 0.02 flights/hr/point count), and only Pacific golden-plovers were recorded at flight altitudes that fall within the rotor swept zone of the proposed turbines.

Mammals:

The Hawaiian hoary bat is the only terrestrial mammal native to Hawai'i. Apart from attempts to determine status of Hawaiian hoary bat in the project area, no surveys for mammals have been conducted in the project area. Non-native wild and domestic mammals observed in the Kahuku Wind Power project area incidental to the avian surveys include small Indian mongoose (*Herpestes javanicus*), domestic cow (*Bos taurus*), horse (*Equus caballus*), feral pig (*Sus scrofa*), feral cat (*Felis catus*), and dog (*Canis lupus familiaris*). Although not seen during the surveys, it is also anticipated that rats (*Rattus* sp.) and house mice (*Mus musculus*) occur on the Kahuku Wind Power project area.

Based on general observations, small Indian mongoose, rats, house mice, and cats are likely common at the Waialua Substation and Flying R Ranch sites. Cows and horses were also observed at the Flying R Ranch site (L. Ong/SWCA, pers. obs.).

3.12.3.1 Potential Impacts of the Proposed Action

The proposed action could impact non-listed wildlife through collisions with wind turbine rotors, the met tower, and the microwave towers. Clearing for the project would also remove a small amount of habitat used by non-listed, mostly non-native, species.

Avian Species:

Under the proposed action, the proposed facility would result in the permanent loss of approximately 32 ac of vegetation composed mostly of non-native plant species. Non-listed birds known to occur in the general area are also mostly non-native (introduced) (Table 3-11). Non-listed bird species occurring in the project area are largely common and widespread on O‘ahu, and most are tolerant of some degree of development and human presence. The proposed project would reduce the amount of habitat available for non-listed bird species. This could result in the displacement of some individuals and slight reduction in some local numbers. However, because these birds are generally common and widespread, the amount of habitat lost represents a very small part of the total range available to each species. Consequently, any impacts to non-listed bird species are not expected to be significant at the population level. Clearing for WTG pads and road edges may provide increased foraging area for some birds, including the Pacific golden-plover.

Non-listed birds also have potential to collide with WTGs and the met towers. Documented avian fatality rates at wind energy facilities differ throughout the world; however, Erickson et al. (2001) estimated that an average of 2.19 bird fatalities occur per wind turbine annually in the United States. Some bird species appear to have a higher risk of collision with wind energy facilities than others. Passerines are known to have comparatively high fatality rates (Erickson et al. 2001, NWCC 2004, Kingsley and Whittam 2007). Some birds, including waterfowl and shorebirds, seem to avoid turbines, but appear to be susceptible to collision with associated wires, particularly when located near wetlands (Curtis 1977, Olsen and Olsen 1980, Percival 2005, Kingsley and Whittam 2007, Powlesland 2009). For this reason, the single permanent met tower would be unguyed to reduce the risk of avian species colliding with the tower. Theoretically, any of the bird species occurring in the general project area would have potential to collide with the proposed WTGs and met towers.

Avian fatalities at wind energy facilities are very low compared to the numbers of fatalities resulting from some other human-related causes. Known sources of anthropogenic bird losses outside of wind energy sites include: lighted buildings, windows, communications towers, power lines, smokestacks, vehicles, cat predation, pesticides, and hunting (Podolsky et al. 1998, Erickson et al. 2001, Martin and Padding 2002, Woodlot Alternatives, Inc. 2003, Federal Register 2004, Mineau 2005). Mortality from these other sources is many orders of magnitude higher than that which occurs at wind facilities.

Mammals:

The non-listed mammals present in the project area, all of which are non-native, have the potential to degrade ecosystems by consuming or trampling native flora and fauna, accelerating erosion, altering soil properties, and promoting the invasion of non-native plants (Stone et al. 1992, Courchamp et al. 2002, USFWS 2008). Because native Hawaiian flora and fauna did not evolve with these mammals, native species are not adapted to take advantage of, or protect themselves from, the activities of these animals (Stone 1985, Stone et al. 1992). Loss of vegetation in the project area would reduce the amount of habitat available for mammals and therefore could result in displacement of some individual mammals and slight reduction in local numbers. Loss of mammals may also occur occasionally as a result of collisions with project vehicles. Potential to cause adverse impacts to introduced mammals could be considered a positive effect of the proposed project, although given the scale of the project, any actual change in local

mammal numbers is likely to be so low as to be insignificant. Therefore, the proposed project is generally expected to have a neutral effect on mammals.

The proposed mitigation measures that are required in the HCP are planned to compensate for adverse impacts to listed species (SWCA and First Wind 2010). However, some of these measures also have the potential to benefit some non-listed avian species by decreasing their risk of predation by introduced mammals (e.g., rats, mongoose, cats, and dogs).

A wildlife education and observation program would be conducted for all regular on-site staff (Appendix I). The program would be long-term, on-going, and updated as necessary. Staff would be trained to identify listed and non-listed native species of birds 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 downed wildlife is found.

As part of their safety training, temporary employees, contractors, and any others that may drive project roads would be educated as to project road speed limits and the possibility of downed wildlife being present on roads. The protocol for the recovery, handling, and reporting of downed wildlife would follow that developed for Kaheawa Wind Power (KWP) Energy Generation Facility (Kaheawa Wind Power LLC, 2006). This protocol was developed in cooperation with DLNR and USFWS. All regular on-site staff would be trained in the protocol, which would include documenting all observed mortality or injury to wildlife (including MBTA-protected birds not otherwise covered by this HCP). Non-listed species would also be collected by a permitted specialist if requested by USFWS or DLNR; collections would be made only by staff personnel permitted by USFWS and DLNR to handle and salvage wildlife. Injured individuals or carcasses would be handled according to guidelines in Appendix J.

3.12.3.2 Potential Impacts of the No Action Alternative

If the facility was not constructed and operated under the No Action Alternative, there would be no impacts to non-listed wildlife.

3.12.4 Listed Species

No federally listed endangered, threatened, or candidate species are known to occur regularly on the Kahuku Wind Power project area and no portion of the project area has been designated as critical habitat for any listed species. The endangered Hawaiian hoary bat or ‘ope‘ape‘a has been documented flying over the project area and low bat activity has been recorded on the acoustic bat detectors. Several federally listed endangered and threatened bird species occur regularly on nearby properties and individuals of some or all of these species may occasionally transit through the airspace of the proposed Kahuku Wind Power facility. Presumed Newell’s shearwaters were detected flying over the Kahuku Wind Power project area during nocturnal radar surveys. No birds believed to be Hawaiian petrels, which also may fly inland at night, were detected during the radar surveys. One state listed endangered species, the Hawaiian short-eared owl or pueo, was heard in the Kahuku Wind Power project area by the radar technicians and is believed to occur at least infrequently.

The proposed WTGs, on-site microwave tower, and met tower associated with the Kahuku Wind Power project would create collision hazards for seven federally listed threatened or endangered species: the Hawaiian stilt or ae‘o, Hawaiian coot or ‘alae ke‘oke‘o, Hawaiian duck or koloa maoli, Hawaiian moorhen or ‘alae ‘ula, Newell’s shearwater or ‘a‘o, Hawaiian petrel or ua‘u, and Hawaiian hoary bat or ‘ope‘ape‘a. These facilities would also create a collision hazard for the state listed Hawaiian short-eared owl. In this document, these eight species are also collectively referred to as the “covered species” because Kahuku Wind Power LLC is seeking to have incidental take of these eight species covered by a

State of Hawai‘i ITL. Table 3-14 lists the federally and state listed species with potential to be adversely impacted by operation of the Kahuku Wind Power project and for which federal or state authorization of incidental take is being sought.

Table 3-14. Federally or state listed species with potential to be impacted by the Kahuku Wind Power project.

Scientific Name	Common, Hawaiian Name(s)	Date Listed	Status[1]
Birds			
Puffinus auricularis newelli	Newell's shearwater, ‘a‘o	10/28/1975	T
Pterodroma sandwichensis	Hawaiian petrel, ua‘u	3/11/1967	E
Anas wyvilliana	Hawaiian duck, koloa maoli	3/11/1967	E
Himantopus mexicanus knudseni	Hawaiian stilt, ae‘o	10/13/1970	E
Fulica alai	Hawaiian coot, ‘ala eke‘oke‘o	10/13/1970	E
Gallinula chloropus sandvicensis	Hawaiian moorhen, ‘alae ‘ula	3/11/1967	E
Asio flammeus sandwichensis	Hawaiian short-eared owl, pueo	--	SE
Mammals			
Lasiurus cinereus semotus	Hawaiian hoary bat, ‘ope‘ape‘a	10/13/1970	E
1) E = federally endangered; T = federally threatened; SE = state endangered			

No federally listed endangered, threatened, or candidate wildlife species are expected to occur at either of the off-site microwave tower sites. However, no radar studies have been conducted at the sites, so it is not known whether Newell's shearwaters or Hawaiian petrels fly past these locations during the nesting season.

Information on each of the eight covered species is briefly summarized below. More detailed information on these species and the potential impacts from the proposed project is provided in Appendix K of this report and in the HCP (SWCA and First Wind 2010).

Newell's Shearwater

The Newell’s shearwater is an endemic Hawaiian sub-species of the nominate species, Townsend’s shearwater (*Puffinus a. auricularis*) of the eastern Pacific. 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).

Day and Cooper (2008) found an extremely low number of targets exhibiting flight speeds and flight patterns that fit the “shearwater/petrel” category during surveillance radar and audiovisual sampling at the project area (Day et al. 2003b). Over five nights of sampling in fall 2007, two petrels or shearwaters were detected flying inland over the Kahuku Wind Power project area toward the Ko‘olau Range and two were detected flying seaward over the site from the Ko‘olau Range. No petrels or shearwaters were detected

flying inland during seven nights of sampling in summer 2008, while seven petrels and/or shearwater-like targets were recorded flying seaward. No visual identification of these birds was possible, but Day and Cooper (2008) suggested that the individuals were likely Newell's shearwaters and not Hawaiian petrels since all targets were recorded after complete darkness.[6] While the uppermost elevation of the site reaches the lower elevation limit for known nesting by this shearwater, no evidence was obtained to suggest that these birds could be nesting on-site.

Newell's shearwater has not been confirmed as a nesting species on Oʻahu. Assuming the detected birds were Newell's shearwaters, then their observed behavior of flying to and from the Koʻolau Range suggests strongly that at least a small number of these birds are breeding in these mountains. Because of the few detections obtained during the Day and Cooper study and lack of radar studies from adjacent lands, it is not known whether the Kahuku Wind Power project area lies within a corridor used regularly by these few birds as they move between their nesting areas and the ocean. Observations of Newell's shearwaters in the Hawaiian Islands indicate that approximately 65% of shearwaters would fly at or below turbine height.

Hawaiian Petrel

The Hawaiian petrel was once abundant on all main Hawaiian Islands except Niʻihau (Mitchell et al. 2005). The population was most recently estimated to be approximately 20,000, with 4,000 to 5,000 breeding pairs (Mitchell et al. 2005). Today, Hawaiian petrels breed in high-elevation colonies on Maui, Hawaiʻi, Kauaʻi and Lānaʻi (Richardson and Woodside 1954, Simons and Hodges 1998, Telfer et al. 1987, DOFAW unpublished data 2006, 2007). Radar studies conducted in 2002 also suggest that breeding may occur on Molokaʻi (Day and Cooper 2002). Breeding is no longer thought to occur on Oʻahu (Harrison 1990).

As discussed in the previous section, 11 birds that met the identification criteria for either Newell's shearwaters or Hawaiian petrels were detected by radar flying over the Kahuku Wind Power site. No visual identification of these birds was possible, but Day and Cooper (2008) suggested that the individuals were likely Newell's shearwaters and not Hawaiian petrels since all targets were recorded after complete darkness. However, because of a lack of definitive identification of these birds, it is considered possible that a small number of Hawaiian petrels could occasionally fly over the Kahuku Wind Power project area during their nesting season (March through September). Hawaiian petrels fly at higher altitudes than Newell's shearwater on average (626 ± 80 ft vs. 410 ± 13 ft, or 191 ± 25m vs 125± 4 m) and would be less likely to collide with the wind turbines and blades than Newell's shearwater.

Hawaiian Duck

The Hawaiian duck is a non-migratory species endemic to the Hawaiian Islands, and the only endemic duck extant in the main Hawaiian Islands (Uyehara et al. 2008). The known historical range of the Hawaiian duck includes all the main Hawaiian Islands, except for the Islands of Lānaʻi and Kahoʻolawe. The only naturally occurring population of Hawaiian duck exists on Kauaʻi, with reintroduced populations on Oʻahu, Hawaiʻi, and Maui (Pratt et al. 1987, Engilis et al. 2002, Hawaiʻi Audubon Society 2005).

Due to the close genetic relationship with mallards, Hawaiian ducks will readily hybridize with mallards and allozyme data indicate there has been extensive hybridization between Hawaiian duck and feral mallards on Oʻahu, with the near disappearance of koloa maoli alleles from the population on the island

[6] Newell's shearwaters move to the interior portions of the islands starting about 30 min after sunset, while Hawaiian petrel movements begin at sunset to about 60 min after sunset (Day et al. 2003b).

(Browne et al. 1993, A. Engilis/UC Davis, pers. comm.). Uyehara et al. (2007) found a predominance of hybrids on O‘ahu and samples collected by Browne et al. (1993) from ducks and eggs at the Ki‘i Unit of the James Campbell NWR found mallard genotypes. In 2005, a peak count of 141 Hawaiian duck x mallard hybrids were recorded on the Ki‘i Unit of the James Campbell NWR (USFWS, unpubl). The current wild population of pure Hawaiian ducks is estimated at approximately 2,200 birds. Because of similarities between the species, it can be difficult to distinguish between pure Hawaiian ducks, feral hen mallards, and hybrids during field studies.

Permanent suitable habitat for Hawaiian duck does not occur at the Kahuku Wind Power project area. Presumed hybrid Hawaiian ducks were seen flying over the lower elevation eastern portion of the Kahuku Wind Power project area on three occasions during point count surveys and once incidental to the surveys (SWCA and First Wind 2008). None of these individuals was observed landing in the project area. A pair of ducks that resembled Hawaiian ducks was also observed on-site following a period of heavy rain in a flooded depression in the area where topsoil had been historically excavated (L. Ong/SWCA pers. obs.). The formation of this and similar areas of standing water that form after heavy rains may occasionally attract ducks to the project area. The portion of the project area where these areas of standing water form is planned to be graded to improve drainage and prevent ponding. This would remove the potential for ducks to be attracted to the project area when the project is in operation. Ducks flying over nearby wetlands have been observed up to heights of approximately 200 ft (60 m). Thus, while flying over the Kahuku Wind Power project area, ducks may be vulnerable to colliding with the WTGs, turbine blades, and the on-site met tower. Based on observations made during the point-count surveys, the estimated passage rate of Hawaiian duck-like ducks over the Kahuku Wind Power project area is 0.003 birds/ha/hr or 8.0 birds/day for the entire site (SWCA and First Wind 2008). Because of hybridization with feral mallards, it is questionable whether the ducks present on O‘ahu are the endemic koloa and are protected under Section 9 of the ESA. However, at the request of the USFWS, Kahuku Wind Power LLC has agreed to treat the Hawaiian duck-like ducks present in the general project vicinity as if they were pure Hawaiian ducks.

Little is known about the interaction of Hawaiian ducks with wind turbines. Studies of wind energy facilities located in proximity to wetlands and coastal areas in other parts of the United States and the world have shown that waterfowl and shorebirds have some of the lowest collision mortality rates at these types of facilities, suggesting that these types of birds are among the best at recognizing and avoiding wind turbines (e.g., Koford et al. 2004, Jain 2005, Carothers 2008). In support of these findings, high avoidance of turbines has also been documented by nēnē or Hawaiian goose (*Branta sandvicensis*) at the KWP facility on Maui, where mortality has been recorded at the average rate of one goose per year (Kaheawa Wind Power 2008).

Hawaiian Stilt

The Hawaiian stilt is a non-migratory endemic subspecies of the black-necked stilt (*Himantopus mexicanus*), which occurs in the western and southern portions of North America, southward through Central America and the West Indies to southern South America and also the Hawaiian Archipelago (Robinson et al 1999). O‘ahu supports the largest number of stilts in the state, with an estimated 35 to 50% of the population residing on the island. Some of the largest concentrations can be found at the James Campbell NWR, Kahuku aquaculture ponds, Pearl Harbor NWR, and Nu‘upia Ponds in Kane‘ohe (USFWS 2005a). The Ki‘i Unit of the James Campbell NWR, and the Waiawa Unit and Pond 2 of the Honouliuli Unit of the Pearl Harbor NWR are the most productive stilt habitats, with birds numbering near 100 or above during survey counts (USFWS 2002, USFWS unpubl. data).

Suitable habitat for Hawaiian stilt is usually absent from the Kahuku Wind Power project area. Given the ability of the species to exploit ephemeral habitats, the formation of ephemeral areas of standing water in

low-lying portions of the project area after heavy rains may occasionally attract stilts. However, as discussed for Hawaiian duck, Kahuku Wind Power LLC is planning to grade the low-lying areas to improve drainage, which would prevent these ponds from forming and attracting stilts when the project is in operation. No Hawaiian stilts were seen flying over the project area during the avian point count surveys conducted by Kahuku Wind Power LLC and SWCA. One dead stilt has been found on the site next to a temporary met tower. A post-mortem investigation by USFWS veterinarians indicated that the bird was emaciated and carried a heavy parasite load, but had no broken bones or abrasions to indicate a collision with the met tower or its guy wires had occurred. The bird was considered most likely to have died of natural causes. However, since the carcass was found at the base of a met tower, the final cause of death was declared indeterminate and not attributed to the met tower (K. Swindle/USFWS, pers. comm.). Because of the known dispersal capabilities of these birds and their regular occurrence at the nearby Kiʻi Unit of James Campbell NWR, it is expected that individual stilts fly over the Kahuku Wind Power project area on a very irregular basis while moving between wetlands, ephemeral ponds, and islands.

Little is known about the interaction of black-necked stilts with turbines in the United States. One black-necked stilt mortality was reported at the Altamont Pass Wind Resource Area from 2005-2007 (Altamont Pass Avian Monitoring Team 2008). The adjusted fatality per turbine was 0.00193 stilt per turbine. In general, low mortality of waterbirds has been documented at wind turbines situated coastally, like the proposed Kahuku Wind Power project, despite the presence of high numbers of waterbirds in the vicinity (Kingsley and Whittam 2007, Carothers 2008). Many studies of coastal wind energy facilities have shown that waterbirds and shorebirds are among the birds most wary of turbines and that these birds readily learn to avoid the turbines over time (Carothers 2008).

Hawaiian Coot

The Hawaiian coot is an endangered species endemic to the main Hawaiian Islands, except Kahoʻolawe. The Hawaiian coot is non-migratory and believed to have originated from migrant American coots (*Fulica americana*) that strayed from North America (Pratt et al. 1987, Brisbin et al 2002). The population of Hawaiian coot has fluctuated between 2,000 and 4,000 birds. Of this total, roughly 80% occur on Oʻahu, Maui, and Kauaʻi (Engilis and Pratt 1993, USFWS 2005a). The Oʻahu population fluctuates between approximately 500 to 1,000 birds. Hawaiian coots occur regularly in the Kiʻi Unit of the James Campbell NWR, with peak counts in 2005 and 2006 reaching nearly 350 birds (USFWS 2002, USFWS 2005a, USFWS unpubl. data).

No Hawaiian coots were observed in flight at the Kahuku Wind Power project area during the year-long avian point count survey. However, Hawaiian coots are known to disperse between islands, so there is potential for coots to occasionally fly over the lower elevations of Kahuku Wind Power project area if moving between wetlands or islands. No suitable habitat for Hawaiian coot occurs in the Kahuku Wind Power project area. This species appears less apt to utilize ephemeral habitats than Hawaiian ducks or Hawaiian stilts because such habitats typically lack the emergent wetland vegetation used for cover. However, it is conceivable that the ephemeral ponds that form in the low-lying portion of the project area after heavy rains may rarely attract coots. Because of the plans to grade this area to improve drainage, no ponding would occur in the future and these features would not be present to attract coots to the site when the project is in operation.

Hawaiian Moorhen

The Hawaiian moorhen is an endangered, endemic, non-migratory sub-species of the cosmopolitan common moorhen (*Gallinula chloropus*). It is believed that the sub-species originated through colonization of Hawaiʻi by stray North American migrants (USFWS 2005a). Originally occurring on all the main Hawaiian Islands (excluding Lānaʻi and Kahoʻolawe), Hawaiian moorhen is currently limited to

regular occurrence on the Islands of Kaua‘i and O‘ahu (Hawai‘i Audubon Society 2005, USFWS 2005a). A population was reintroduced to Moloka‘i in 1983, but no individuals remain on the island today.

No Hawaiian moorhens were detected during the year of avian point count surveys on the Kahuku Wind Power project area or on adjacent wetlands, although the birds are known to occur regularly at the Ki‘i Unit of James Campbell NWR. This lack of detection is likely because moorhens rarely fly and typically remain within or close to dense vegetation. However, as colonization of Hawai‘i by moorhens does attest, members of the species are able to fly considerable distances when they so desire. It is considered very unlikely that Hawaiian moorhens regularly fly over the Kahuku Wind Power project area; however, given their ability to fly and their regular occurrence at the nearby Ki‘i Unit of James Campbell NWR, it is possible that individual Hawaiian moorhens would very occasionally fly over the site, especially the lower elevation eastern portion nearest the adjacent wetlands.

No suitable habitat for Hawaiian moorhen occurs in the Kahuku Wind Power project area. This species is not expected to utilize the ephemeral areas of standing water that can form in the project area after heavy rains because these areas lack the emergent wetland vegetation the birds use for cover. Because of the grading plans to improve drainage, ponding would not occur during project operation and no potential would exist for moorhens to be attracted to the project area.

Hawaiian moorhens are considered to be at low risk from wind farms because there have only been a few published reports of the closely related common moorhen colliding with turbines in Europe (Ireland, Percival 2003) and Netherlands (Hotker et. al 2006) and none in the United States. This is despite the fact that common moorhens are frequently found around wind turbines located near wetlands. However, one study in Spain lists the common moorhen at “some” collision risk with power lines due to their flight performance and also records one instance of mortality due to collision (Janss 2000).

Hawaiian Short-eared Owl

The Hawaiian short-eared owl is an endemic subspecies of the nearly cosmopolitan short-eared owl (*Asio flammeus*). This is the only owl native to Hawai‘i and it is found on all the main islands from sea level to 8,000 ft (2,450 m). The Hawaiian short-eared owl is listed by the State of Hawai‘i as endangered only on the Island of O‘ahu. No surveys have been conducted to date to estimate the population size of Hawaiian short-eared owl. The species was widespread at the end of the 19th century, but numbers are thought to be declining (Mostello 1996, Mitchell et al. 2005).

Habitats present in the project area match those typically associated with Hawaiian short-eared owl. No Hawaiian short-eared owls were detected on or over the Kahuku Wind Power project area during any of the avian point count surveys conducted by First Wind and SWCA. One Hawaiian short-eared owl was heard on-site in July 2008 by personnel conducting the radar survey for seabirds. Because these owls can be active during daytime and crepuscular periods, it seems probable that they would have been detected during the avian point counts if resident on-site, since more time was spent conducting the point count surveys than was spent conducting the radar surveys. Given this discrepancy, it seems that Hawaiian short-eared owl is most likely an irregular visitor to the Kahuku Wind Power project area.

Little information is available on the impacts of wind facilities on owls. However, four fatalities of short-eared owl (*Asio flammeus flammeus*) have been recorded at McBride Lake, Alberta, Canada, Foote Creek Rim, Wyoming, Nine Canyon, Wyoming, and Altamont Wind Resource Area, California (Kingsley and Whittam 2007). Hawaiian short-eared owls are present year-round and observed regularly in the vicinity of the KWP facility on Maui, with no fatalities reported in approximately three and a half years of operation. In the vicinity of turbines, most observations of Hawaiian short-eared owl have been below the rotor swept zone of the turbines and thus their susceptibility to collision appears to be low (G.

Spencer/First Wind, pers. comm.). At Wolfe Island, Ontario, it was observed that short-eared owls were most vulnerable to colliding with turbine blades when avoiding predators and during aerial flight displays (Stantec Consulting Ltd. 2007). Short-eared owls on O‘ahu have no aerial predators and thus may only be vulnerable to colliding with turbines during flight displays.

Hawaiian Hoary Bat

The Hawaiian hoary bat is the only native land mammal present in the Hawaiian archipelago. It is a sub-species of the hoary bat (*Lasiurus cinereus*), which occurs across much of North and South America. The bat has been recorded on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, but no historical population estimates or information exist for this sub-species. Population estimates for all islands in the state in the recent past have ranged from hundreds to a few thousand bats (Menard 2001). However, based on monitoring currently underway on the Island of Hawai‘i, the population is estimated to possibly be as high as 100,000 bats on the Island of Hawai‘i alone (F. Bonaccorso/USGS, pers. comm.).

Bat activity was recorded by the Anabat™ detectors from April 2008 to April 2009 at a rate of 0.0130 bat passes/detector/night or 0.016 bat call sequences/detector/night. The limited data suggest that bat activity may increase from June to September and is lowest or absent from December to February. The detection rates at Kahuku Wind Power are 40-fold lower than detection rates recorded at Hakalau National Wildlife Refuge (0.660 passes/detector/night, Bornaccorso, unpubl.). Bat activity at the Kahuku Wind Power project area was similar to the post-construction bat activity recorded at the Kaheawa Wind Power project, which had an activity rate of 0.014 bat call sequences/detector/night (SWCA 2009).

The actual number of bats represented by the detections made by the Anabat™ data-loggers on the Kahuku Wind Power site is not known. No bats were sighted at the Kahuku Wind Power project area during the nocturnal point count surveys conducted from October 2007 through December 2008. Day and Cooper (2008) visually observed one Hawaiian hoary bat on-site incidental to the seabird radar survey in the summer of 2008. Given these results, it is presumed that a very small number of Hawaiian hoary bats forage over the Kahuku Wind Power project area on a somewhat regular basis. Such bats could also roost in trees in the project area. When present, areas of standing water that forms for short periods after heavy rain may provide a source of drinking water for bats. Because presence of this water is infrequent and unpredictable, it is not expected to be an important resource for Hawaiian hoary bats (J. Kwon/USFWS, pers. comm.). The proposed grading would eliminate these areas, thereby also eliminating a potential bat attractant from the project area.

In their North American range, hoary bats are known to be more susceptible to collision with wind turbines than most other bat species (Johnson et al. 2000, Erickson 2003, Johnson 2005). Most mortality has been detected during the fall migration period. Hoary bats in Hawai‘i do not migrate in the traditional sense, although as indicated some seasonal altitudinal movements occur. Currently, it is not known if Hawaiian hoary bats are equally susceptible to turbine collisions during their altitudinal migrations as hoary bats are during their migrations in the continental US. At the KWP facility on Maui, one Hawaiian hoary bat fatality has been recorded after three and a half years of operation (G. Spencer/First Wind, pers. comm.).

3.12.4.1 Potential Impacts of the Proposed Action

Construction and operation of Kahuku Wind Power would create the potential for federally and state listed bird and bat species to collide with wind turbines, temporary and permanent met towers, and cranes used for construction of the turbines. Some limited potential exists for the species to collide with the on-site and off-site microwave towers, overhead collection lines, relocated distribution lines, and utility

poles; however, these components are not expected to create a significant collision hazard to any covered species.

The potential for each listed species to collide with on-site project components was identified based on the results of the on-site surveys discussed in Sections 3.12.2 and 3.12.4 and the proposed project design. Avian fatality estimate models were developed that incorporated rates of species occurrence, observed flight heights, encounter rates with turbines and met towers, and considered ability of birds to avoid project components. Ability of birds to avoid turbines was then varied in the models to create a range of probabilities of mortality for each species on an annual basis. Range of expected mortality coincides with the amount of "direct take" expected from construction and operation of the Kahuku Wind Power project.

In addition to "direct take," mortality of listed species resulting from collisions with project components could also result in "indirect take." For example, it is possible that adult birds killed through on-site collisions could have been tending to eggs, nestlings, or dependent fledglings or adult bats could have been tending to dependent juveniles. The loss of these adults would then also lead to the loss of the eggs or dependent young. Loss of eggs or young would be "indirect take" attributable to the proposed project. Methods for determining indirect take are described in detail in the HCP (SWCA and First Wind 2010).

The direct and indirect impacts to each covered species expected to result from construction and operation of the proposed action is summarized briefly below. Extensive information concerning potential direct and indirect impacts of the project is contained in the Kahuku Wind Power HCP (SWCA and First Wind 2010) and in Appendix K of this report. Cumulative impacts are discussed in Section 3.16.11.2.

For most of the covered species, expected rates of take are expected to average less than one individual per year. DOFAW-DLNR requires that applications for ITLs request take authorizations in terms of whole numbers of individuals. Consequently, the HCP also identifies the whole number of individuals for which take authorization is being sought by Kahuku Wind Power LLC. As those numbers reflect requested level of take authorization rather than the expected rate at which mortality would occur (i.e., the actual impact of the proposed action), those numbers are not included in this assessment. A summary of the estimated and requested take of the covered species is provided in Table 3-15.

Mitigation measures proposed by Kahuku Wind Power LLC to compensate for the expected impacts of the project were selected in collaboration with biologists from USFWS, DLNR-DOFAW, First Wind, and SWCA, and with members of the ESRC (Table 3-16). The mitigation proposed to compensate for impacts to the covered species is based on anticipated levels of incidental take as determined through on-site surveys, modeling, and the results of post-construction monitoring conducted at other wind projects in Hawai‘i and elsewhere in the United States. Mitigation takes into account the expected annual rate of direct and indirect take.

Table 3-15. Summary of estimated and requested authorized take of covered species at the Kahuku Wind Power facility.

covered species	Expected Rate of Take		Requested ITL Authorization	
	Annual	***20-Yr Project Life***	***Annual***	***20-Yr Project Life***
Hawaiian petrel	0.17 adults 0.17 chicks	4 adults 4 chicks	2 adults 2 chicks	4 adults 4 chicks
Newell's shearwater	0.34 adults 0.16 chicks	7 adults 4 chicks	2 adults 1 chick	8 adults 4 chick
Hawaiian duck	0.026 adults 0.031 ducklings	1 adult 1 duckling	2 adults 2 ducklings	8 adults 8 ducklings
Hawaiian stilt	0.026 adults 0.0012 chicks	1 adult 1 chick	2 adults 1 chicks	8 adults 4 chicks
Hawaiian coot	0.026 adults 0.012 chicks	1 adult 1 chick	2 adults 1 chicks	8 adults 4 chicks
Hawaiian moorhen	0.026 adults 0.017 chicks	1 adult 1 chick	2 adults 2 chicks	8 adults 6 chicks
Hawaiian short-eared owl	0.33 adults 0.31 owlets	7 adults 7 owlets	2 adults 2 owlets	8 adults 8 owlets
Hawaiian hoary bat	0.19 adults 0.34 juveniles	4 adults 7 juveniles	5 adults 3 juveniles	12 adults 9 juveniles

Table 3-16. Proposed mitigation for the covered species: Lower, Baseline and Higher Take Scenarios.

Species	Proposed Mitigation by Measured Take Level			Benefit of Proposed Mitigation
	Baseline	Lower	Higher	
Seabirds	Predator control and a social attraction study for Newell's shearwater and Hawaiian petrel at Makamakaʻole or other suitable seabird nesting sites on Maui, Kauaʻi or elsewhere	Same as Baseline	Increased mitigation efforts at the same site or additional mitigation measures at one or more additional sites on Maui or Kauaʻi or elsewhere	Predation mortality has been documented for adults, fledglings, and eggs. Predator trapping at a chosen seabird colony is expected to increase overall productivity and result in a net benefit to the species. If fencing is erected, cats and mongoose would also be excluded, further increasing productivity. If the social attraction program is implemented, the colony may be further enhanced by attracting a greater number of seabirds to nest in the managed area.
Waterbirds	Predator control, vegetation maintenance, and monitoring at Hamakua Marsh for 3 to 5 years; removal of feral ducks, mallards, and Hawaiian duck hybrids; subsequent mitigation efforts to meet baseline requested take as required	Same as Baseline	Additional mitigation efforts at Hamakua Marsh or predator control and monitoring at additional wetlands	The trapping of cats, dogs, mongoose, and rats at Hamakua Marsh is expected to increase the reproductive success of Hawaiian coot, Hawaiian stilt, and Hawaiian moorhen. The eradication of hybrid and feral ducks is expected to reduce the continued hybridization of feral mallards with the Hawaiian duck.

Species	Proposed Mitigation by Measured Take Level			Benefit of Proposed Mitigation
	Baseline	Lower	Higher	
Hawaiian short-eared owl	Upfront contribution of $25,000 for research and rehabilitation and $25,000 up to a maximum of $50,000 for management as it becomes available	Same as Baseline	Additional funding of $15,000 for research and rehabilitation and $15,000 up to a maximum of $30,000 to implement management strategies	As little is known about the life history of the Hawaiian short-eared owl, research could be designed to develop protocols to monitor Hawaiian short-eared owl populations, determine habitat use and preferences, evaluate the effectiveness of habitat management techniques, and subsequently implement practicable management actions to aid in the recovery of the species. Injury due to vehicular collisions is identified as a cause of death for Hawaiian short-eared owls on Maui, O‘ahu, and Kaua‘i. Thus, implementation of the rehabilitation program may minimize these deaths.
Hawaiian hoary bat	Up to a maximum of $150,000 for management of bat habitat	Same as Baseline	Low-wind speed curtailment and additional funding of $15,000 up to a maximum of $75,000 for management	Because of the lack of life history information on the Hawaiian hoary bat, research is identified as one of the key components in the recovery of this subspecies. The Recovery Plan for the Hawaiian Hoary Bat (USFWS 1998) states that “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.” In-house research is also expected to advance avoidance and minimization strategies that wind facilities in Hawai‘i and elsewhere can employ to reduce bat fatalities. Additionally, native habitat plant restoration is expected to increase foraging and roosting habitat for the Hawaiian hoary bat and result in a long-term net benefit to the species.

In addition to the species specific mitigation measures, general wildlife-related measures have also been proposed by Kahuku Wind Power LLC. A wildlife education and observation program would be conducted for all regular on-site staff (Appendix I). Furthermore, all regular on-site staff would be trained in the wildlife casualty monitoring protocol which would include documenting all observed mortality or injury to wildlife (including MBTA-protected birds not otherwise covered by the Kahuku Wind Power HCP). This protocol was developed in cooperation with DLNR and USFWS. Injured individuals or carcasses would be handled according to guidelines in Appendix J.

A summary of mitigation efforts proposed by Kahuku Wind Power LLC for the covered species and their anticipated benefits is provided in Table 3-16. Additional details regarding mitigation measures and their potential impacts are provided in this section. Kahuku Wind Power LLC would be required to implement these mitigation measures under the ITL, and they are included in the EA as an integral part of the proposed project. A more detailed description of the mitigation measures, the criteria used for determining appropriate mitigation measures, the goals of the mitigation measures, and rationale for the proposed levels of effort is outlined in the HCP (SWCA and First Wind 2010) and Appendix K.

Newell's Shearwater

Newell's shearwaters are not known nor expected to breed in the project area, so the proposed action would not result in any habitat impacts for this species. Newell's shearwaters do have the potential to collide with WTGs or met towers associated with the proposed project. Given the brevity of the construction period and the low occurrence rate of Newell's shearwater over the project area, potential for Newell's shearwaters to collide with construction cranes is considered to be negligible. Some potential exists for construction or maintenance vehicles to strike downed shearwaters (birds already injured by collision with turbines or towers) while traveling project roads. However, this source of mortality does not result in an increase in the amount of direct take expected from the proposed project because these birds are accounted for in the collision strike mortality modeling.

Expected rates of take for Newell's shearwater, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Expected Rate of Take

Annual average	0.34 adults and 0.16 chicks
20-year project life	7 adults and 4 chicks

Direct and indirect take is expected to result in the loss of an average of 0.50 shearwater per year (0.34 adult + 0.16 juvenile = 0.50 bird). One-half bird per year represents approximately 0.0005% to 0.001% of the estimated Newell's shearwater population. Given these very low percentages, it is considered extremely unlikely that take caused by the proposed project would result in significant adverse effects to Newell's shearwater at the population level.

The major threats identified for the covered seabirds are introduced predators, which can prey on adults, eggs, and fledglings; feral ungulates, which degrade habitat and may trample burrows; and artificial lighting, which may disorient fledglings and increase their risk of collision with artificial structures (Mitchell et al. 2005). As described in the HCP, Kahuku Wind Power LLC proposes, with the concurrence of ESRC, USFWS, and DLNR, that mitigation for Newell's shearwaters and Hawaiian petrels would consist of predator control, fencing, or colony and habitat enhancement at a seabird colony on Maui, Kaua'i or elsewhere. Suppressing predator populations is expected to increase nesting success and adult survival rates at the colony. If fencing is erected, cats and mongoose would also be excluded, further increasing productivity. If insufficient naturally occurring burrows are found within the fenced

area, Kahuku Wind Power LLC may consult with USFWS and DLNR to implement social attraction techniques for both covered seabird species within the fenced area to increase the number of active burrows. If the social attraction program is implemented, the colony may be further enhanced by attracting a greater number of seabirds to nest in the managed area. Currently, the preferred mitigation site is situated on West Maui at Makamaka‘ole.

The cat-proof fence at Makamaka‘ole would be approximately 1.6 - 2 miles (2.6 – 3.2 km) long. The actual length and location of the fence, and the size of the enclosed area, would be determined in concurrence with USFWS and DLNR. Construction of the fence at Makamaka‘ole would result in the disturbance and removal of limited amounts of vegetation. The fence would be approximately 1.6 to 2 mi long and a swath of no greater than 12 ft of vegetation would be cleared, resulting in a maximum potential disturbance of approximately 2.9 acres (2 mi x 12 ft = 126720 sq ft = 2.9 acres) (1.17 ha). Prior to construction, the final fence alignment would be surveyed by qualified specialists to ensure the fence would be appropriately placed to avoid adverse impacts to sensitive biological and cultural resources.

Designated critical habitat for two endangered plant species, *Cyrtandra munroi* (ha‘iwale) and *Clermontia oblongifolia ssp. mauiensis* (‘oha wai), occurs in the vicinity of the Makamaka‘ole colony. The current potential fence boundary includes roughly 95.0 ac (38.0 ha) and 127.0 ac (52.0 ha) of critical habitat for *C. oblongifolia ssp. mauiensis* and *C. munroi*, respectively. It is unknown whether individuals of these plants actually occur in the area; however, fence construction and monitoring, predator control, social attraction studies, and habitat management activities proposed as seabird mitigation may potentially impact listed plants and their designated critical habitats. In order to avoid and minimize impacts to listed plants and critical habitat, Kahuku Wind Power LLC would hire a qualified botanist to fully survey the area and proposed fence line prior to construction and management activities. Any listed or candidate plant species discovered in the area would be clearly flagged, and appropriate protocols would be used to avoid direct or indirect impacts to listed plants. The initial survey would document baseline conditions at the site for assessing impacts to listed plants and designated plant critical habitat. If listed plants or their designated critical habitats appear to be impacted, construction and monitoring methods may be modified in consultation with DLNR and USFWS and mitigation would be prescribed, as appropriate.

In addition, fence contractors would be educated regarding the sensitivity of this project including working in critical habitat. For this analysis, the conservative estimate of 2.9 acres is used; however, the actual impact should be far less. Common species of native plants would be removed only when necessary, and removal of native plants greater than 6 inches in diameter would be avoided as much as possible. Cut vegetation would be left to decompose.

Fence construction can create conditions that facilitate the establishment of non-native species, primarily due to soil and vegetation disturbance. Furthermore, the fencing crew has the potential to unintentional introduce non-native species via equipment and field gear (packs, rain gear, etc). Gear-cleaning procedures to reduce the introduction of noxious plant seeds and propagules, as well as arthropods such as exotic ants, would be strongly enforced. To reduce the potential for introduction of non-native invasive species at the site, all equipment and materials (including boots) would be stored in a weed-free area and inspected and cleaned prior to accessing the area. Inspection protocols and the need for any post-construction monitoring would be determined in cooperation with DOFAW, USFWS, and the Maui Invasive Species Committee (MISC).

The disturbance is expected to be short-term as native vegetation would regenerate post construction. The plant critical habitat protected by the fence would benefit as herbivory and trampling by feral pigs may be reduced. By implementing the measures described above, adverse effects to listed plant species and plant critical habitat would be minor.

To minimize soil erosion and impacts to the habitat, only the minimal amount of clearing would be done in order for the fence to be built. To minimize the potential for erosion, the extent and steepness of exposed ground areas would be reduced to the maximum extent possible. BMPs would also be incorporated as appropriate (e.g. avoiding earthwork during inclement weather, temporary stabilization with geotextile mats, and revegetation with native species).

Prior to construction, the final fence alignment would be surveyed by a qualified biologist to document sensitive wildlife, particularly seabird burrows and the Hawaiian hoary bat. The fence would be appropriately placed to avoid adverse impacts to these resources. Fence contractors would be trained to identify seabird nesting burrows and to be aware of endangered species and sensitive habitats. Noise associated with construction may temporarily disrupt seabirds nesting within the area; therefore, all construction activities would be conducted outside of the nesting season of the two covered seabird species to minimize impacts. To minimize the potential for birds to collide with the fence, Kahuku Wind Power LLC would improve the visibility of the fence with steel reinforced white poly-vinyl tape. The tape would be interwoven horizontally at various heights along the fence.

Hawaiian hoary bats roost during the day in trees and shrubs. Trees greater than 15 feet would be removed only when necessary and tree cutting or clearing would be avoided during the bat-pupping season (April – August) in order to avoid potential for harm to non-volent juvenile bats. During fence construction, if a Hawaiian hoary bat (adult or pup) is discovered near construction activities, the area would be avoided as long as the bat is present. The completed fence could serve as a hazard for Hawaiian hoary bats flying or roosting in the area. Due to the possibility of fence line impacts involving bats, there would be no barbed wire on any portion of the fence, thereby reducing any possible impalement on the fence. Because the project is designed to protect native habitat through fencing and predator removal, the total impact on the bat population is anticipated to be positive.

The covered seabird species are not expected to be attracted to rodenticide (if used to control rats within the fence) because the adults of the covered seabird species feed by foraging for fish and other marine organisms offshore (DOFAW 2009). Seabirds are not expected to eat organisms that have been contaminated by eating rodenticide. Thus, the use of rodenticides is not anticipated to negatively impact seabird populations.

Prior to construction of the fence, the area to be disturbed would be surveyed by a qualified specialist to ensure that all historical, cultural, and archaeological resources are avoided. Construction of the fence is not expected to impact cultural practices by restricting access due to the remote location of the fence and the size of the area expected to be fenced.

Makamaka‘ole is situated on State land within a Conservation District; therefore a State EA would be prepared by DLNR DOFAW prior to construction in accordance with Chapter 343 of HRS. This process would more specifically assess impacts of the proposed fence and include consultation with the State Historic Preservation Division.

Proposed mitigation measures are expected to more than offset the anticipated take and contribute to both 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 are expected.

No seabird mortality (or mortality of any other listed species) has been recorded at the existing Crown Castle tower near Flying R Ranch or at the Waialua Substation site, although DOE is not aware that any systematic mortality monitoring has been conducted at these locations. Because the proposed Waialua Substation and Flying R Ranch towers would be located in areas with structures similar in height to the proposed microwave towers (utility poles, street pole, etc.) and associated power lines, and because they

would be immobile, the towers are not expected to create a significant collision hazard to any covered species if they should happen to transit the tower location. Studies have shown that only 1% of Newell's shearwaters (n = 688 birds; B. Cooper, pers. comm.) fly below 60 ft and of these individuals, the estimated collision avoidance rate is 97% (Day et al., In prep). It is expected that Newell's shearwater individuals could occasionally transit over the off-site microwave tower sites, but at much higher altitudes than the towers themselves (average flight height estimated at 627 ± 82 ft or 191 ± 25 m). Given that the seabird traffic rate on O'ahu is extremely low, the likelihood of a seabird flying at such low altitudes and colliding with the microwave towers, overhead cable, or utility poles related to the microwave tower is considered to be remote. Therefore, the proposed off-site microwave towers were not identified as a potential source of take of Newell's shearwater in the mortality modeling performed for the species and, thus, the amount of take requested to be authorized through the ITL is based solely on mortality expected to occur as a result of construction and operation of the WTGs and associated on-site facilities.

However, if in the unlikely event a seabird mortality is found in the future and that mortality can be attributed to the on-site construction cranes, Kahuku Wind Power microwave towers, or associated overhead cables or utility poles, Kahuku Wind Power LLC would mitigate for that loss at a level commensurate with any take recorded on-site and through the methods described in the HCP. After commissioning, the lease for both off-site microwave tower sites may be turned over from Kahuku Wind Power LLC to HECO. If so, any take responsibility (if any) associated with potential take at the off-site tower may be transferred as well. The transfer of responsibility would be determined in consultation with DLNR and USFWS).

Hawaiian Petrel

Like Newell's shearwater, Hawaiian petrels are not known nor expected to breed in the Kahuku Wind Power project area. Consequently, the proposed action is not expected to result in any habitat impacts for this species. No birds believed to be Hawaiian petrels were recorded flying over the site during the radar studies, and their documented numbers on O'ahu are very low. Because no Hawaiian petrels were identified flying over the site, mortality modeling for this species would identify an expected rate of take of zero. Given the results of the radar studies and the very low number of petrels believed to occur on O'ahu, it does seem that the risk of the proposed project causing take of this species is very low, but not zero. Therefore, the Kahuku Wind Power HCP assumed that the average annual rate of direct take of adult Hawaiian petrel would be half that of Newell's shearwater (0.34 shearwater/year), or 0.17 petrel/year (SWCA and First Wind 2010). This estimate includes potential fatality caused by collision with turbines, met towers, and associated structures, as well as mortality due to vehicular strikes. Over the 20-year life of the project, this equates to loss of approximately 4 Hawaiian petrels (0.17 petrel/year x 20 years = 3.4 petrels).

Expected rates of take for Hawaiian petrel, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Expected Rate of Take

Annual average	0.17 adults and 0.17 chicks
20-year project life	4 adults and 4 chicks

The current population of Hawaiian petrel is estimated to be approximately 20,000 birds, with 4,000 to 5,000 breeding pairs (Mitchell et al. 2005). The average rate of take of Hawaiian petrel is expected to be no more than 0.34 petrel/year (0.17 adults and 0.17 chicks). This represents less than 0.009% of the estimated Hawaiian petrel breeding population and less than 0.002% of the estimated total population. Given these very low percentages, it is considered extremely unlikely that take of Hawaiian petrel caused

by the proposed project would result in significant adverse effects to Hawaiian petrel at the population level.

The major threats identified for the covered seabirds are introduced predators, which can prey on adults, eggs, and fledglings; feral ungulates, which degrade habitat and may trample burrows; and artificial lighting, which may disorient fledglings and increase their risk of collision with artificial structures (Mitchell et al. 2005). 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), and predation on adults has also been documented (Simons 1983). In Haleakalā National Park, Hodges and Nagata (2001) identified predation as accounting for 41% of total terrestrial mortality (adults, fledglings, and eggs) in cases in which a cause of death could be determined. Predation mortality was attributed to cats and mongooses (38%), rats (41%), dogs (14%) and owls (6%) (Hodges and Nagata 2001). Data from Hodges (1994), Hu et al. (2001), and Hodges and Nagata (2001) show that predator control (trapping and fencing) generally results in a significant increase in Hawaiian petrel nesting success. Suppressing predator populations is also expected to increase adult survival rates.

Similar to Newell's shearwaters, the mitigation for Hawaiian petrels would consist of predator control, fencing, or colony and habitat enhancement at a seabird colony on Maui, Kaua'i or elsewhere. One possible mitigation alternative to the Makamaka'ole colony that has emerged through discussion with the National Park Service (NPS) is the opportunity to participate in the management of the Hawaiian petrel colony in the crater of Haleakalā located on the eastern portion of Maui. NPS has indicated that a roughly 220 ac (89 ha) area with approximately 100 burrows are protected from habitat damage by feral goats and pigs, but are not protected from predators. NPS does not have funds to conduct the needed predator control in this area and does not anticipate receiving funds in the near future (Bailey, pers. comm.). Kahuku Wind Power would contract the labor and purchase equipment required to conduct predator trapping in this area and to conduct monitoring to document success.

Gear-cleaning procedures to reduce the introduction of noxious plant seeds and propagules, as well as arthropods such as exotic ants would be strongly enforced for biologists and/or contractors that conduct predator control or monitoring efforts. There is some potential for seabirds to get caught in traps, and on rare occasions, this can result in the death of the bird. Trapping and monitoring at Haleakalā would closely follow the protocols that have already been established by NPS. This includes appropriate trap placement and regular monitoring. Therefore, potential adverse impacts to seabirds as a result of the proposed mitigation are not anticipated. If diphacinone (or another rodenticide) is used to control rats at Haleakalā, the adults of the covered seabird species are not expected to be attracted to the toxin or eat organisms that have been contaminated (as described above). Thus, the use of rodenticides is not anticipated to negatively impact seabird populations.

Designated critical habitat for the threatened *Argyroxiphium sandwicense spp. macrocephalum* ('ahinahina or Haleakalā silversword) occurs in the vicinity of the proposed Haleakalā mitigation site. Predator control activities, as well as increased foot traffic through the area for deployment of monitoring of traps may adversely impact the species and its critical habitat. In order to avoid impacts to listed plants, all listed individuals in the vicinity would be clearly flagged, and appropriate protocols would be used to avoid direct or indirect impacts to listed plants. Because the mitigation would closely follow protocols that have already been established by NPS at nearby areas that also contain critical habitat for *A. sandwicense spp. macrocephalum*, adverse impacts would be minor.

Proposed mitigation measures are expected to more than offset the anticipated take and contribute to 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 are expected.

Similar to Newell's shearwater, no radar studies were conducted at the off-site microwave tower sites because the low heights of the towers (60 ft or less) and their small profiles would present minimal collision risk to petrels. It is expected that Hawaiian petrel individuals could occasionally transit over the off-site microwave tower sites, but at much higher altitudes than the towers themselves (average flight height estimated at 410 ± 13 ft or 125± 4 m). Given that the seabird traffic rate on O'ahu is extremely low, the likelihood of a seabird flying at such low altitudes and colliding with the microwave towers, overhead cable, or utility poles related to the microwave tower is considered to be remote. Therefore, the proposed off-site microwave towers were not identified as a potential source of take of Hawaiian petrel in the mortality modeling performed for the species and, thus, the amount of take requested to be authorized through the ITL is based solely on mortality expected to occur as a result of construction and operation of the WTGs and associated on-site facilities.

Hawaiian Duck Hybrids

Grading to eliminate the formation of areas of standing water that form after heavy rain events would result in loss of some habitat available to (hybrid) Hawaiian ducks. However, because the presence of these features is infrequent and unpredictable, this habitat resource is not considered important to these ducks (J. Kwon/USFWS, pers. comm.). Given this, removal of the ability of this area to hold water and attract ducks to the project area is considered a beneficial component of the proposed project as it would reduce the risk of collision with WTGs and other project facilities during the operation phase.

Low mortality of waterbirds has been documented at wind turbines situated coastally, like the proposed Kahuku Wind Power project, despite the presence of high numbers of waterbirds in the vicinity (Kingsley and Whittam 2007). Studies at wind energy facilities located in proximity to wetlands and coastal areas have shown that waterbirds and shorebirds are among the birds most wary of turbines and that these birds readily learn to avoid the turbines over time (Koford et al. 2004, Jain 2005, Carothers 2008).

The potential for hybrid Hawaiian ducks to collide with construction cranes is considered to be negligible. In addition to the cranes being on-site for only a few months, the ducks are primarily diurnal and the cranes would be highly visible and so should be readily avoided. Some potential exists for construction or maintenance vehicles to strike downed ducks (ducks already injured by collision with turbines or towers) while traveling project roads. As for Newell's shearwater and Hawaiian petrel, this potential source of mortality is accounted for in the collision mortality estimate and so does not result in an increase in the amount of take expected from the proposed project.

Expected rates of take for Hawaiian duck hybrids, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Expected Rate of Take

Annual average	0.026 adult ducks and 0.031 ducklings
20-year project life	1 adult duck and 1 duckling

An estimated 300 hybrid Hawaiian ducks are present on O'ahu (Engilis et al. 2002, USFWS 2005a). The expected level of take over the 20-year life of the project is approximately one adult duck and whatever number of eggs or ducklings being tended at the time of collision. Mortality realized at this very low rate is not expected to cause significant negative impacts to the O'ahu population of hybrid Hawaiian ducks. Regardless, because it is anticipated that all hybrid Hawaiian ducks on O'ahu will ultimately be removed/relocated to allow for the reintroduction of pure Hawaiian ducks, loss of hybrid ducks as a result of operation of the Kahuku Wind Project is not considered to be biologically significant or adverse.

The Kahuku Wind Power HCP proposes to mitigate for possible impacts to Hawaiian duck, Hawaiian stilt, Hawaiian coot, and Hawaiian moorhen concurrently at one wetland site because of the similar habitat requirements of these species, and because they face similar threats to their habitat and reproductive success. Proposed mitigation for the take of waterbirds by operation of the Kahuku Wind Power project would focus on predator control and vegetation maintenance at one or more wetland sites on O‘ahu that has regular waterbird nesting activity, as identified by DLNR-DOFAW and USFWS (see Appendix K). As no pure Hawaiian ducks exist on O‘ahu due to hybridization, mitigation for Hawaiian ducks would also include removal of feral ducks, mallards, and Hawaiian duck hybrids at the mitigation site. Currently, the preferred mitigation site is Hamakua Marsh, a 23-acre wetland located on east O‘ahu.

Concern was expressed by USFWS about the possible take of waterbirds as a consequence of predator trapping at the marsh. Moorhen are attracted to traps (DesRochers et al. 2006) and moorhen on O‘ahu have been documented entering live traps (DesRochers et al. 2006, Nadig pers. comm.). Thus, predator trapping poses some risk of harassment due to capture, and may result in injury or mortality to the covered waterbird species. However, at Hamakua Marsh, traps are not placed within moorhen habitat (Misaki, pers. comm.) and in the five years of predator trapping, no injuries or fatalities due to the by-catch of moorhen or any of the other covered waterbird species have been reported. Due to the minimal risk of injury or mortality expected at Hamakua Marsh, no additional take is requested for any of the covered waterbird species. However, in the unlikely event a waterbird mortality or injury is caused by the mitigation measures, Kahuku Wind Power LLC would mitigate for that loss at a level commensurate with any take that occurs and measures would be put in place to prevent a repeat of the same occurrence as far a practicable.

The trapping of cats, dogs, mongoose, and rats at Hamakua Marsh, is expected to increase the reproductive success of Hawaiian coot, Hawaiian stilt, and Hawaiian moorhen. The eradication of hybrid and feral ducks is expected to reduce the continued hybridization of feral mallards with the Hawaiian duck. These proposed mitigation measures are expected to more than offset the anticipated take and contribute the species’ recovery by providing a net conservation benefit, as required by State law. For this reason, no significant adverse impacts to the covered waterbirds’ overall populations are expected.

Hawaiian duck hybrids frequently fly at altitudes that the on-site and off-site microwave towers, collection lines and utility poles would extend to (see HCP). Therefore, potential for ducks to collide with these structures exists. However, as Hawaiian hybrid ducks are primarily diurnal, they are expected to easily avoid the microwave tower which would be highly visible during daylight hours. Observations of ducks conducted at nearby wetlands demonstrated that Hawaiian duck hybrids easily negotiated the overhead powerlines strung across the wetland habitat. No ducks were observed to have any collisions or near-collisions with the overhead powerlines or utility poles (147 flocks observed, average of two birds per flock). Consequently, potential for hybrid Hawaiian ducks to collide with the microwave towers, collection lines and utility poles associated with the project is considered to be negligible.

Pure Hawaiian Ducks

The possibility of existence of genetically pure Hawaiian ducks on O‘ahu is currently considered very remote (Engilis et al. 2002, USFWS 2005a, A. Engilis pers. comm to SWCA.). However, as discussed, the USFWS is planning on James Campbell NWR playing a key role in the future reintroduction of pure Hawaiian ducks to O‘ahu (USFWS 2005a, Kwon/USFWS pers. comm.). At present it is uncertain when that will occur, but it is possible that reintroductions could occur during the 20-year life of the project.

The reintroduction of pure Hawaiian ducks would first require the removal of all hybrid Hawaiian ducks and feral mallards from O‘ahu. If that were to occur during the life of the project, the potential for hybrid ducks to be killed through collision with project components as described above would be eliminated and

replaced with potential for project operations to cause mortality of pure Hawaiian ducks. There likely would be some interval of time between eradication of the hybrid ducks and re-introduction of the pure ducks in which no potential existed for Hawaiian-type ducks to collide with the proposed turbines and met tower.

It is not known how many pure Hawaiian ducks would be released or what behavior patterns they would establish, so it is not possible at this time to estimate accurately an expected passage rate and model expected mortality rates. However, it does seem probable that the number of pure ducks released would be lower than the number of hybrid Hawaiian ducks currently present in the general project area, and that the population of pure ducks would eventually build to approximate that of the current hybrid population. Consequently, it appears the potential for collisions would initially be lower than that expected for the hybrid ducks but could eventually match it. Thus, it appears that the project should have potential to result in the direct loss of no more than one pure adult Hawaiian duck over the 20-year life of the project.

Should reintroduction of pure Hawaiian ducks occur during the lifetime of the project, Kahuku Wind Power LLC believes the same take authorizations and limits should be applied to the species as requested for the hybrid ducks above.

Mitigation measures of the pure Hawaiian duck would be the same as the hybrids. Proposed mitigation measures are expected to more than offset the anticipated take and contribute to species' recovery by providing a net conservation benefit, as required by State law.

Impacts as a result of construction and operation of the off-site microwave towers are the same as those described for the hybrid Hawaiian duck.

Hawaiian Stilt

The areas of standing water that occasionally form in the project area after heavy rain events may create temporary habitat for a small number of Hawaiian stilts. Given that these areas form on an infrequent and unpredictable basis, they are not considered to provide habitat important for the species (J. Kwon/USFWS, pers. comm.). The proposed grading would eliminate the ability of these areas to form; however, because the areas of standing water are not considered to provide important habitat for Hawaiian stilts, elimination of this possible attractant in conjunction with project operation is considered beneficial.

As with Hawaiian petrel, no Hawaiian stilts were observed flying over the project area during the avian surveys so modeling would result in an estimated take rate of zero. Because Hawaiian stilts occur regularly in the Kahuku area, it is considered that the project would create some risk of causing take of this species, however small. Therefore, the Kahuku Wind Power HCP assumed the rate of take of Hawaiian stilt would be the same as for Hawaiian duck hybrids, or an average of 0.026 stilt/year lost through collision with turbines, the met tower, and other associated structures, as well as vehicular strikes (SWCA and First Wind 2010). The assumed rate of direct take of 0.026 stilt/year equates to direct loss of essentially one stilt over the 20-year life of the project as it did for hybrid Hawaiian duck.

Expected rates of take for Hawaiian stilt, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Annual Expected Rate of Take

Annual average	0.026 adults and 0.0012 fledglings
20-year project life	1 adult and 1 fledgling

O‘ahu supports 35-50% of the state’s stilt population with approximately 450 to 700 birds present on the island. The take of stilts at the expected rate of one adult stilt over 20 years is not expected to significantly impact the stilt population on O‘ahu. Moreover, the proposed mitigation (as briefly described in the previous section) is expected to more than offset the anticipated take of one bird per year and contribute to the species’ recovery by providing a net conservation benefit, as required by State law. The mitigation is expected to be successful as the Hawaiian stilt is classified as a species with a high potential for recovery (USFWS 2005a) where the biological and limiting factors are well understood, the threats are understood and easily alleviated and intensive management is not needed or the known techniques have been documented with a high probability of success (USFWS 1983).

Higher levels of take, depending on the actual rate, might be capable of impacting the island population due to its small population numbers in absence of mitigation. As stated previously, mortality of waterbirds at wind farms has historically been low, despite the proximity of large populations of waterbirds near turbines. Waterbirds also learn to avoid turbines over time (Kingsley and Whittam 2007, Carothers 2008). Therefore, occurrence of take at a higher rate is not expected. Because mitigation efforts would be adjusted in response to occurrence of take at higher levels, a higher level of take is expected to be offset such that this level of take also would not affect Hawaiian stilt at the population level.

Impacts as a result of construction and operation of the off-site microwave towers are the same as those described for the Hawaiian duck.

Hawaiian Coot

The areas of standing water that occasionally form in the project area after heavy rains are generally not expected to attract Hawaiian coots because they lack emergent wetland vegetation favored by the species. Even if these areas could receive occasional use by coots, given that these areas form on an infrequent and unpredictable basis they are not considered to provide habitat important for the species (J. Kwon/USFWS, pers. comm.). The proposed grading would eliminate the ability of these areas to form; however, because the areas of standing water are not expected to be used by, nor considered to provide important habitat for, Hawaiian coots, elimination of this possible attractant in conjunction with project operation is considered beneficial.

No Hawaiian coots were observed flying over the project area during avian surveys so mortality modeling for this species would result in an estimated take rate of zero. As for Hawaiian stilt, because Hawaiian coots occur regularly in the Kahuku area, it is considered that the project would create some risk of causing take of this species, however small. Therefore, also as for Hawaiian stilt, the Kahuku Wind Power HCP assumed the rate of take of Hawaiian coot would be the same as for Hawaiian duck hybrids, or an average of 0.026 coot/year lost through collision with turbines, met towers, and other associated structures, as well as vehicular strikes (SWCA and First Wind 2010). The assumed rate of direct take of 0.026 coot/year equates to direct loss of essentially one coot over the 20-year life of the project. Expected rates of take for Hawaiian coot, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Annual Expected Rate of Take

Annual average	0.026 adults and 0.012 chicks
20-year project life	1 adult and 1 chick

O‘ahu supports between 500 and 1,000 coots, or up to 33% of the state population. The expected loss of one adult coot over the life of the project, if realized, is not expected to have a significant impact on the population of the coot on O‘ahu. The proposed mitigation is 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. The mitigation is expected to be successful as the Hawaiian coot is classified as a species with a high potential for recovery (USFWS 2005a) where the biological and limiting factors are well understood, the threats are understood and easily alleviated and intensive management is not needed or the known techniques have been documented with a high probability of success (USFWS 1983).

Higher levels of take, depending on the actual rate, might be capable of impacting the island population of Hawaiian coot in absence of mitigation. As stated previously, mortality of waterbirds at wind farms has historically been low, despite the proximity of large populations of waterbirds near turbines. Waterbirds also learn to avoid turbines over time (Kingsley and Whittam 2007, Carothers 2008). Therefore, occurrence of take at a higher rate is not expected. Because mitigation efforts would be adjusted in response to higher take levels, take at the higher level would be offset such that this level of take also would not affect Hawaiian coot at the population level.

Impacts as a result of construction and operation of the off-site microwave towers are the same as those described for the Hawaiian duck.

Hawaiian Moorhen

No direct impacts to habitat for Hawaiian moorhen would occur as a result of the proposed action. No habitat for this sub-species occurs in the project area, and the areas of standing water that sometimes form in the area are not expected to attract moorhens because of their lack of emergent cover. The proposed grading would eliminate any potential for these areas to attract Hawaiian moorhens to the project area during the operational phase of the project.

No Hawaiian moorhens were detected at Kahuku Wind Power during the 15-month long avian point count survey and are thought to be at very low risk of collision with turbines because of their sedentary habits (see Section 3.12.4). For the same reasons discussed for Hawaiian stilt and Hawaiian coot, risk of collision by this species is not zero and in the HCP is assumed to occur at the same rate assumed for those species, or on an average of 0.026 moorhen/year as a result of collision with turbines, met towers and associated structures, as well as mortality due to vehicular strikes (SWCA and First Wind 2010). This equates to essentially one Hawaiian moorhen lost to collision mortality over the 20-year life of the project.

Expected rates of take for Hawaiian moorhen, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Annual Expected Rate of Take

Annual average	0.026 adults and 0.017 chicks
20-year project life	1 adult and 1 chick

Biannual waterbird surveys record an average of 341 moorhens throughout the state (USFWS 2005a). This average is likely an inaccurate under-estimate of true population size as moorhens are secretive and difficult to census (USFWS 2005a). Given that the population of Hawaiian moorhen is at least the measured average, the expected loss of one adult Hawaiian moorhen over the 20-year project life is not expected to result in significant adverse effects to the sub-species at the population level. The proposed mitigation is 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. The mitigation is expected to be successful as the moorhen is classified as a species with a high potential for recovery (USFWS 2005a), where the biological and limiting factors are well understood, the threats are understood and easily alleviated and

intensive management is not needed or the known techniques have been documented with a high probability of success (USFWS 1983).

Higher levels of take, if realized, may have potential to adversely impact the state population given its presumed small size in the absence of compensatory mitigation. Higher levels of take are considered extremely unlikely to be realized because of the tendency of moorhens to swim or walk rather than fly (Bannor and Kiviat 2002), and lack of suitable habitat to attract moorhens to the project area. Moorhens in Hawai‘i are highly sedentary and no records of inter-island flights have been documented (Bannor and Kiviat 2002). Because mitigation efforts would be adjusted in response to higher take levels, take at the higher level would be offset such that this level of take also would not affect Hawaiian moorhen at the population level.

Impacts as a result of construction and operation of the off-site microwave towers are the same as those described for the Hawaiian duck.

Hawaiian Short-eared Owl

No Hawaiian short-eared owls were seen during the avian point count surveys conducted over 15 months at the Kahuku Wind Power project area. However, because one Hawaiian short-eared owl was heard in the project area in July 2008 during the seabird radar survey (see Section 3.12.2); it is assumed the sub-species occurs in the project area on at least an irregular basis. Project construction would result in the loss of approximately 32 ac of vegetation within the 578-ac project area. This would reduce the amount of foraging area available to any short-eared owls present in the general vicinity, and the loss of vegetation may result in a slight decrease in the number of potential prey items (e.g., mice) available to owls. Because the vegetation clearing would be spread across a relatively large area rather than concentrated in one area, the reduction in number of potential prey items in any particular area is expected to be slight. Thus, the loss of potential foraging area and any reduction in numbers of prey items is not expected to significantly affect the ability of any owls that utilize the project area from being able to sustain themselves.

Post-construction monitoring data from North America suggest the species is generally not vulnerable to collision with wind turbines. Data on status of Hawaiian short-eared owl in the project area is too scant to enable a reasonable estimation of the mortality rate for this species that may result from completion of the proposed project. Observations of short-eared owls at the KWP facility on Maui suggest most generally fly low over the ground, preferring open pastures and grasslands away from most structures (G. Spencer/First Wind, pers. comm.). Potential for short-eared owls to collide with wind turbines seems it would be greatest when birds were performing aerial breeding displays or if the birds were needing to avoid some aerial predator. The paucity of observations of this species from the project area strongly suggests Hawaiian short-eared owls do not breed in or directly adjacent to the project area, so the probability of short-eared owls colliding with wind turbines while performing breeding displays appears to be exceedingly low. No potential aerial predators of Hawaiian short-eared owl occur on O‘ahu, so it also appears very unlikely that short-eared owls would collide with any of the proposed wind turbines for this reason.

Potential for short-eared owls to collide with the permanent, unguyed met tower or cranes during the turbine construction period is considered negligible because these structures would be immobile and stationed in cleared sites. Thus, the tower and cranes should be readily visible to, and avoidable by, owls.

The expectation that short-eared owls are not likely to collide with the proposed turbines and met tower, or with construction cranes, is supported by the results of post-construction monitoring and general observations made at the KWP facility on Maui. Short-eared owls are observed regularly at the KWP

facility yet, as indicated above, no short-eared owl fatalities have been recorded after three and a half years of operation (G. Spencer/First Wind, pers. comm.). Lack of recorded fatalities at a site where the species occurs regularly and, hence, has greater exposure to collision hazards, suggests strongly that risk of collision at the Kahuku Wind Power facility would be very low given that it has not been documented on the site.

Some very low potential exists for construction or maintenance vehicles to strike short-eared owls that may be hunting low over the project area. Project personnel would be educated regarding the possibility of owls flying low across project roadways or resting on the ground adjacent to roadways and speed limits (10 mph) would be emplaced and enforced on project roadways to minimize potential for vehicle strikes to harm short-eared owls.

Given the above information, it is possible that no Hawaiian short-eared owl fatalities would be realized during the life of the Kahuku Wind Power project. However, because the species is known to occur in the general vicinity of the project area at least on occasion, the risk of collision cannot therefore be considered zero. Given the on-site survey results and monitoring results from the KWP site on Maui, it seems reasonable to assume that the chance of the proposed project causing a short-eared owl fatality in any given year is well less than 1.0. The Kahuku Wind Power HCP assumed that the proposed project would on average result in the loss of 0.33 Hawaiian short-eared owl/year (SWCA and First Wind 2010). This equates to one owl every three years or about seven owls over the 20-year life of the project, and was chosen as a conservative estimate based on the findings at KWP where no short-eared owls have been lost to project operations after more than three years.

Expected rates of take for Hawaiian short-eared owl, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Expected Rate of Take

Annual average	0.33 adults and 0.31 owlets
20-year project life	7 adults and 7 owlets

No population numbers for Hawaiian short-eared owl are available for the Island of O‘ahu or any of the other Hawaiian Islands. However, given the rate of assumed loss, it is unlikely that the proposed project would cause a significant impact on the Hawaiian short-eared owl population on O‘ahu.

Higher levels of take may impact the O‘ahu population of Hawaiian short-eared owl if its population is small, but realization of take at higher levels is considered extremely unlikely to occur because Hawaiian short-eared owl have been heard only once at the Kahuku Wind Power site over the course of 15 months of surveys, and given the rate of owl mortality observed to date at KWP on Maui.

Mitigation for possible take of the Hawaiian short-eared owl by Kahuku Wind Power LLC would consist of three parts: funding research; rehabilitation of injured owls; and subsequently implementing management actions on O‘ahu as they are identified and as needed to bring mitigation ahead of take (i.e., provide a net benefit). No adverse impacts are anticipated as a result of implementing these mitigation measures. All individuals involved in the research and rehabilitation programs would be trained on how to appropriately handle and care for injured Hawaiian short-eared owls. Kahuku Wind Power LLC’s proposed mitigation for the anticipated take would contribute to a greater understanding of the species’ occurrence and status on O‘ahu, which in turn would help guide future management and recovery efforts and should result in an overall net conservation benefit for the species. For this reason, no significant adverse impacts to the species’ overall populations are expected.

Potential for short-eared owls to collide with the off-site microwave towers is considered negligible because these structures would be immobile and stationed in cleared sites. Thus, the towers should be readily visible to, and avoidable by, owls.

Hawaiian Hoary Bat

Based on surveys conducted to date, a low but consistent level of Hawaiian hoary bat activity occurs year-round on site with some small increase in activity between June and September (Appendix G). The proposed construction would eliminate approximately 32 ac of vegetation that could support and produce insects preyed upon by Hawaiian hoary bats, as well as provide roosting sites for bats. Clearing of trees during construction is proposed to be performed outside the bat breeding season to avoid potential to directly harm any young bats that would be incapable of avoiding machinery used to clear vegetation. The loss of 32 ac of vegetation represents an approximately 5.6% loss of vegetation across the 578-ac project area. This relatively small amount of impact is not considered likely to significantly affect the prey base available to Hawaiian hoary bats in the project area given the small number of bats that appear to utilize the area.

The HCP identifies an estimated average rate of take for the Kahuku Wind Power project of 0.016 bat/turbine/year. This equates to a total average take of 0.19 bat/year or roughly one bat every five years for all 12 turbines on the site.

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. While the guy wires on the temporary met towers may pose a somewhat greater threat to bats, bats at KWP on Maui have not been found to have collided with the guyed met towers after three years of operation nor with any cranes during the construction phase of that project. Of 64 wind turbines studied at Mountaineer Wind Energy Center in the Appalachian plateau in West Virginia, bat fatalities were recorded at operating turbines, but not at a turbine that remained non-operational for control purposes during the study period (Kerns et al. 2005). This supports the expectation that presence of the stationary structures such as met towers and cranes should not result in bat fatalities.

Expected rates of take for Hawaiian hoary bat, based on the information provided in Appendix K and the HCP (SWCA and First Wind 2010), is summarized below.

Expected Rate of Take

Average	0.19 adults and 0.34 juveniles	0.44 bats/year
20-year project life	4 adults and 7 juveniles	

No recent population estimates exist for Hawaiian hoary bat, though previous estimates have ranged from several hundred to several thousand (Tomich 1969, Menard 2001). Although overall numbers of Hawaiian hoary bats are believed to be low, they are thought to occur in the greatest numbers on the Islands of Hawai‘i and Kaua‘i (Menard 2001).

The assumed level of take is low and commensurate with the results of mortality observed to date at the KWP facility on Maui. Because of this, it is considered unlikely to result in a significant impact on the overall population of the Hawaiian hoary bat. Higher levels of take may adversely impact the O‘ahu population if the population is very small, but they would not likely impact the status of the species on other islands where populations are assumed to be more robust.

Mitigation for the Hawaiian hoary bat by Kahuku Wind Power LLC was developed through discussions with USFWS, DLNR, and bat experts at USGS. Kahuku Wind Power LLC proposes to participate in

research by monitoring Hawaiian hoary bats on-site, as well as documenting how Hawaiian hoary bats interact with wind facilities. Kahuku Wind Power LLC would also fund a native habitat restoration program to improve bat habitat. Native habitat plant restoration at the Polipoli area of the Kula Forest Reserve in East Maui has been identified as a potential location for enhancing bat habitat.

Several listed plant species have designated critical habitat in the vicinity of the Kula Forest Reserve: *Argyroxiphium sandwicense ssp. macrocephalum* (‘ahinahina), *Bidens micrantha ssp. kalealaha* (ko‘oko‘olau), *Clermontia lindseyana* (‘oha wai), *Diellia erecta*, and *Geranium arboretum* (Hawaiian ref-flowered geranium). Increased foot traffic and the potential introduction of non-native species associated with the proposed mitigation may adversely impact the listed species and their critical habitat. In order to avoid and minimize impacts to listed plants and critical habitat, all restoration materials would be certified weed-free and appropriate BMPs would be implemented by the contractor during the native plant restoration. Gear-cleaning procedures to reduce the introduction of invasive species would be strongly enforced for biologists and/or contractors. By implementing the measures described above, adverse impacts of the proposed mitigation measures would be minor.

The amount of habitat restored would be at a level that is commensurate with the requested take and would provide a net benefit to the species (Appendix K). Proposed mitigation measures 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 populations are expected.

The potential for bats to collide with the off-site microwave towers is considered to be negligible because they would be immobile and should be readily detectable by the bats through echolocation.

3.12.4.2 Potential Impacts of the No Action Alternative

The No Action Alternative is not expected to cause any adverse impacts to the seven federally listed species and one state listed species because no potential for collision with wind turbines or project infrastructure would be created. However, the No Action Alternative would not provide the net benefits to the covered species expected under the proposed action because proposed beneficial measures would not be implemented. Thus, the No Action Alternative would not contribute to recovery efforts, research, or habitat protection for listed species.

3.13 Socioeconomic

3.13.1 Social and Economic Environment

The proposed Kahuku Wind Power facility is located in the community of Kahuku, within the Ko‘olau Loa District, on the Island of O‘ahu. The total resident population of the Island of O‘ahu is approximately 905,034 individuals (DBEDT 2009). The majority of the resident population on O‘ahu lives in the District of Honolulu. The Ko‘olau Loa District is not heavily populated compared to other districts on the island; it represented less than 2.2% of the entire island’s population in 2000 (DBEDT 2009). The district experienced a 2.5% change in population between 1990 and 2000.

The most recent estimate of the population of the Kahuku Census Designated Place (CDP), as defined at the U.S. Census Bureau, is 2,097 individuals (U.S. Census Bureau 2003). Kahuku has experienced relatively minor population growth since 1990. The Kahuku area did not support many residents until the development and distribution of water made agriculture possible in the late 1800s (R.M. Towill Corporation 2008). Estimated population figures for these areas are summarized in Table 3-17.

Table 3-17. Population figures for selected areas.

Area	1980	% change	1990	% change	2000	% change	2005
O‘ahu Island	762,534	9.7	836,231	4.8	876,156	3.2	904,645
Ko‘olau Loa District	14,195	29.9	18,443	2.5	18,899	--	--
Kahuku CDP	--	--	2,063	1.6	2,097	--	--
Source: (DBEDT 2009), US Census Bureau (2003).							

During the plantation days, both economic and social activity in Kahuku centered around a sugar mill (R.M. Towill Corporation 2008). Since that time, the sugar mill has closed and most residents of the Kahuku area are now employed in the services industry. Job growth in the Ko‘olau Loa District is anticipated to increase by 32% from 2000 to 2030. Most of this growth is expected to occur in the service sector. Compared to the rest of the island, this growth is low.

In 2008, the estimated median household income for the Kahuku area was $51,432 and the estimated per capita income was $15,488 (R.M. Towill Corporation 2008). In 1999, the median household income in the Kahuku CDP was $39,135 and the median per capita income was $12,340. In 2000, approximately 11.8% of families and 14.6% of individuals in the Kahuku CDP had an income below poverty level. In comparison, on O‘ahu, families and persons living below the poverty level comprised 7% and 9.9%, respectively (U.S. Census Bureau 2003). Throughout the State of Hawai‘i, approximately 7.6% of families and 10.7% of individuals are considered to be living below poverty level.

3.13.1.1 Potential Impacts of the Proposed Action

Adverse short-term or long-term impacts to the social or economic condition of the area are not expected to occur as a result of the proposed action. The proposed action would not result in a large number of new residents moving to the Kahuku area or the Island of O‘ahu. Energy generated from the facility would provide power “as available” and would be used to substitute other energy sources. The population of the area is not expected to increase due to increase energy availability; therefore, the project would not be considered growth inducing. The proposed action is not anticipated to impact housing costs or availability.

Because the proposed action would support construction and operation of the wind energy facility, it does have the potential to benefit the community due to direct socio-economic effects. During the construction phase, Kahuku Wind Power may employ an average of 15 to 20 people per day, with an anticipated maximum level of 40 employees. The work would include general construction and more specialized installation of electrical equipment and wind turbine components. Local residents of Kahuku or O‘ahu may be employed during the general construction of the project. Following construction, the operation of the wind facility would be staffed by four to five full-time, regular employees working on-site Monday through Friday (Environet, Inc. 2009). These employees would include biologists, road maintenance workers, engineers, and technicians. The proposed off-site microwave towers would be serviced intermittently by maintenance personnel. Local residents of Kahuku or O‘ahu may be employed during

operation of Kahuku Wind Power; however, because the operations staff would be small, the project is not expected to result in a substantial long- term employment increase for the area. Another socio-economic benefit of the proposed project would be ongoing expenditures for materials and outside services.

3.13.1.2 Potential Impacts of the No Action Alternative

No changes in existing social or economic conditions would occur under the No Action Alternative. The positive socio-economic effects of the proposed action would not occur under the No Action Alternative.

3.13.2 Environmental Justice

Executive Order 12898 requires federal agencies to take appropriate steps to identify and avoid disproportionately high and adverse effects of federal actions on the health and surrounding environment of minority and low-income populations. All federal programs, policies, and activities that substantially affect human health or the environment shall be conducted to ensure that the action does not exclude persons or populations from participation in, deny persons or populations the benefits of, or subject persons or populations to discrimination under such actions because of their race, color, income level, or national origin. The Executive Order was also intended to provide minority and low-income communities with access to public information and public participation in matters relating to human health and the environment.

The Council on Environmental Quality (CEQ) has issued guidance to federal agencies to ensure that environmental justice concerns are effectively identified and addressed throughout the NEPA process. DOE guidance recommends that DOE consider pathways or uses of resources that are unique to a minority or low-income community before determining that there are no disproportionately high and adverse impacts on the minority or low-income population.

The State of Hawai‘i has also developed its own legislation and guidance related to environmental justice. Act 294 was signed by Governor Lingle in July 2006 to define environmental justice in the unique context of Hawai‘i and to develop and adopt environmental justice guidance that addresses environmental justice in all phases of the environmental review process (Kahihikolo 2008).

Race data for Kahuku in 2000 is shown in Figure 3-20. The population of Kahuku in 2000 was primary composed of Native Hawaiian and other Pacific Islanders (27.3% alone, 25.2% in combination[7]) and Asians (26.8% alone, 24.5% in combination). In comparison, the largest racial group on the Island of O‘ahu is Asian (46% alone, 15.5% in combination). Native Hawaiians and Other Pacific Islanders represent a much smaller percentage of O‘ahu’s population (8.9% alone, 12.7% in combination) (US Census Bureau 2000).

[7] In combination with one or more of the other races listed. The numbers and percentages for race "alone or in combination" may add to more than the total population because individuals may report more than one race.

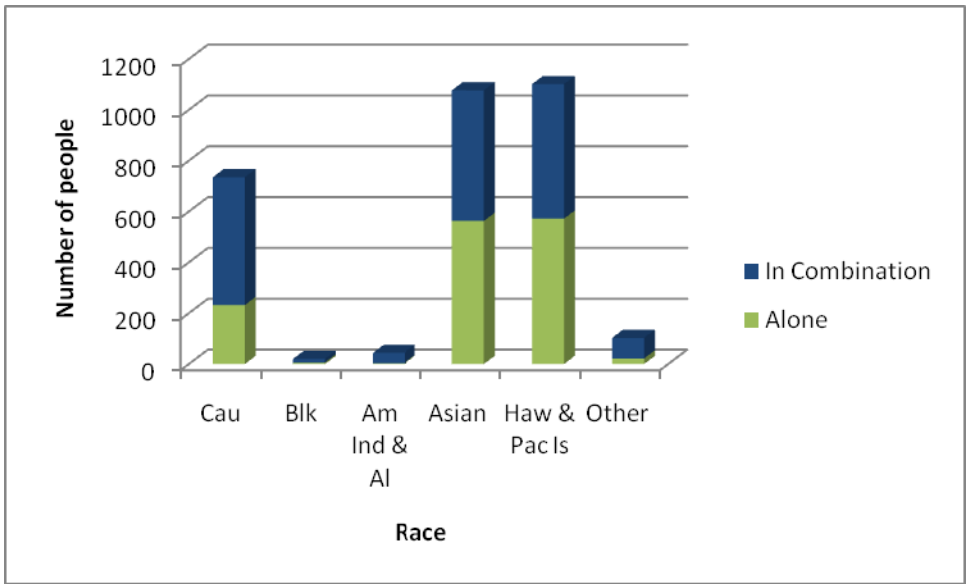


Figure 3-20. Breakdown of the racial composition of the Kahuku CDP.
Notes: "In Combination" means that one or more race listed was selected by a respondent. Cau = Caucasian; Blk = Black or African American; Am Ind & Al = American Indian and Alaska Native; Haw & Pac Is = Native Hawaiian and Other Pacific Islander.

The project area is located adjacent to the rural commercial center in Kahuku. Rural commercial centers are a mix of retail shopping, restaurant, personal service, entertainment and professional office uses that serve residents and some tourists. These establishments are typically small stores (markets, restaurants, retail shops, etc) concentrated along Kamehameha Highway (DPP 1999).

3.13.2.1 Potential Impacts of the Proposed Action

Typically, minorities are defined as individuals who are members of the following population groups: African Americans, American Indians, Alaskan Natives, Asians, Hispanics, Native Hawaiians, or Other Pacific Islanders. However, as recognized in the Hawai'i Environmental Justice Initiative Report (Kahihikolo 2008), the minority population distribution of Hawai'i differs greatly from that of the continental U.S. In contrast to the continental U.S., where Caucasians account for the majority of the population, no racial group in Hawai'i comprises even as much as half of the state population. On the Island of O'ahu, the largest racial group is Asian, comprising 46% of the island's population (OMPO and DPP 2004). O'ahu (and the state in general) is also unique in that 20% of the O'ahu population reported multiple races; only 2.4% did so in the continental U.S. Thus, the minority definitions developed to determine environmental justice impacts on the mainland U.S. may not be applicable or appropriate for O'ahu (OMPO and DPP 2004).

The percentage of Native Hawaiian and other Pacific Islanders (alone) living in Kahuku is more than three times the island average for that group (27.3% alone vs. 8.9% alone). However, the population of Native Hawaiians and other Pacific Islands (alone) in Kahuku is still less than 50%.

Low-income populations are defined using the poverty thresholds as defined by the U.S. Census Bureau. As stated in Section 3.13.1, the percentage of families and individuals in the Kahuku CDP with an income below poverty level is slightly greater than the averages for O'ahu (U.S. Census Bureau 2000). However, there are no concentrations of low income or minority populations in the vicinity of the project area.

The proposed project complies with Executive Order 12898. No persons would be displaced as a result of this project. The proposed project is not expected to result in substantial environmental, human health, or economic impacts on surrounding populations. Furthermore, since the proposed action would benefit the local economy, including low-income and minority households in Kahuku, these individuals would not experience a disproportionate share of the impacts of the project.

3.13.2.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, there would be no environmental justice impacts.

3.14 Historic, Archaeological, and Cultural Resources

3.14.1 Regulatory Framework

The National Historic Preservation Act of 1966 (NHPA) is the primary federal law protecting cultural, historic, Native American, and Native Hawaiian resources. Section 106 of the NHPA (36 CFR 800) requires federal agencies to assess and determine the potential effects of their proposed undertakings on prehistoric and historic resources (e.g. sites, buildings, structures, and objects) and to develop measures to avoid or mitigate any adverse effects. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO).

Detailed requirements for complying with Section 106 of the NHPA are addressed in regulations promulgated by the Advisory Council on Historic Preservation (ACHP) under 36 CFR 800. Section 800.16(l)1 of the ACHP regulations defines a "historic property" as "any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the Secretary if the Interior." Section 800.16(d) of the ACHP regulations requires agencies to determine the area of potential effects (APE), defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist."

In consultation with SHPO, a roughly 230 ac (93 ha) APE was decided upon for this study (Figure 3-21). The APE was defined given the nature of the proposed development, the history of past land use, and the expressed community desire (following extensive consultation) to preserve the coral escarpment formations that exist within the subject property (Rechtman 2009). With the exception of the two off-site microwave towers, there would be no development activities planned for any areas outside of the defined APE.

3.14.2 Pre-Contact and Historical Context

The project area is located in the ahupuaʻa of Kahuku.[8] Kahuku literally translates as "the projection" (Pukui et al. 1974). The naming of Kahuku is suggested in old stories. Traditional legends relate that Kahuku was once a floating island that had been struck apart from Oʻahu by Lonokaʻeho. After blowing around in the ocean, the island was reattached to Oʻahu by the people of the Koʻolauloa District with hooks and ropes (Rechtman 2009). Several versions of this story are told (Rechtman 2009).

[8] An ahupuaʼa is a wedge or pie-shaped land unit that became the equivalent of a local community, with its own social, economic, and political significance. Ahupua'a were ruled by *aliʻi ʻai ahupuaʻa,* or lesser chiefs, and managed by a *konohiki*, or headman under the chief (Rechtman 2009).

Distinctive features of the Kahuku ahupuaʻa include: a rich fishery; a broad coastal plain of wetlands (makai of the present day highway), springs, and brackish pools; and Kalaiokahipa ridge, the coral reef escarpment that juts up above the Kahuku plain (Rechtman 2009). Caves in the porous formation of Kalaiokahipa ridge and more inland areas were used as places of burial by the old Hawaiians and hiding places. Prior to European contact and during early Historic times, the Kahuku plain was known for its hala groves (Rechtman 2009).

After European contact, socioeconomic and demographic changes influenced by Westerners promoted the establishment of a Euro-American style of land ownership. Beginning in the 1850s, Kahuku and the surrounding area were leased and sold to foreigners, who established sheep and cattle ranches. Sugar cultivation by the Kahuku Plantation Company became the dominant industry in Kahuku during the late 19th century.

The historical record indicates that by 1935, irrigated sugarcane fields covered nearly the entire APE and project area. An artesian well and a several acre reservoir were also located in the area (Rechtman 2009). The Kahuku Plantation Company continued to operate in the project area and the surrounding area until 1971. Evidence of this use is present across the parcel in the form of earthen ditches, concrete and metal flumes, and old roadways. Other remnants of sugarcane cultivation on the property include concrete foundations, a dry reservoir, old utility poles, and a large metal water pipe line. After sugarcane cultivation ceased, the project area was used as pasture for horses and cattle and briefly as a wind farm (Rechtman 2009).

3.14.3 Previous Archaeological Research and Historic Sites

Three previous archaeological studies were conducted on portions of the project area by Paul H. Rosendahl, Inc. (Jensen 1989), Archaeological Consultants of Hawaiʻi (Kennedy 1989), and Cultural Surveys Hawaiʻi, Inc. (Stride et al. 2003). Collectively, these surveys resulted in the identification of 18 archaeological sites in the project area containing 42 features. All but three of the previously recorded sites were assigned State Inventory of Historic Places (SIHP) site numbers (Rechtman 2009).

None of these sites were identified within the currently defined APE, although one site, SIHP Site 4707, was assigned to an irrigation feature that is undoubtedly related to the historic sugar plantation infrastructure that also exists within the current APE (Rechtman 2009).

Rechtman Consulting, LLC (2009) conducted a comprehensive archaeological survey of the project area in August-September 2007 and July 2009 (Appendix L). This survey involved mapping, photographing, and describing any archaeological resources encountered along transects spaced throughout the APE. In addition to the archaeological fieldwork, archival cartographic material relative to the plantation infrastructure was obtained and correlated with the field findings (Rechtman 2009).

The survey by Rechtman Consulting, LLC indicated the presence of an extensive network of irrigation features within the project area associated with the former sugarcane cultivation. Fieldwork and archival review indicated that, with the exception of a few small areas of wasteland, the entire APE was once planted in sugarcane (Rechtman 2009).

One historical site was recorded within the APE during the field investigation. This site, SIHP Site 4707, incorporates the extensive sugarcane field infrastructure (primarily an irrigation network) that still remains within Kahuku. Features of Site 4707 are widespread within the current APE. Functionally related features of Site 4707 also exist outside of the APE within the surrounding area. This sugarcane field infrastructure was developed by the Kahuku Sugar Plantation between 1890 and 1971. Dates

inscribed in concrete at features within the APE suggest that the major infrastructural development for sugarcane cultivation within the APE likely took place between 1925 and 1943 (Rechtman 2009).

Although impacted by modern land disturbance, vegetation, and erosion, much of the sugarcane irrigation infrastructure is still present within the APE. Specific features of Site 4707 that remain in the APE include flumes, ditches, pipes, reservoirs, wells, pumps and pump houses, markers, roads, and bridges (Rechtman 2009).

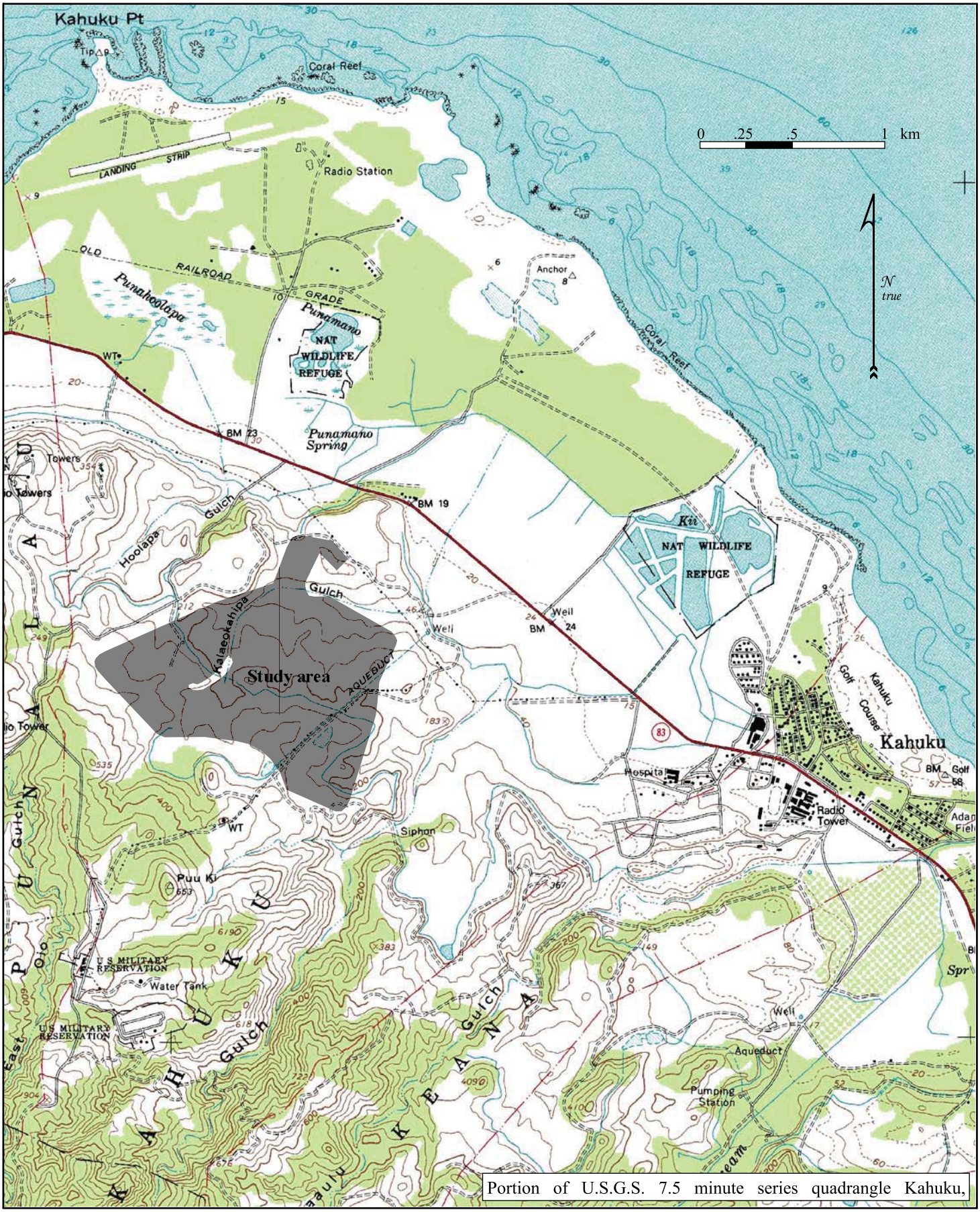


Figure 3-21. Area of potential effects (APE) consisting of approximately 230 acres.

In addition to the archaeological survey, extensive community consultation with individuals and organizations knowledgeable about the area and past land use practices was conducted by Kahuku Wind Power LLC. Consulted organizations have included the Koʻolauloa Neighborhood Board, the Boards of the Kahuku Village Association and the Kahuku Community Association, Kahuku Elderly Housing, and the Lāʻie Community Association (Rechtman 2009).

Rechtman Consulting, LLC conducted an archaeological survey at the Waialua microwave tower area in October 2009 and at the Flying R Ranch site in January 2010. The Waialua tower would be located within the HECO Waialua Substation in Haleʻiwa, which is an already developed site. The proposed new tower location at Flying R Ranch is situated on the eastern ridge of Kaumoku Gulch at an elevation of roughly 750 feet above sea level. It is contained within a fenced paddock that is currently used as pasture by the Flying R Ranch. The location of the proposed tower places it well to the south and east of the three archaeological sites previously recorded (Appendix L). An inspection of the development area by Rechtman Consulting, LLC on January 8, 2010, revealed that the proposed new tower site has been previously bulldozed, and that no archaeological resources are present. A proposed access road corridor that follows a firebreak road from an existing access road to the proposed tower location was also inspected and no archaeological resources were encountered.

3.14.3.1 Potential Impacts of the Proposed Action

The only historic resource with the potential to be impacted by the proposed action is Site 4707. The significance of Site 4707 was evaluated by Rechtman Consulting, LLC. (2009) based on the National Register Criteria (36 CFR § 60.4), which are as follows:

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

Although Site 4707 is not functional and in a state of disrepair, the site does retain sufficient integrity to be considered significant under Criterion d for the historical information it has yielded relative to the development of the sugarcane industry in Hawaiʻi; thus, the site is potentially eligible for listing in the National Register of Historic Places. The SHPO concurred with DOE's determination that a reasonable and adequate amount of information was collected about this potential historic property during the archaeological study such that no further mitigation is warranted, and a no adverse effect determination for this site with respect to the proposed action is appropriate.

Coordination between Kahuku Wind Power LLC and the community highlighted the rich history of the coral escarpments located in and near the project area (outside of the APE). In response to community concerns, Kahuku Wind Power LLC has committed to preserve the coral escarpment areas located within the project area, as well as to the document the moʻolelo (stories, legends) concerning these culturally significant areas. Sixty-foot buffer areas would be placed around these coral escarpment areas. Thus, the integrity and future preservation of any potential cultural or historical resources in this portion of the project area are not anticipated to be impaired as a result of the project.

The Waialua Substation is an already developed site, and the placement of an additional tower within this site would have no effect on historic properties. The proposed Flying R Ranch site was previously disturbed, and no archaeological resources were encountered during field investigations. No known historical, archaeological, or cultural activities associated with the off-site microwave tower sites are anticipated to be impacted by the proposed project.

DOE determined that no historic properties would be affected by the proposed action under Section 106 of the National Historic Preservation Act, and the SHPO concurred (Appendix L). DOE also notified OHA and two local community leaders of its finding and provided an opportunity for comment. OHA concurred with DOE's no adverse effect determination and requested that consultation with individuals knowledgeable with the Flying R Ranch site be conducted. Based on suggestions from OHA, three individuals were contacted regarding the site. None of these individual were aware of any culturally or historically significant resources at or surrounding the site. In addition to comments received by OHA, DOE received comments on the archeological survey from Mr. Ralph Makaiau, President of Kahuku Community Association. DOE's responses to OHA and Mr. Makaiau are included in Appendix L.

3.14.3.2 Potential Impacts of the No Action Alternative

No impacts on historic, archaeological, or Native Hawaiian resources would occur under the No Action alternative.

3.15 Utilities and Public Services

3.15.1 Energy

The State of Hawai‘i uses a higher percentage of petroleum to generate electricity than any other state in the U. S. In 2005, oil was used to produce 80% of electricity sold by the State's utilities (Planning Solutions, Inc. 2009). The remaining electricity generation during that year was supplied by coal (13.9%), municipal solid waste (2.6%), geothermal (2%), hydroelectricity (0.7%), bagasse or sugarcane waste (0.6%), wind (0.1%), and a very small amount from solar photovoltaics. Imported oil costs the state between $2 and $4 billion annually (DBEDT 2008b). As a result, Hawai‘i pays among the highest electricity costs in the country and faces a high level of energy insecurity due to the volatility of oil prices and the potential for disruptions in petroleum supply and shipping.

Fortunately, Hawai‘i has abundant renewable resources, including a robust wind resource on several islands. Significant potential for small or distributed wind energy projects exists throughout the Hawaiian Islands (Global Energy Concepts LLC 2006). It has been estimated that the state has a combined wind energy potential of 1,000,000 kWh (State of Hawai‘i and Hawaiian Electric Companies 2008). Due to increasing fossil fuel costs, energy security issues, and concerns over climate change, the State of Hawai‘i is striving to utilize its own renewable energy (M & E Pacific, Inc. 2008). Hawai‘i's Renewable Portfolio Standards (HRS Chapters 269-91 to 269-95) present a timeline to increase the amount of electricity generated using renewable resources. According to these standards, each electric utility company that sells electricity for consumption in the state shall establish a renewable portfolio standard of 15% of its net electricity sales by December 31, 2015, and 20% of its net electricity sales by December 31, 2020. A proposal to increase the standard to 40% by 2020 is under consideration by the Hawai‘i State Legislature.

In January 2008, the State of Hawai‘i and DOE signed an agreement to establish the Hawai‘i Clean Energy Initiative (HCEI). The goal of this agreement is to have 70% or more of the state's energy derived from clean, renewable energy for electricity and transportation by 2030. This goal has the potential of reducing Hawai‘i's current crude oil consumption by 72% (State of Hawai‘i and USDOE 2008). Hawai‘i also passed various House bills (HB2848 CD1, HB 2175 CD1, and SB 988 CD1, HB 2505 CD1, HB

2863 CD1) to promote energy efficiency and renewable energy sources. In October 2008, the State of Hawai‘i signed an Energy Agreement with HECO to help reach the state’s energy objectives by facilitating the production of renewable energy sources on the islands, such as wind resources (State of Hawai‘i and Hawaiian Electric Companies 2008). The agreement includes a commitment by HECO to encourage and explore the development of known project proposals.

In order to meet the 70% clean energy goal, local renewable energy alternatives need to be developed in Hawai‘i. Several wind energy facilities are already operating in the state and others are being proposed (Table 3-18).

Hawai‘i Island and Maui currently produce 25% and 16% of their respective energy from renewable sources. O‘ahu, which consumes the vast majority of the state’s electricity because of its high population, has proportionally less renewable energy generation. Currently, the largest source of renewable energy on O‘ahu is burning refuse or municipal solid waste at the Honolulu Project of Waste Energy Recovery (H-Power) facility in the Campbell Industrial Park (Rocky Mountain Institute 2008, R W Beck 2008). Burning waste meets only 4% of the island’s electrical load. O‘ahu cannot draw on renewable energy generated on neighboring islands until inter-island transmission lines are constructed to connect the different island electrical grids, and the estimated date of construction of such transmission lines is unknown.

Table 3-18. Existing and potential (P) wind energy facilities throughout the State.

Facility Name	Operator	Energy Generated	Island
Lalamilo Wind Farm	Hawai‘i Electric Light Company	1.2 MW	Hawai‘i
Pakini Nui	Tawhiri Power, LLC	20.5 MW	Hawai‘i
Upolu Point	Hawi Renewable Development	10.5 MW	Hawai‘i
Kaheawa Wind Power (KWP)	First Wind	30 MW	Maui
Auwahi Wind Project (P)	Auwahi Wind Energy LLC	22 MW	Maui
Kaheawa Wind Power (KWP) II (P)	First Wind	21 MW	Maui
Kahuku Wind Power (P)	First Wind	30 MW	O‘ahu
Kawailoa Wind Power (P)	First Wind	50 – 70MW	O‘ahu
Na Pua Makani (P)	O‘ahu Wind Partners LLC	25 MW	O‘ahu
Ikaika Wind Power I (P)	First Wind	50 MW	Moloka‘i
Ikaika Wind Power II (P)	First Wind	200 MW	Moloka‘i
Unknown (P)	Castle & Cooke	200 MW	Lāna‘i
Kaua‘i Wind Power (P)	First Wind	10.5 -15 MW	Kaua‘i

HECO provides all electrical service for the Island of O‘ahu. Its electrical grid is independent, relatively small, and sensitive to power fluctuations. Utility-scale electricity sold by renewable energy producers is sold directly to HECO. A HECO 46-kV electric transmission line runs through the northeastern portion of the project area to the north of the proposed base yard. The electricity generated from the WTGs at Kahuku Wind Power would tie into this line and subsequently flow through O‘ahu’s grid, powering approximately 8,900 homes.

3.15.1.1 Potential Impacts of the Proposed Action

With the 30 MW of power potentially generated by the proposed facility, HECO would be able to eliminate the use of approximately 154,550 barrels of oil annually that would otherwise be used to produce conventional power. Reducing the proportion of its energy that comes from fossil fuel would decrease the amount of money that HECO spends on imported fuel and buffer the system from the energy cost fluctuations that accompany volatile oil prices.

The proposed action would contribute to the goals outlined in the Hawai‘i’s Renewable Portfolio Standards and the HCEI by increasing the percentage of the state’s energy that is derived from clean, renewable sources. The exact percentage is unknown; however, Kahuku Wind Power is expected to power approximately 8,900 of the 337,152 homes on O‘ahu (DEBDT 2008). It also would support recently passed state statutes designed to promote energy efficiency and renewable energy sources.

The proposed project 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. Electrical power generated by the WTGs would be transformed and channeled to the proposed electrical substation via a combination of underground and overhead collection circuits. The electrical substation would transform the voltage from the on-site collection system and facilitate the interconnection to the existing HECO electrical transmission line (see Section 2.2.6).

No new transmission lines would be constructed as part of the project; however, HECO would relocate a portion of an existing 11-kV electrical distribution line toward the southwestern boundary of the project area to accommodate construction of the WTGs.

3.15.1.2 Potential Impacts of the No Action Alternative

Under the No Action Alternative, there would be no change from the existing conditions. The benefits of reducing the proportion of imported fossil fuel would not occur if the facility was not constructed and operated. The No Action Alternative would not support the goals outlined in the Hawai‘i’s Renewable Portfolio Standards or the HCEI.

3.15.2 Police Services

The Kahuku Police Headquarters is located at 56-470 Kamehameha Highway roughly 2.4 mi (3.7 km) southeast of the access gate on Kamehameha Highway. The Wahiawa Police Station is the closest station to the proposed off-site microwave towers. It is located at 330 North Cane Street, approximately 14 mi (23 km) southwest of the Waialua Substation site and 9 mi (14 km) southeast of the Flying R Ranch site.

3.15.2.1 Potential Impacts of the Proposed Action

The facility would not place substantial additional demands upon the existing police service. During construction, there would likely be 24-hour on-site security personnel. During regular operations, only

one locked gate would provide road access to the site. No polices services would be required for the off-site microwave towers.

3.15.2.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.3 Fire Protection

The closest fire station to the project area is the Kahuku Fire Station (#13) located 2.4 mi (3.7 km) southeast of the access gate. Two additional fire stations are located in Sunset Beach and Hauula, 7.4 mi (11.9 km) west and 7.9 mi (12.7 km) southeast on Kamehameha Highway, respectively. The Waialua Fire Station (#14) located on Hale‘iwa Road is the closest station to the proposed off-site microwave towers.

3.15.3.1 Potential Impacts of the Proposed Action

Construction and operation of the proposed project would not involve undue use of flammable material or cause undue fire hazards. As such, the proposed facility would have minimal impact on the staffing needs at the Kahuku Fire Station. Kahuku Wind Power LLC is investigating feasible architectural design solutions to ensure that all fire code requirements are met.

3.15.3.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.4 Hospitals

The nearest hospital to the proposed Kahuku Wind Power facility is the Kahuku Medical Center located approximately 5,000 ft (1,500 m) from the project area. Wahiawa General Hospital is the closest medical center to the off-site microwave towers. In case of emergencies, paramedic/ambulance services are available.

3.15.4.1 Potential Impacts of the Proposed Action

The facility is not expected to place substantial additional demands on health care facilities in the area.

3.15.4.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.5 Airports

Wheeler Army Airfield and Dillingham Airfield are located roughly 23 mi (14 km) from the project area. Dillingham Airfield is roughly 8 mi (5 km) from the microwave tower sites, while Wheeler Army Airfield is approximately 13 mi (8 km) distant.

3.15.5.1 Potential Impacts of the Proposed Action

Under the provisions of 49 U.S.C. 44718 and Title 14 of the Code of Federal Regulations, part 77, the FAA conducted an aeronautical study of the temporary and permanent met towers for the project, as well

as the proposed WTG. The FAA has determined that the structures do not exceed obstruction standards and would not be a hazard to air navigation provided the structures are marked and/or lighted in accordance with FAA regulations. Eight of the 12 WTGs would be painted white and lit with medium intensity, synchronized red-flashing lights (FAA 2009e). The temporary and permanent met towers would also be lit with medium intensity, synchronized red-flashing lights (FAA 2009a, 2009b, 2009c, 2009d). However, once the WTGs are constructed and lighting installed, Kahuku Wind Power LLC may be able to turn off the light on the permanent met tower due to its proximity to the lighted turbines. To minimize visual impacts due to lighting, on-site operational lighting would be minimal and shielded. This no-hazard determination also includes temporary construction equipment under 424 ft in height (e.g. cranes) used to construct the structures.

The proposed facility would not create a significant aircraft collision hazard and would not have a significant impact on the safe and efficient use of navigable airspace by aircraft.

3.15.5.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.6 Water Supply

Water resources and distribution on O‘ahu is managed by the Board of Water Supply (BWS). A connection to City and County water facilities is not anticipated to be needed for the proposed project. Kahuku Wind Power LLC plans to tap an existing well located on an adjacent site owned by Continental Pacific for its water requirements. Given the nature of the proposed project and small number of people working on-site, water usage would be very low.

3.15.6.1 Potential Impacts of the Proposed Action

Because water for the project would be obtained from a local well, the facility is not expected to be a burden on the island’s municipal water supply. The very low water usage associated with the project is not expected to adversely affect local water availability.

3.15.6.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.7 Wastewater

Wastewater produced by residents in the area is treated at the Kahuku Wastewater Treatment Plant, located near the Ki‘i Unit of the James Campbell NWR (R.M. Towill Corporation 2008). It is anticipated that an on-site septic tank system would be constructed to deal with project-associated wastewater generated from the few people working on-site. The wastewater discharge from the project area would be within the City and County requirement of less than 1,000 gallons per day. The waste that accumulates in the septic tank system would be collected by a private contractor and transported to an appropriate wastewater treatment facility or other approved location for disposal. The small amount of wastewater that this represents can easily be accommodated in the existing treatment and disposal facilities.

3.15.7.1 Potential Impacts of the Proposed Action

Wastewater generated by employees of the proposed facility can easily be accommodated in existing treatment and disposal facilities. Therefore, no significant impact to wastewater treatment facilities is expected from the proposed action.

3.15.7.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.8 Solid Waste

Solid waste generated by the residents in Kahuku is disposed of at the Waimānalo Gulch landfill or burned at the H-Power facility.

3.15.8.1 Potential Impacts of the Proposed Action

Construction and operation of the proposed project is not anticipated to generate a significant amount of solid waste. Although the exact amount is unknown, for other facilities of this kind, waste typically does not exceed one small dumpster per week (Planning Solutions, Inc 2009). During construction, all waste would be transported to and stored within the temporary use area and periodically carried out and properly disposed of in a permitted landfill. During operation, waste would be collected by a private solid waste management company once a week and disposed of in an approved landfill. Some solid waste may be recycled. These materials would be stored and hauled separately to the appropriate recycling company. An on-site septic tank system would be constructed in the project area to handle sewage, as described in Section 3.15.7.

The vast majority of waste created during construction and operation of wind energy facilities is non-hazardous solid waste, such as shipping crates, boxes, and packing material (S. O'Brian/SWCA, pers. comm.). No hazardous solid waste is expected to be generated as a result of construction or operation of the proposed project.

Because only a small amount of solid waste is expected to be generated during construction and operation, and appropriate management practices would be implemented, impacts to solid waste disposal or processing are expected to be minor.

3.15.8.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.9 Parks and Recreation

Three parks or recreational areas occur within a 2 mi (3.2 km) radius of the project area. These are Kawela Bay Beach Park (2 mi away), Kahuku District Park (0.75 mi or 1.2 km away), Kahuku Golf Course (1 mi or 1.6 km away), and Turtle Bay Golf Course (1.2 mi or 2 km away).

3.15.9.1 Potential Impacts of the Proposed Action

WTGs would be visible from the Kahuku Golf Course parking lot and potentially from portions of the course itself. WTGs may also be visible from portions of the other parks and recreation areas. However,

the inherent character of these areas or access to any parks or their associated recreational activities would not be affected by the proposed project.

3.15.9.2 Potential Impacts of the No Action Alternative

If the proposed project were not built and operated, there would be no change from existing conditions.

3.15.10 Roadways

Access to the project area would be provided by Charlie Road off Kamehameha Highway. Kamehameha Highway is under the jurisdiction of the State of Hawai‘i Department of Transportation. According to a 2006 report by the State Highways Division, Highway Planning Branch, the average two-way daily traffic total at the Mālaekahana Stream Bridge along Kamehameha Highway, approximately 1.6 miles (2.6 km) southeast of the project area, is 10,867 cars. Morning peak hour volumes are approximately 322 cars in the southbound direction and 332 cars in the northbound direction, while afternoon peak hour volumes are approximately 459 cars in the southbound direction and 475 cars in the northbound direction (R.M. Towill Corporation 2008).

The traffic monitoring station along Kamehameha Highway between Turtle Bay Golf Course and Kuilima Drive (Station B72008300907) showed an average daily traffic of 4,015.5 per lane per day (for period spanning May 23-25, 2005). Near the shrimp farms along Kamehameha Highway (Station B72008301408) the average daily traffic was 4,020.5 per lane per day (for period spanning March 22-24, 2005) (Environet, Inc. 2009).

3.15.10.1 Potential Impacts of the Proposed Action

Under the proposed action, all of the equipment, employees, and materials needed for construction and operation of the proposed project would access the site from the existing Charlie Road. No paving or road changes are anticipated, although approximately 1.75 mi of unpaved dirt roads are planned within the project boundary.

Construction Phase:

Construction of the proposed project would generate vehicle traffic on roadways in the vicinity throughout the construction period. During the construction period, an average of 15 to 20 employees would be onsite, with an anticipated maximum level of 40 employees. It is anticipated that employees would generate a maximum of 40 one-way vehicle trips daily during the construction period. These trips would likely occur between 6 and 7 a.m. and 3 and 4 p.m. Additional trips to Kahuku town would likely occur during lunchtime.

Equipment delivery trips would involve the transport of large and small pieces of equipment from Barber’s Point to the project area. The number of oversized equipment delivery trips during the six-month construction period is estimated to average 80 one-way trips per day. The transport of large pieces of equipment in oversized vehicles may slow traffic and cause minor temporary traffic delays during a small portion of this period. To minimize these delays, the entrance to the access road (Kamehameha Highway/Charlie Road Intersection) would be manned by two people during construction working hours. These flagmen would stop other traffic for the time needed for the large trucks to turn into and out of the site access road.

Select material (e.g. cement) would also be brought from Hālawa to the project area for construction of the turbine pads and other purposes. Approximately 100 one-way cement truck trips would be needed during the construction period per day.

Project-related vehicle traffic would vary greatly over the course of construction. Although the proposed project would result in a short-term increase in traffic during construction, the increase would not be sufficient to have a measurable effect on the level of service.

Operation Phase:

During operation, the majority of the vehicular-traffic associated with the proposed facilities would be employees reporting to or leaving the facility and service trips by HECO maintenance personnel. The maximum number of vehicle trips during operation is estimated to be 10 one-way vehicle trips per day. This represents less than 0.2% of the current traffic load on Kamehameha Highway. Additional trips to Kahuku town would likely occur during lunchtime.

Operation of the proposed facility would cause a slight increase in traffic on Kamehameha Highway and Charlie Road, but would not otherwise impact normal business and organizational functions of surrounding properties. Increases on Kamehameha Highway are not expected to be noticeable to the public. Because the amount of vehicular-traffic associated with the proposed facilities during operation would be minimal, the proposed project is not anticipated to increase traffic volumes on Kamehameha Highway or roadways in the area in the long-term.

3.15.10.2 Potential Impacts of the No Action Alternative

If the facility was not constructed and operated, no change in traffic levels would occur in the project area.

3.16 Cumulative Impacts

This section considers projects in the past, present, and reasonably foreseeable future that involve impacts to resources for which the proposed action could contribute incrementally. "Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (40 CFR 1508.7). This discussion is limited to recent past, present, and reasonably foreseeable future actions within the project area and the immediate vicinity (defined as the Kahuku community). However, for impacts to state and federally listed species, cumulative impacts are evaluated for actions within the regional area, defined as the Island of O‘ahu, that may have overlapping impacts to the same state and federally listed species that have the potential to be impacted by the proposed project.

The project area is predominantly rural and comparatively few projects have occurred in the immediate vicinity. No future projects are anticipated to occur in the project area (although small complementary agricultural uses may occur in the project area, as discussed previously). Two reasonably foreseeable future actions were identified within the vicinity of the project area (the Kahuku community) that could affect resources expected to be used or impacted by the proposed project:

1. Kahuku Village: Continental Pacific, LLC has developed a plan for the Kahuku Village located southwest of the project area makai of Kamehameha Highway. The Kahuku Village project would create 175 new lots including residential (165), golf course (2), beach parks (2), cemeteries (2), open space (1), and school lots (1). Of these lots, only 64 are vacant and would be sold to individuals for home construction. The project also includes planned improvements to roadways and public utilities (R.M. Towill Corporation 2008).

2. Na Pua Makani: O‘ahu Wind Partners LLC (OWP) has proposed to develop Na Pua Makani, a 25-MW wind energy facility, on state agricultural land immediately southeast of the proposed project.

OWP has applied to DLNR for a lease to use the state land (WSB-Hawai‘i 2009) and submitted a Draft EA to DLNR; however, OWP has not secured a CUP for the proposed facility from the City and County of Honolulu (WSB-Hawai‘i 2009).

In addition, one reasonably foreseeable future action has the potential to have overlapping impacts to the same state and federally listed species that may be impacted by the proposed project.

3. Kawailoa: First Wind is planning to develop a second wind generation facility on agricultural land at Kawailoa, located near the community of Hale‘iwa. This facility is located roughly 7 mi (11 km) from the proposed project area. Currently, four met towers are located on the Kawailoa site.

Analyses of potential cumulative impacts associated with these reasonably foreseeable future actions focused on the four resource areas most relevant to potential cumulative impacts: climate change, noise, scenic resources, and wildlife.

3.16.1 Climate and Global Climate Change

The proposed action would not adversely affect temperature, rainfall, humidity, wind regime, or other meteorological parameters; therefore, it would not contribute to adverse climate impacts from other projects in the area.

Construction and operation of the proposed project would result in minor emissions of greenhouse gases and therefore would contribute slightly to overall cumulative global greenhouse gas emissions. However, greenhouse gas emissions associated with construction and operation of the proposed project are expected to represent a negligible proportion of Hawai‘i-based greenhouse gases.

Operation of motor vehicles and motorized equipment by residents of Kahuku and visitors to the area also contributes to local emission of greenhouse gases. Local emission of greenhouse gases would be expected to increase slightly with the completion of Kahuku Village and with construction and operation of Na Pua Makani and Kawailoa.

The release of anthropogenic greenhouse gases and their potential contribution to global warming are inherently cumulative phenomena. Greenhouse gas emissions from the proposed action are relatively small compared to the 8,026 million tons (7,282 million metric tonnes) of CO_2-equivalent greenhouse gases emitted in the U.S. in 2007 (Energy Information Administration Report #DOE/EIA-0573) and the 54 billion tons (49 billion metric tonnes) of CO_2-equivalent anthropogenic greenhouse gases emitted globally in 2004 (IPCC 2007). However, emissions from the proposed action in combination with past and future emissions from all other sources would contribute incrementally to climate change impacts. At present there is no methodology that would allow DOE to estimate the specific impacts (if any) this increment of climate change would produce in the vicinity of the facility or elsewhere.

Greenhouse gas emissions caused by construction and operation of the proposed project, Na Pua Makani, and the Kawailoa facility, would be more than offset by allowing for significant decreases in the amount of petroleum currently burned on O‘ahu to generate electricity. The 30 MW of power potentially generated by the Kahuku Wind Power facility would be able to eliminate the use of approximately 154,550 barrels of oil annually. This would reduce emission of approximately 159.6 million pounds of CO_2, 330.3 thousand pounds of SO_2, and 237.7 thousand pounds of NO_x per GWh per year. According to WSB-Hawai‘i (2009), Na Pua Makani would decrease annual emissions by the following amounts: 115 thousand pounds of CO; 106 million pounds of CO_2; 187 thousand pounds of SO_x; 359 thousand pounds of NO_x; 5.69 thousand pounds of particulates; and 6.39 thousand pounds of volatile organic compounds. These amounts far exceed those which would be produced by construction and operation of the wind

facilities. Emission reduction estimates are not currently available for the proposed Kawailoa facility; however, the Kawailoa facility is expected to reduce more greenhouse gas emissions than Kahuku Wind Power due to the greater anticipated energy generation of the facility (30 MW vs. 50-70 MW).

Given this, the three wind energy generation facilities currently being planned for O‘ahu are expected to result in beneficial cumulative effects on local and statewide levels of greenhouse gas emissions.

3.16.2 Noise

WTGs at the proposed Kahuku Wind Power facility are not likely to be audible in the surrounding communities under most operating and weather conditions, although they may be audible under especially quiet (and atypical) weather conditions. Ambient noise measures were not taken at the adjacent proposed Na Pua Makani project area; therefore it cannot be determined whether sounds produced by the WTGs would be audible over background levels. However, according to WSB-Hawai‘i (2009), no receivers in the Kahuku Agricultural Park or Kahuku Town are anticipated to be impacted by noise from the Na Pua Makani facility. The Kahuku Wind Power facility would not add measurably to the sound level at these receptors because it is considerably farther away and on the other side of the Na Pua Makani site. The only potential noise receiver located between the two projects is Ki‘i Road farms. The maximum expected increase in ambient sound at this location as a result of Kahuku Wind Power (3 dB) is not a perceptible difference to most listeners (DLAA, Ltd. 2009). Although the maximum expected increase in ambient sound at this location as a result of the Na Pua Makani facility is not known, the increase may be similar to Kahuku Wind Power, because Ki‘i Road farms is roughly the same distance from the Na Pua Makani facility. If an additional 3 dB was expected from the Na Pua Makani wind facility, the total sound level would still be below the DOH limit of 70 dBA. Thus, cumulative noise impacts are not expected.

3.16.3 Scenic Resources

Construction of the facility would add to the amount of structural development within the visual landscape and would introduce different visual features into the viewshed. Construction of the adjacent Pua Na Makani facility would augment this impact. Both projects are proposing to use Clipper Liberty™ 2.5 MW and therefore the visual impact of the two would be similar. WTGs at both of the projects would be visible from the following vantage points: Kamehameha Highway, Romy’s Shrimp Truck, Kahuku Hospital, Kahuku High School, and Kahuku Golf Course. However, the projects would maintain open spaces between the WTGs and the rural character of the community.

3.16.4 Wildlife

3.16.4.1 Non- Listed Species

The proposed action would contribute to a cumulative reduction of habitat for some non-listed wildlife species when added to impacts resulting from projects in the vicinity. However, a large amount of similar habitat is available at other locations on the island. In general, non-listed wildlife species occurring on the property are common and widespread in the region and seemingly tolerant of development. Therefore, cumulative effects to non-listed wildlife are expected to be minor.

3.16.4.2 Listed Species

No ESA Section 10(a)(1)(B) permits for the covered species have been issued through an HCP on the Island of O‘ahu. However, take has been authorized through two Safe Harbor Agreements (SHAs) on O‘ahu (Table 3-19). Under a Safe Harbor Agreement, property owners voluntarily undertake

management activities on their property to enhance, restore, or maintain habitat benefiting species listed under the ESA. These agreements assure property owners they will not be subjected to increased property use restrictions if their efforts attract listed species to their property or increase the numbers or distribution of listed species already on their property. The USFWS issues the applicant an "enhancement of survival" permit, which authorizes any necessary future incidental take through Section 10 (a)(1)(A) of the ESA. Accordingly, all impacts associated with these take authorizations have been mitigated.

Table 3-19. Take authorizations for the covered species on O'ahu through Safe Harbor Agreements.

Applicant	Issued	Duration	Species	Location
Chevron SHA	09/23/2005	6 years	Hawaiian stilt Hawaiian coot	Kapolei, O'ahu Island
Participants of USDA Farm Bill Conservation Programs	09/12/2007	10 years	Hawaiian stilt Hawaiian coot Hawaiian duck Hawaiian moorhen	Statewide

The proposed adjacent Na Pua Makani wind facility project and Kawailoa project have the potential to result in incidental take of the covered species. Thus, there is a possibility of cumulative impacts to these species. However, it is expected that if approved, the impacts and mitigation for Na Pua Makani and Kawailoa would resemble those discussed for Kahuku Wind Power. The proposed mitigation for Kahuku Wind Power is expected to more than offset the anticipated take and provide a net benefit to the species.

At a broader scale, Kahuku Wind Power represents one of many projects that can be expected to occur on the Island of O'ahu. O'ahu has experienced increasing human population growth and real estate development, and will likely continue increasing in the future. Some of the causes of decline of the covered species (such as mammal predation, light disorientation, pesticide use, and loss of nesting or roosting habitats) may be on the increase due to this growth. Through mitigation, projects like Kahuku Wind Power are among the few that are implementing measures to provide a net benefit to the affected species. In general, it is assumed that future development projects would be conducted in compliance with all applicable local, state, and federal environmental regulations.

Seabirds (Newell's Shearwater and Hawaiian Petrel)

Currently, there is no authorized take of Newell's shearwater or Hawaiian petrel in the immediate vicinity (or on O'ahu). Take authorization for these species will likely be requested for Na Pua Makani and Kawailoa because these projects have the potential to result in incidental take of the species by colliding with WTGs and other project components. The proposed Kahuku Village would also result in slight increases in artificial nighttime lighting, which also has the potential to impact the seabirds.

The proposed mitigation measures described for two seabirds 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. With the low expected rate of take, the proposed mitigation measures are expected

to produce a measurable net benefit in the form of a marginal increase in the species' population. Similar mitigation measures are expected for Na Pua Makani and Kawailoa. For this reason, no significant adverse impacts to the species' overall population, and no significant cumulative impacts to the species, are anticipated.

Waterbirds (Hawaiian Duck, Hawaiian Stilt, Hawaiian Coot, Hawaiian Moorhen)

Currently, there is no authorized take of the Hawaiian duck, Hawaiian stilt, Hawaiian coot, or Hawaiian moorhen in the immediate vicinity. Take authorization for these federally listed waterbirds will likely be requested for Na Pua Makani and Kawailoa because these projects have the potential to result in incidental take of these species by colliding with WTGs and other project components.

The most important causes of decline of the Hawaiian stilt and other Hawaiian waterbirds is the loss of wetland habitat and predation by introduced animals. Other factors that have contributed to population declines include altered hydrology, alteration of habitat by invasive nonnative plants, disease, and possibly environmental contaminants (USFWS 2005a). Development of the Kahuku Wind Power project would not increase losses due to these other causes. However, some of these causes (loss of wetlands and pesticide use) may be on the increase due to continued real estate development on O'ahu, and will likely continue increasing in the future. Thus, the possibility of cumulative impacts in addition to the anticipated take at Kahuku Wind Power exists.

However, the proposed mitigation measures described for the federally listed waterbirds 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. With the low expected rate of take, the proposed mitigation measures are expected to produce a measurable net benefit in the form of a marginal increase in the species' population. Similar mitigation measures are expected for Na Pua Makani and Kawailoa. For this reason, no significant adverse impacts to the species' overall population, and no significant cumulative impacts to the federally listed waterbirds, are anticipated.

Hawaiian Short-eared Owl

Currently, there is no authorized take of the Hawaiian short-eared owls in the immediate vicinity (or on O'ahu). However, take authorizations of this species will likely be requested for Na Pua Makani and Kawailoa.

Some of the major threats to the Hawaiian short-eared owls may be on the increase due to continued real estate development on O'ahu, and will likely continue increasing in the future. In particular, Hawaiian short-eared owls appear particularly sensitive to habitat loss and fragmentation. Trauma, apparently from vehicular collisions, also causes death of Hawaiian short-eared owls throughout the state. Thus, the possibility of cumulative impacts from these threats, in addition to the anticipated take at Kahuku Wind Power exists.

However, Kahuku Wind Power LLC has proposed mitigation measures for the species that would contribute to a greater understanding of the species' occurrence and status, which in turn would help guide future management and recovery efforts and should result in an overall net conservation benefit for the species. Similar mitigation measures are expected for Na Pua Makani and Kawailoa. For this reason, no significant adverse impacts to the species' overall population are expected, and no significant cumulative impacts to the species, are anticipated.

Hawaiian Hoary Bat

Currently, there is no authorized take of the Hawaiian hoary bat in the immediate vicinity (or on O‘ahu). However, take authorizations of this species will likely be requested for Na Pua Makani and Kawailoa.

Other actions that can be expected to occur on O‘ahu and that have potential to adversely modify habitat used by the species include habitat loss and roost disturbance from resort or recreational developments (e.g. golf courses), housing and commercial developments, road construction, and farming. Pesticide use is also believed to threaten the species (USFWS 1998). The possibility of cumulative impacts from these threats, in addition to the anticipated take at Kahuku Wind Power, exists.

As stated in Section 3.12.4, no historical population estimates exist for the Hawaiian hoary bat. Current population estimates are not based on systematic surveys and methods for accurately estimating population numbers do not exist (USFWS 1998). Thus, as stated in the Recovery Plan for the Hawaiian Hoary Bat (1998), the decline of the bat is largely inferred and the presumed “limited distribution may be, at least partially, an artifact of localized search efforts by researchers.” Because the population of this species is not known, it is difficult to gauge whether the take of Hawaiian hoary bat will result in a significant impact on the overall population. Kahuku Wind Power LLC’s proposed mitigation for the anticipated take of Hawaiian hoary bat would contribute to a greater understanding of the species’ status on O‘ahu, which in turn would help guide future management and recovery efforts and should result in an overall net conservation benefit for the species. Therefore, there is no anticipated cumulative impact to the Hawaiian hoary bat.

Changed Circumstances Provided for in the Habitat Conservation Plan

The HCP includes a discussion of anticipated changes in circumstances affecting the covered species and other species occurring in the project area or the efforts expended towards mitigation that could occur during the life of the HCP (SWCA and First Wind 2010). Possible changed circumstances included in the HCP for the proposed project include: climate change; disease outbreaks in any of the listed species; deleterious change in relative abundance of non-native plant species or ungulates occurring at the mitigation sites for covered species; hurricanes or other major storms that may affect the project area and/or mitigation sites; changes in the price of raw materials and labor; the de-listing of any species covered in the HCP; and the listing of one or more species that already occur on-site, or fly over the site, not currently covered in the HCP.

If these circumstances were to occur, Kahuku Wind Power LLC would consult with DLNR and USFWS to determine if measures to remediate these changes are available, practical, and necessary. Potential remediation measures to address changed circumstances would be identified, approved, conducted, and monitored in consultation with DLNR and USFWS; therefore, any potential impacts to listed species and critical habitat would be minimized. Overall, the remediation measures are anticipated to improve the overall habitat quality and/or health of the covered species following recognition of a changed circumstance.

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CHAPTER 5: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONTACTED

Federal Agencies

U.S. Fish and Wildlife Service (USFWS)

U.S. Army Corps of Engineers

U.S. Department of Agriculture

State Agencies

Department of Land and Natural Resources (DLNR)
- Division of Forestry and Wildlife (DOFAW)
- State Historic Preservation Division (SHPD)

Office of Hawaiian Affairs (OHA)

Department of Health (DOH)
- Environmental Planning Office (EPO)
- Environmental Health Service Division (EHSD)

Department of Business, Economic Development & Tourism (DBEDT), Office of Planning

Department of Transportation (DOT)

County Agencies

Department of Planning and Permitting (DPP)

Board of Water Supply (BWS)

Organizations

Kahuku High and Intermediate School

Kahuku Community Association

Lāʻie Community Association

Kahuku Village Association

Defend Oʻahu Coalition

Koʻolau Loa Neighborhood Board

North Shore Neighborhood

Hawaiian Electric Company, Inc.

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