Kahana Solar Project

Draft Biological Resources Survey Report

Prepared for:

Kahana Solar, LLC

February 2021

TETRA TECH

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1.0 Introduction

Kahana Solar LLC (Kahana Solar) is proposing to build and operate the Kahana Solar Project (Project) located in Napili-Honokōwai on the Island of Maui. The Project will consist of a 20-megawatt (MWac[1]) solar photovoltaic system coupled with a 20-MW, 4-hour (80MWh) photovoltaic coupled battery energy storage system (PV-Coupled ESS) as well as ancillary support infrastructure located within an approximately 412-acre (167 hectares) Study Area (Figure 1). The Project will primarily be located on tax map key (TMK) 4-3-001:017, owned by Maui Land & Pineapple Company (ML&P) (Figure 1).

Kahana Solar contracted Tetra Tech, Inc. (Tetra Tech) to conduct biological surveys for the Project. The purpose of the surveys was to characterize the habitat and verify whether state or federally-listed[2] threatened, endangered, or otherwise rare plants or animals have the potential to occur and could be impacted by construction or operation of the Project. This report summarizes the results of the biological surveys conducted by Tetra Tech and LeGrande Biological Surveys Inc. on June 16-22 and July 2-3, 2020, as well as the yellow-faced bee survey conducted by Dr. Karl Magnacca on July 18, 2020. In addition to the biological surveys, a site visit to investigate potential Waters of the U.S. and other site constraints was conducted on October 19, 2020 with a former ML&P employee, Wes Nohara, who worked in the area for 40 years.

1.1 Project Description

The major infrastructures of the Project will include the following: the solar photovoltaic system, a network of AC and DC electrical collector lines, battery energy storage and inverter units, step-up transformers, a collector substation and transformer, a Maui Electric Company, Ltd. (Maui Electric) 69-kilovolt (kV) switchyard, an overhead 69-kV transmission line (less than 400 feet [122 meters] in length), internal access roads, and temporary laydown (i.e., staging) areas for construction. The solar arrays and associated infrastructure would occupy approximately 220 acres located on TMK 4-3-001:017. The Project would connect into the Maui Electric grid via a new Maui Electric switchyard that would be constructed adjacent to the Project's substation on TMK 4-3-001:017. Maui Electric will connect their new switchyard to the existing transmission grid via an new 400-foot (or less) overhead 69-kV transmission line that would extend from the switchyard west to the existing Maui Electric 69-kilovolt overhead transmission line that runs north-south along the eastern boundary of TMK 4-3-001:084. The main access route to the solar array areas would utilize an existing (to be improved) agricultural access road that extends from the intersection of Honoapi'ilani Highway and Akahele Street and would pass through TMK 4-3-001:082 (owned by Maui Ocean View LP) and 4-3-001:084 (owned by ML&P) to access TMK 4-3-001:017. The portion of the access road on TMK 4-3-001:082 may be replaced by the Maui Ocean View LP road network if the Pulelehua residential community is constructed on TMK 4-3-001:082

[1] A 20-MWac project means the Project has a generation capacity of up to 25,000,000 watts of alternating current (AC) electricity at one moment in time.

[2] State or federal listed under the Endangered Species Act (50 CFR §17) and/or Hawaii Revised Statues (HRS) Chapter 195D.

during the construction or operational period of the Project. A network of existing (to be improved) and new on-site access roads will be utilized within the solar array areas on TMK 4-3-001:017.

It is anticipated that Project construction and commissioning would require approximately 12 months. The power generated by the Project will be sold to Maui Electric under a 25-year Power Purchase Agreement (PPA). At that point in time, the Project may be repowered under a renegotiated PPA or other contract (with subsequent permits/approvals) or decommissioned. Decommissioning will involve removal of all equipment associated with the Project and returning the area to substantially the same condition as existed prior to Project development. Decommissioning will include the recycling and reuse of materials demolished or removed from the site to the extent feasible.

Kahana Solar Project

Figure 1
Study Area and Vicinity

MAUI COUNTY, HI

- Study Area
- Highway
- Existing County Road
- Existing Agricultural Access Road
- TMK Boundary

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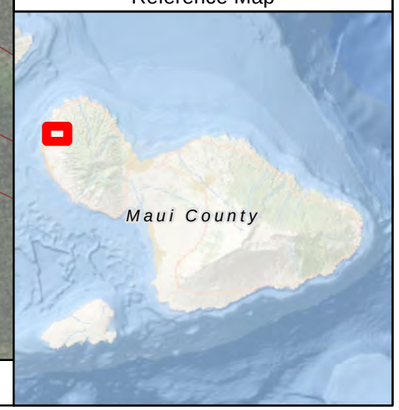
Reference Map



HONOAPIILANI HIGHWAY
AKAHELE STREET
KAPALUA AIRPORT
4-3-001:068
4-3-001:084
4-3-001:079
4-3-001:082
AREA 4
AREA 3
AREA 2
AREA 1
4-3-001:017
4-3-001:071

1:14,000 WGS 1984 UTM Zone 4N

0 0.25 0.5 1 Miles

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2.0 Description of Study Area

As shown in Figure 1, the Study Area encompasses approximately 412 acres (167 hectares) of privately owned land located in the Napili-Honokōwai area of West Maui, approximately 1.2 miles (1.95 kilometer [km]) mauka (inland) of the Kapalua Airport on the western slope of Puʻu Kukui. The major components of the Project will be located within the western portion of TMK 4-3-001:017 owned by ML&P. The portions of the Study Area located on TMK 4-3-001:082 (owned by Maui Ocean View LP) and TMK 4-3-001:084 (owned by ML&P) are associated with the Project's main access road which would extend from the intersection of Honoapiʻilani Highway and Akahele Street, south of the Kapalua Airport, then mauka to the main Project Study Area. A small portion of Study Area associated with the main access road includes the southeast corner of TMK 4-3:001:068 (Figure 1), which is owned by the State of Hawaiʻi; however, Kahana Solar intends to avoid use of this parcel.

The Study Area was previously utilized for commercial pineapple and sugar cane cultivation. Pineapple operations ceased in 2009, and the land is currently undeveloped (Munekiyo Hiraga 2019; Pacific Legacy, in prep For descriptive purposes, area numbering is labeled on report figures and include the following (south to north): Area 1, Area 2, Area 3, Area 4. Remnant features of past agricultural use are scattered throughout the Study Area, and are primarily related to water management (e.g., water valves, water tanks, pump stations). Several water reservoirs from legacy agriculture are within or immediately adjacent to the Study Area. Kahana Solar has no site control over these existing reservoirs including the one located within the Study Area. The Department of Water Supply maintains existing infrastructure in the vicinity including the a reservoir and the Māhinahina Water Treatment Facility.

2.1 Climate

The climate in the Study Area ranges from arid and very dry near the western access road to seasonally mesic in the upper elevations (Price et al. 2012). According to the Online Rainfall Atlas of Hawaiʻi (Giambelluca et al. 2013), the area receives a mean annual rainfall of approximately 29.3 inches (745 millimeters [mm]) at the Kapalua Airport to 72.1 inches (1,830 mm) in the upper elevations of the Study Area. Rainfall is typically highest in December/January and lowest in June through September (Giambelluca et al. 2013).

The mean annual rainfall collected Kapalua Airport gauge from 1989-2019 is 28.6 inches (726 mm). The monthly rainfall totals recorded at the Kapalua Airport in 2020 is shown in Table 1. April 2020 (2.87 inches) was above the mean, May 2020 (0.32 inches) was below the mean, and June 2020 (1.43 inches) was above the mean.

Table 1. Monthly Rainfall Totals Collected at the Kapalua Airport in 2020

Month (2020)	Rainfall (Inches)
January	4.21
February	2.16
March	2.41
April	2.87
May	0.32
June	1.43
July	1.13
August	0.37
September	0.57
October	2.31
November	1.43
December	0.90

Source: Kevin Kodama/Senior Hydrologist, NWS Honolulu Forecast Office, pers. comm., August 2020; NRCS 2021.

2.2 Topography, Geology, and Soils

The Study Area lies at the base of the dormant volcano of the West Maui Mountains. The elevation of the Study Area ranges from approximately 80 feet (24 meters [m]) above mean sea level (amsl) in the western portion near Akahele Street to approximately 1,360 feet (415 m) amsl near the eastern boundary of the Study Area (Figure 2). Most of the Study Area has a 0-15% slope with some areas over 15%. In general, the terrain slopes west toward the Pacific Ocean (ocean).

Geologically, the northern portion is underlain by Honolua Volcanics, between 1.1-1.3 million years old. The southern portion of the Study Area is underlain by Wailuku Volcanic, ranging from 1.3 to 2.0 million years old (Sherrod et al. 2007).

The Natural Resources Conservation Service (NRCS 2019) identifies 10 soil types in the Study Area (Figure 2). The Study Area is primarily composed of Alaeloa silty clay, Kahana silty clay, and Olelo silty clay; all well-drained silty clay loams that are associated with agricultural practices. Rough broken and stony land (rRS) and rough mountainous land (rRT) primarily occurs in the gulches.

Kahana Solar Project

Figure 2
Topography and Soils

MAUI COUNTY, HI

- Study Area
- 100 ft Contour
- TMK Boundary
- Highway
- Existing County Road
- Existing Agricultural Access Road

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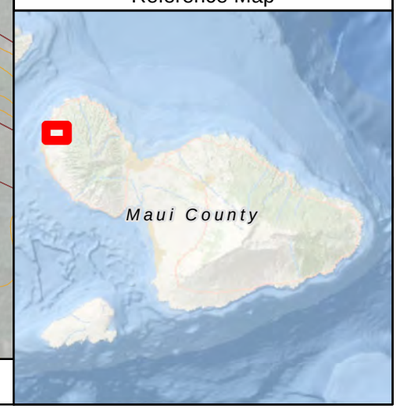
Reference Map



Map Unit Symbol: Map Unit Name

- AeC: Alaeloa silty clay, 7 to 15 percent slopes, MLRA 158
- AeE: Alaeloa silty clay, 15 to 35 percent slopes, MLRA 164
- KbB: Kahana silty clay, 3 to 7 percent slopes
- KbC: Kahana silty clay, 7 to 15 percent slopes
- LaB: Lahaina silty clay, 3 to 7 percent slopes, MLRA 158
- LaC: Lahaina silty clay, 7 to 15 percent slopes, MLRA 158
- OFC: Olelo silty clay, 15 to 50 percent slopes, MLRA 164
- rRK: Rock land
- rRS: Rough broken and stony land
- rRT: Rough mountainous land

1:14,000 WGS 1984 UTM Zone 4N

0 0.25 0.5 1 Miles

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2.3 Hydrology

The Study Area is within the Honokōwai and Kahana watersheds (CWRM 2008; Group 70 & SRGII 2016). Figure 3 depicts water resources mapped within the Study Area and vicinity by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) data and the U.S. Geological Survey (USGS) topographic and National Hydrography Dataset (NHD), and the State of Hawai'i Division of Aquatic Resources (DAR) dataset.

2.3.1 Non-Wetland Waters

According to NWI, NHD, and DAR data two tributaries—Pulepule Gulch and Kahanaiki Gulch—cross through the Study Area. Pulepule Gulch and Kahanaiki Gulch are tributaries of the perennial Kahana Stream which flows immediately north of the Study Area. Kahanaiki Gulch joins Pulepule Gulch approximately 0.75 miles (1.26 km) west of the Study Area and eventually joins the main branch of Kahana Stream approximately 1.5 miles (2.5 km) west of the Study Area. Kahana Stream crosses Honoapi'ilani Highway and empties in the ocean just north of Kaea Point and Kahana Village. Pulepule Gulch and Kahanaiki Gulch are classified as intermittent streams by NHD (2020), perennial streams by DAR (2008), and Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC) by NWI (2019).

Māhinahina Gulch is also mapped by the NWI, NHD, and DAR dataset as crossing immediately south of the Study Area. It is classified as an intermittent stream by NHD (2020), non-perennial stream by DAR (2008), and Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC) by NWI (2019). Māhinahina Gulch is not identified in the Atlas of Hawaiian Watersheds (Parham et al. 2008). One other gulch (referred to as Unnamed Gulch) runs through the Study Area north of Māhinahina Gulch and south of Kahanaiki Gulch. This unnamed gulch is not mapped by NHD, NWI, or DAR. The Unnamed Gulch connects with Māhinahina Gulch roughly 0.4 miles (0.6 km) east of Honoapi'ilani Highway.

On July 1-3, 2020 Tetra Tech and its subcontractor delineated four non-wetland water features located in the Study Area that may be subject to jurisdiction under Section 404 of the Clean Water Act. A supplemental site visit was conducted on October 19, 2020 to gather additional data from Wes Nohara, a former ML&P employee and the current Associate Director of West Maui Soil & Water Conservation District (SWCD), who has worked in the Study Area for 40 years (until 2009). Details on the potential jurisdictional water features within the Study Area are provided in the Project's Waters of the U.S. determination and delineation report (Tetra Tech, in prep.). Based on the data collected in the field, review of available water resource data and discussions with residents and workers in the area, all of the features delineated in the Study Area (Pulepule Gulch, Kahanaiki Gulch, the Unnamed Gulch, and Māhinahina Gulch) are likely ephemeral under the Navigable Waters Protection Rule (NWPR) [3] because

[3] On June 22, 2020, the NWPR became effective across the United States. Under the NWPR, ephemeral features are defined as "surface water flowing or pooling only in direct response to precipitation, such as rain or snow fall" (USACE and EPA 2020). Notable, the NWPR does not consider ephemeral features jurisdictional under the Clean Water Act.

they only have surface flow in direct response to rainfall. Additional details can be found in the Project's Waters of the U.S. determination and delineation report (Tetra Tech, in prep.).

2.3.2 Ditches and Water Management Features

Several concrete-lined and earthen ditches and pipes related to water management for agriculture are present in the Study Area. The only active ditch is Honolua/Honokōhau Ditch (referred to as Honokōhau Tunnel by USGS 1983), which is a concrete-lined irrigation ditch that mostly tunnels under the Study Area (Pacific Legacy, in prep). The depth of the ditch varies but is estimated to be approximately 25-50 feet (8-15 m) below ground (Wes Nohara/ SWCD, pers. comm, October 2020). The Honolua/Honokōhau Ditch surfaces at one location in the Study Area, at the westernmost stream crossing of Kahanaiki Gulch. It also surfaces just outside of the Study Area south of Māhinahina Gulch. The Honolua/Honokōhau Ditch is still in use and has perennial flow underground (Wes Nohara/ SWCD, pers. comm, October 2020). Water diverted from the Honolua/Honokōhau Ditch is treated at the Māhinahina Water Treatment Facility (Cheng 2014) and it supplies drinking water to the County of Maui.

Several aboveground earthen and concrete-lined ditches also occur on the surface in the Study Area (Pacific Legacy, in prep). Many of these ditches formerly connected to the Honolua/Honokōhau Ditch system; however, they are no longer actively used because agricultural operations have ceased in the area. No surface water was observed in these auxiliary ditches during the survey.

2.3.3 Wetlands

No wetlands occur in the Study Area.

A reservoir is present in a flat portion of Area 2 between Kahanaiki Gulch and the Unnamed Gulch. This reservoir was built in 2006 and is less than 1.5 acre (0.6 ha) in surface area. Some standing water was observed in the reservoir during the Waters of the U.S. survey conducted July 1-3, 2020, but it is assumed to be an accumulation of rainfall as the reservoir is no longer in use for agricultural irrigation purposes (Wes Nohara/ SWCD, pers. comm, October 2020). Molasses grass (*Melinis minutiflora*—FAC), California grass (*Urochloa mutica*—FACW), Madagascar fireweed (*Senecio madagascariensis*—FACU), indigo (*Indigofera suffruticosa*—UPL), and sword fern (*Nephrolepis brownii*—FAC) were observed in the reservoir. Four additional reservoirs occur in within 0.25 miles (0.4 km) of the Study Area and two reservoir ponds occur approximately 0.3 miles (0.5 km) south of the Study Area.

The Lake/Pond identified by NHD on TMK 4-3-001:079, south of the Project's main access road and mauka of Honoapiʻilani Highway, is associated with the detention basin constructed in the lower reach of Māhinahina Gulch. The NHD polygon is outside the Study Area and does not line up with the actual detention basin location which is further south (away from the Study Area) than the NHD polygon.

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Figure 3
Water Resources Identified by NWI, NHD, DAR

MAUI COUNTY, HI

- Study Area
- Highway
- Existing County Road
- Existing Agricultural Access Road
- TMK Boundary
- Unnamed Gulch
- Lake/Reservoir (NHD)
- Intermittent Stream (NHD)
- Canal/Ditch (NHD)
- DAR Streams

Wetland Types (NWI)

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine

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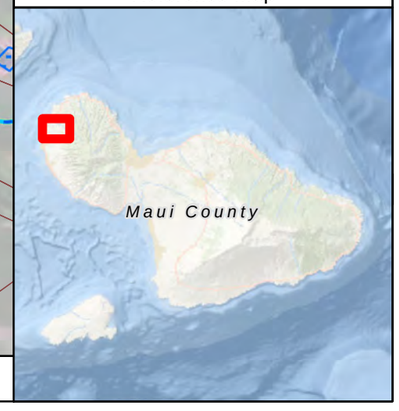
Reference Map



Kahana
Kahanaiki Gl
Mailepai
Honokahua
4-3-001:084
AKAHELE STREET
4-3-001:068
KAPALUA AIRPORT
4-3-001:082
4-3-001:079
HONOAPIILANI HIGHWAY
Pulepule Gl
AREA 4
AREA 3
AREA 2
AREA 1
Unnamed Gulch
4-3-001:017
Mahinahina Gl
4-3-001:071
Honokowai

1:18,000 WGS 1984 UTM Zone 4N

0 0.25 0.5 1 Miles

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3.0 Methods

Prior to the field survey, Tetra Tech conducted a review of relevant publicly available literature and data with respect to biological resources in and near the Study Area. This review included environmental assessments and environmental impact statements, NWI data, the USGS NHD, scientific journals and reports, and available, unpublished data that are relevant to the natural history and ecology of the area. In addition, Tetra Tech reviewed available geospatial data, aerial photographs, and topographic maps of the Study Area to identify occurrences of state or federally-listed species, or rare species, or habitats that could harbor these species. Details of the biological field survey conducted by Tetra Tech, LeGrande Biological Surveys Inc., and Dr. Karl Magnacca are provided below. A Waters of the U.S. survey was conducted on July 1-3 and on October 19, 2020. Observations made during those surveys regarding biological resources within the Study Area are incorporated in this report.

3.1 Plants

On June 16-20, 2020 and July 2-3, 2020, Tetra Tech and LeGrande Biological Surveys Inc. conducted a pedestrian survey to record all plant species, dominant vegetation types, as well as any listed or rare plant species within the Study Area. During the survey, biologists examined areas more likely to support native plants (e.g., rocky outcrops, gulches, and shady areas) more intensively. Plant identifications were made in the field; plants that could not be positively identified were photo-documented for comparison with the recent taxonomic literature.

Plants recorded during this survey are indicative of the season and environmental conditions at the time of the survey. The presence and location of plants can be influenced by seasonal and temporal changes; therefore, it is possible additional species may occur within the Study Area but were not present during this survey.

The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999, 2012), Wagner and Herbst (2003), and Imada (2012) for native and naturalized flowering plants, and Staples and Herbst (2005) for ornamental plants. Common/Hawaiian names are provided first, followed by scientific names in parentheses. If no common or Hawaiian name is known, only the scientific name is provided. A list of plants observed during the survey are presented in Appendix B.

3.2 Wildlife

3.2.1 Birds

On June 16-20, 2020 and July 2-3, 2020, Tetra Tech recorded all birds seen or heard while walking and driving within the Study Area. Habitats or plants that could support listed birds were also identified, if present (such as water features as potential habitat for listed Hawaiian waterbirds). In addition to the pedestrian surveys, 20-minute point counts were conducted at the reservoir located within the Study Area and at the four reservoirs within 0.25 miles (0.4 km) of the Study Area boundary in an attempt to document listed waterbirds that could occur within or near the Study Area. Incidental observations of

waterbirds at the two reservoirs located approximately 0.3 miles south of the Study Area (approximately 900 feet [274 meters] south of the Māhinahina Water Treatment Facility) were also recorded.

Scientific nomenclature for birds follows Birds of the World (Billerman et al. 2020).

3.2.2 Mammals

On June 16-20, 2020 and July 2-3, 2020, Tetra Tech and LeGrande Biological Surveys Inc. recorded all mammals observed within the Study Area. The survey was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. Scientific names for mammals follow Tomich (1986).

Specific surveys for the endangered Hawaiian hoary bat or ʻōpeʻapeʻa (*Lasiurus cinereus semotus*), through the use of acoustic bat detectors or nighttime observation, were not conducted. The USFWS and Hawaiʻi Division of Forestry and Wildlife (DOFAW) recognize all woody vegetation greater than 15 feet (4.5 m) tall as potential bat roosting habitat (DOFAW 2015, USFWS 2019a). For this reason, Tetra Tech noted the presence or absence of trees or shrubs greater than 15 feet (4.5 m) tall within the Study Area.

3.2.3 Insects and Spiders

The insect surveys focused on searching the Study Area for the presence of the state and federally-endangered Blackburn's sphinx moth (*Manduca blackburnii*)[4] and state and federally-endangered yellow-faced bees (*Hylaeus* spp.) and their hosts plants; however, other large insects and spiders observed while walking and driving the Study Area were also recorded incidentally. Scientific nomenclature follows Nishida (2002).

3.2.3.1 Blackburn's Sphinx Moth

Larvae of the Blackburn's sphinx moth feed on plants in the nightshade family (Solanaceae), including the non-native, weedy tree tobacco (*Nicotiana glauca*), which is common on Maui. If tree tobacco plants were encountered in the Study Area or vicinity during the surveys they would be scanned for Blackburn's sphinx moth larvae, eggs, or evidence of larval feeding (e.g., chewed stems, frass, or leaf damage). If encountered, general locations of tree tobacco were mapped to inform Project design and future Blackburn's sphinx moth survey efforts.

3.2.3.2 Yellow-Faced Bees

Dr. Karl Magnacca surveyed the Study Area for listed yellow-faced bees and their primary host plants on July 18, 2020. The purpose of these surveys was to identify if the Study Area may be inhabited by native yellow-faced bees, particularly the endangered assimulans yellow-faced bee (*Hylaeus assimulans*),

[4] The 2019 5-year review for the Blackburn's sphinx moth stated that the species "…is not likely to become extinct within the foreseeable future and more closely meets the definition of threatened rather than endangered" (USFWS 2019b).

anthricinan yellow-faced bee (*H. anthracinus*), longhead yellow-faced bee (*H. longiceps*), and easy yellow-faced bee (*H. facilis*), and determine if their suitable habitat is present. The primary host plants for the listed yellow-faced bees were mapped during the plant survey (see Section 3.1). These host plants include ʻilima (*Sida fallax*), ʻakoko (*Euphorbia* spp.), *Bidens* spp., ʻaʻaliʻi (*Dodonaea viscosa*), *Santalum* spp., naupaka (*Scaevola* spp.), naio (*Myoporum sandwicense*), and pua kala (*Argemone glauca*). Dr. Karl Magnacca concentrated his survey efforts in locations where potential host plants were observed during the botanical surveys. During his survey, native plants were checked for flowers, observed for the presence of bees, and assessed for the potential quality of yellow-faced bee habitat. Other native and non-native species (e.g., non-native ants) were also noted as their presence would indicate habitat suitability.

4.0 Results and Discussion

In general, the Study Area is degraded land that has been highly disturbed and is dominated by non-native plant and wildlife species. Previous agricultural activities have reduced the number and abundance of native species and habitats suitable for native species. Of the native species observed, most are common across Maui and other Hawaiian Islands. However, one state and federally-listed endangered species was observed within the Study Area—the Hawaiian stilt or a‘eo (*Himantopus mexicanus knudseni*). Additionally, the threatened Hawaiian goose or nēnē (*Branta sandwichensis*) was recorded in the immediate vicinity of the Study Area. Several other state or federally-listed species not observed in the Study Area during the survey may occasionally occur in or traverse the Study Area. These species are discussed in further detail below. During the October 19, 2020 site visit, Tetra Tech observed that a portion of the Study Area, primarily in Area 2, was burned during the September 30, 2020 wildfire, thus removing many of the plants observed during the June/July surveys. The below results reflect the pre-wildfire conditions.

Representative photographs of the Study Area are presented in Appendix A.

4.1 Plants

Biological surveys documented 141 plant species within the Study Area or immediate vicinity (Appendix B). None of the plants observed are listed as endangered or threatened by USFWS and DOFAW. The vegetation is dominated by weedy plants that are non-native to the Hawaiian Islands. Eighteen of the observed plant species are native to the Hawaiian Islands, including six endemic species and 12 indigenous species (Table 2). The remaining 123 plant species observed within the Study Area are non-native to the Hawaiian Islands.

The vegetation within the Study Area is primarily characterized by fallow, overgrown pineapple fields on the flatter areas between densely forested gulch vegetation. Ruderal vegetation occurs along the edges of access roads and ornamental plantings are common at the old farmhouse located at the junction of the Project’s main access roadway and Area 2.

Table 2. Native Plant Species Recorded in the Study Area and Immediate Vicinity During the Survey

Common/Hawaiian Name	Scientific Name	Status
ʻaʻaliʻi	*Dodonaea viscosa*	I
ʻakoko	*Euphorbia celastroides* var. *amplectens*	E
ʻākia	*Wikstroemia oahuensis* var. *oahuensis*	E
alaheʻe	*Psydrax odorata*	I
ʻēkaha	*Asplenium nidus*	I
huehue	*Cocculus orbiculatus*	I
ʻiliahialoʻe, coast sandalwood[1/]	*Santalum ellipticum*	E
kāʻapeʻape	*Cyrtomium caryotideum*	I
kīlau	*Pteridium aquilinum* ssp. *decompositum*	E
kolokolo	*Adenophorus tenellus*	E
koali ʻawahia, koali ʻawa	*Ipomoea indica*	I
moa	*Psilotum nudum*	I
ʻōhiʻa lehua	*Metrosideros polymorpha* var. *glaberrima*	E
palaʻā	*Sphenomeris chinensis*	I
palapalai	*Microlepia strigosa* var. *strigosa*	I
pūkiawe	*Leptecophylla tameiameiae*	I
ʻuhaloa	*Waltheria indica*	I
ʻūlei	*Osteomeles anthyllidifolia*	I

Status: E = Endemic (native only to the Hawaiian Islands); I = Indigenous (native to the Hawaiian Islands and elsewhere).
1/ Species observed just outside the Study Area.

Fallow Agricultural Fields

The fallow agricultural fields in the Study Area are dominated by non-native plant species; however, some native plants were observed. The densest concentration of native plant species recorded in the Study Area were observed in Area 4, the northernmost fallow agricultural field just south of Kahana Stream. Mixed in with Eucalyptus trees (*Eucalyptus* spp.) and molasses grass (*Melinis minutiflora*) understory, several large indigenous ʻaʻaliʻi (*Dodonaea viscosa*) trees occur along the northern boundary of Area 4 (see Photo 1 in Appendix A). This native species is usually found as small to medium shrubs; however, the plants in the Study Area are up to 8 feet (2.4 m) tall. The endemic ʻakoko (*Euphorbia celastroides* var. *amplectens*) also occurs along the northern boundary of Area 4 (see Photo 2 in Appendix A). This variety of ʻakoko is a variable medium sized shrub that occurs from sea level to upland locales on all the main Hawaiian Islands. Of all eight recognized varieties of *E. celastroides*, variety *amplectens* is the only one with such a widespread geographical range. Other native species observed along the northern edge of Area 4 include huehue (*Cocculus orbiculatus*), pūkiawe (*Leptecophylla*

tameiameia), ʻākia (*Wikstroemia oahuensis var. oahuensis*), and palaʻā (*Sphenomeris chinensis*). One ʻiliahialoʻe plant (*Santalum ellipticum*) was recorded less than 10 feet (3 m) to the north of the Study Area boundary. One native naio (*Myoporum sandwicense*) plant was also seen approximately 65 feet (20 m) outside of the Study Area toward Kahana Stream.

Large portions of Area 4 are dominated by stands of guava (*Psidium guajava*) and formosan koa (*Acacia confusa*) with very little understory. A few small noni (*Morinda citrifolia*) were observed in the guava stands along with some scattered Guinea grass (*Urochloa maxima*), lantana (*Lantana camara*), and laua'e (*Phymatosorus grossus*). The more open areas of low growing vegetation include grasses such as molasses grass, natal redtop (*Melinis repens*), sourgrass (*Digitaria insularis*), and Guinea grass. The grassland along the southern side of Area 4 is covered with the invasive maunaloa vine (*Canavalia cathartica*) (see Photo 3 in Appendix A). Eucalyptus species (*Eucalyptus comaldulenis* and *Eucalyptus rudis*) are prevalent along the road near the northern boundary.

Area 3 between Pulepule Gulch and Kahanaiki Gulch is dominated in the upper elevations by monotypic stands of Guinea grass with few scattered trees such as silk oak (*Grevillea robusta*) and guava. The lower elevations are dominated by thick stands of Asian sword fern (*Nephrolepis brownii*) mixed with molasses grass and various vining species such as lilikoi (*Passiflora edulis*) and white thunbergia (*Thunbergia fragrans*) (see Photo 4 in Appendix A). Vestiges of the previous agricultural plantings remain in the lower elevation portion of this section including pineapple (*Anas cosmosus*) plants still growing and fruiting in some areas. A few koa (*Acacia koa*) trees were observed outside of the Study Area, approximately 0.1 miles (0.16 km) to the east.

In Area 2 and Area 1, the upper elevation boundaries are vegetated by larger non-native tree species such as *Cryptomeria japonica*, *Cupressus macrocarpa*, Eucalyptus species, silk oak, Formosan koa, and Christmas berry (*Schinus terebinthifolius*). A few natives are scattered in the understory, confined to this upper boundary area or along the upper slopes of gulches, including ʻūlei (*Osteomeles anthyllidifolia*), alaheʻe (*Psydrax odorata*), and ʻaʻaliʻi. The remaining portions of Area 2 and Area 1 are dominated by the fallow overgrown fields of pineapple similar to Area 4 and Area 3 (see Photo 5 in Appendix B). The upper elevations of Area 2 are dominated by thick head high Guinea grass (see Photo 6 in Appendix B) with large shrubs of butterfly bush (*Buddleja asiatica*) and African tulip (*Spathodea campanulata*) trees.

Gulch Vegetation

The edges of the fallow agricultural fields are mostly delineated by dirt access roads and/or the tops of gulches. Dense vegetation is present along most gulch edges. Koa haole (*Leucaena leucocephala*), Guinea grass, Christmas berry, guava, and java plum (*Syzigium cumini*) are the most common species noted in these areas. Much of the gulch bottoms have open or grassy understory, with overstory trees such as kukui (*Aleurites moluccana*), Christmas berry, Java plum, lychee (*Litchi chinensis*), and padang cassia (*Cinnamomum burmanii*) (see Photo 7 in Appendix B). The native ferns palapalai (*Microlepia strigosa var. strigosa*) and ʻēkaha (*Asplenium nidus*) were commonly observed in many of the gulches

surveyed. Other species in the gulch vegetation include ti (*Cordyline fruticosa*), lantana (*Lantana camara*), laua‘e (*Phymatosorus grossus*), and rough maidenhair fern (*Adiantum hispidulum*).

Along the northern edge of Area 1 along the unnamed gulch there is a pocket of native plants including ‘ōhi‘a lehua (*Metrosideros polymorpha* var. *glaberrima*), ‘a‘ali‘i, pūkiawe, ‘ākia, kā‘ape‘ape (*Cyrtomium caryotideum*), kīlau (*Pteridium aquilinum* sub. *decompositum*), moa (*Psilotum nudum*), and kolokoko (*Adenophorus tenellus*). None of these plants were abundant in the area, only a few individuals of each species were observed with the exception of the ‘ōhi‘a lehua in which at least six trees are present.

Other infrequently observed species in gulches or at road crossings include castor bean (*Ricinus communis*), golden crown-beard (*Verbesina encelioides*), spiny amaranth (*Amaranthus spinosus*), hairy abutilon (*Abutilon grandifolium*), and various grasses such Guinea grass, natal redtop (*Melinis repens*), sourgrass (*Digitaria insularis*), and swollen finger grass (*Chloris barbata*).

Old Farmhouse - Ornamental Plantings

At the junction of the Project’s main access roadway and Area 2 there is an existing farmhouse with many ornamental plantings surrounding the buildings. Typical ornamentals planted in the yard include plumeria (*Plumeria* sp.), norfolk pine (*Araucaria heterophylla*), panax (*Polyscias guilfoylei*), hibiscus (*Hibiscus* sp.), *Bougainvillea* sp., *Citrus* sp., and cape plumbago (*Plumbago auriculata*). Fruit trees such as papaya (*Carica papaya*), banana (*Musa* sp.), coconut (*Cocos nucifera*), and mango (*Mangifera indica*) are also growing in the area. One individual of the native vine koali ‘awa (*Ipomoea indica*) was observed along the roadway just to the south of the farmhouse.

Ruderal Vegetation

Ruderal vegetation occurs along the edges of the main access road. Besides the native ‘uhaloa, it is dominated by a mix of non-native plants including guinea grass, koa haole, *Crotalaria* spp., castor bean, sourbush (*Pluchea carolinensis*), Jamaican vervain (*Stachytarpheta jamaicensis*), lantana, root beer plant (*Polygala paniculata*) (see Photo 8 in Appendix B). A recent fire in the lower elevations of the access road showed rapid regrowth of non-native plants such as Guinea grass, spiny amaranth, and golden crown-beard.

4.1.1 Listed Species and Critical Habitat

As stated above, no plant species listed by USFWS and DOFAW were found in the Study Area. Rare native plants are known to occur within the Pu‘u Kukui Watershed Preserve which is located approximately 0.75 miles (1.2 km) east of the Study Area, and the Kapunakea Preserve located 0.83 miles (1.3 km) southeast of the Study Area (Figure 4). According to Hobdy (2012) two endangered plant species —māhoe (*Alectryon macrococcus*) and *Bonamia menziesii*—have been recorded south of the Study Area in Honokōwai Canyon. It is possible that rare plants also occur within the West Maui Forest Reserve located approximately 0.1-mile (0.16 km) southeast of the Study Area (Figure 4).

No federally designated critical habitat occurs in the Study Area or immediate vicinity. The closest plant critical habitat to the Study Area is Lowland Mesic—Unit 2, which is 0.75 miles (1.2 km) to southeast of the Study Area (Figure 4). Lowland Mesic—Unit 2 is currently occupied by four listed plant species—pauoa (*Ctenitis squamigera*), Maui remya (*Remya mauiensis*), ‘iliahi (*Santalum haleakalae var. lanaiense*), and a‘e (*Zanthoxylum hawaiiense*)—and is considered by USFWS to be unoccupied critical habitat for three additional listed plant species (USFWS 2016). Lowland Wet Unit 2 and Wet Cliff—Unit 7 are also southeast of the Study Area (Figure 4).

4.2 Wildlife

4.2.1 Birds

Nineteen bird species were recorded within the Study Area (Table 3). Most of these bird species are non-native to the Hawaiian Islands, and are species commonly found in rural or agricultural areas. Warbling white-eye (*Zosterops japonicus*), red-billed leiothrix (*Leiothrix lutea*), and common myna (*Acridotheres tristis*) were the most common bird species recorded during the surveys. Three native (endemic) birds were detected in the Study Area: the ‘apapane (*Himatione sanguinea*), Hawai‘i ‘amakihi (*Chlorodrepanis virens*), and ae‘o or Hawaiian stilt (*Himantopus mexicanus knudseni*). Hawai‘i ‘amakihi and ‘apapane were heard along the forested edges of Kahanaiki Gulch and Māhinahina Stream on the eastern edge of the Study Area. Additionally, the threatened Hawaiian goose or nēnē (*Branta sandwichensis*) was recorded in the immediate vicinity of the Study Area. Federally and state listed species are described in more detail below.

Kahana Solar Project

Figure 4
Closest Designated Critical Habitat and Reserves

MAUI COUNTY, HI

AKAHELE STREET
KAPALUA AIRPORT
HONOAPIILANI HIGHWAY
4-3-001:068
4-3-001:084
4-3-001:082
4-3-001:079
AREA 4
AREA 3
AREA 2
AREA 1
4-3-001:017
4-3-001:071
PUU KUKUI WATERSHED PRESERVE (ML&P)
WEST MAUI FOREST RESERVE
KAPUNAKEA PRESERVE (NATURE CONSERVANCY)

- Study Area
- Highway
- Existing County Road
- Existing Agricultural Access Road
- Kapunakea Preserve
- Puu Kukui Watershed Preserve
- West Maui Forest Reserve
- TMK Boundary

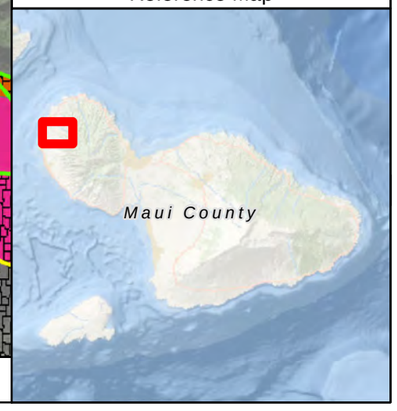
Critical Habitat

- Lowland Mesic 02
- Lowland Wet 02
- Lowland Wet 06
- Wet Cliff 07

TETRA TECH

Kahana Solar LLC

Reference Map



1:20,000 WGS 1984 UTM Zone 4N

0 0.25 0.5 1 Miles

NOT FOR CONSTRUCTION

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Table 3. Birds Recorded in the Study Area and Nearby Vicinity During the Survey

Common Name	Scientific Name	Status	MBTA	ESA
ʻApapane[1]	*Himatione sanguinea*	E	X	
Barn owl	*Tyto alba*	NN	X	
Black francolin	*Francolinus francolinus*	NN		
Cattle egret	*Bubulcus ibis*	NN	X	
Chinese hwamei	*Garrulax canorus*	NN		
Common myna	*Acridotheres tristis*	NN		
Gray francolin	*Francolinus pondicerianus*	NN		
Hawaiʻi ʻamakihi[1]	*Chlorodrepanis virens*	E	X	
Hawaiian goose, nēnē[2]	*Branta sandwichensis*	E	X	Thr
Aeʻo, Hawaiian stilt	*Himantopus mexicanus knudseni*	E	X	End
House finch	*Haemorhous mexicanus*	NN	X	
Japanese Bush Warbler	*Horornis diphone*	NN		
Northern cardinal	*Cardinalis cardinalis*	NN	X	
Red-billed leiothrix	*Leiothrix lutea*	NN		
Red-crested cardinal	*Paroaria coronata*	NN		
Scaly-breasted munia	*Lonchura punctulata*	NN		
Spotted dove	*Streptopelia chinensis*	NN		
Warbling white-eye	*Zosterops japonicus*	NN		
White-rumped shama	*Copsychus malabaricus*	NN		
Zebra dove	*Geopelia striata*	NN		

Status: E = Endemic, M = Migrant, NN = non-native established species, MBTA = Migratory Bird Treaty Act.

ESA: Thr = Threatened, End= Endangered

[1] Indicates the bird was identified by call not by sight.

[2] Indicates the species was recorded outside the Study Area but in the nearby vicinity.

4.2.1.1 Listed Species and Critical Habitat

Hawaiian waterbirds: The state and federally endangered Hawaiian stilt was observed at the reservoir within the Study Area in Area 2, as well as at the four water reservoirs within 0.25 miles (0.4 km) of the Study Area boundaries and the reservoir located further south of the Study Area (see Figure 5). It is likely that Hawaiian stilt will fly through and occur within other portions of the Study Area outside the reservoir area. Hawaiian stilts can be found in variety of fresh to saline wetlands and forage along shallow ponds, mud flats, salt ponds, rice and taro fields, and impoundments (Robinson et al. 2020). Hawaiian stilts tend to nest in shallow freshwater wetlands on dikes, islands, or other high spots with sparse emergent vegetation cover and have a strong tendency to nest in human made impoundments (Robinson et. al 2020). In addition to the Hawaiian stilt, one other listed waterbird species—Hawaiian

coot (*Fulica alai*)—could also occur in the Study Area. Suitable habitat for these species (water reservoirs) occurs within the Study Area and in close proximity to the Study Area boundaries.

At some solar facilities in the continental U.S., water-dependent birds (such as grebes, loons, rails, coots, shorebirds, and waterfowl) have been documented to collide with photovoltaic arrays (Kosciuch et al. 2020). It has been hypothesized that some waterbirds may perceive the panel arrays to be bodies of water and collide with the panels while attempting a water landing (Kagan et al. 2014, WEST 2014, Walston et al. 2016); this hypothesis has been termed the "lake effect". However, no studies have found a causal link for the source of waterbird mortalities observed in the continental U.S. More research is needed to investigate whether water-dependent birds are attracted to solar panel arrays, and if proximity to water sources or other factors relate to avian mortality at the facilities (Walston et al. 2016, Kosciuch et al. 2020).

Listed waterbird species that occur in Hawai'i have not been documented to collide with photovoltaic arrays. Hawai'i currently has over 1000 MW of installed solar (HECO 2020, KIUC 2021) and utility scale solar has existed in Hawai'i since 2008, yet there are no public records indicating endangered birds are colliding with solar panel arrays in Hawai'i. Waterbird activity and abundance varies regionally and may result in variation in avian mortality risk across different landscapes. There have been no reports to date of the "lake effect" from operating solar facilities in Hawai'i or information to indicate listed birds are colliding with solar panel arrays in Hawai'i.

Hawaiian goose: Although not observed within the Study Area boundaries, eight Hawaiian geese were observed on the manicured lawn area of the Māhinahina Water Treatment Facility approximately 0.16 miles (0.26 km) from the southwest boundary of the Study Area and two Hawaiian geese were observed in the water reservoir located approximately 0.32 miles (0.52 km) south from the southwest boundary of the Study Area (Figure 5). According to Maui DOFAW, Hawaiian geese have also been documented nesting in the vicinity of the treatment facility (Stephanie Franklin/DOFAW, pers. comm., January 2021). The threatened Hawaiian goose uses various habitat types, including beach strand, shrubland, grasslands, and lava rock (Banko et al. 2020). Hawaiian geese are also known to use landscaped/maintained areas, such as golf courses, grazed pastures, playing fields, and lawns. Although no Hawaiian geese were observed in the Study Area during the biological survey, several were recorded using water reservoirs and maintained lawn areas in the immediate vicinity of the Study Area. It is likely that Hawaiian geese will fly through and occur within the Study Area (e.g. water reservoirs). Hawaiian geese also have the potential to be attracted to the Study Area during or after construction if foraging habitat is created (i.e., mowed lawns).

Seabirds: The endangered Hawaiian petrel (*Pterodroma sandwichensis*), threatened Newell's shearwater (*Puffinus newelli*), and endangered band-rumped storm-petrel (*Oceanodroma castro*) (collectively referred to as seabirds) have not been documented in the Study Area, and suitable nesting habitat does not occur in the Study Area. However, suitable nesting habitat for listed seabirds exists at upper elevations of the West Maui Mountains (Hobdy 2012), therefore it is possible for these birds to fly over the Study Area at night from May through October while transiting between nest sites and the ocean.

These listed seabirds may be attracted to construction lights at night. Disorientation and fallout as a result of light attraction could occur for individuals attracted to nighttime construction lighting and unshielded nighttime facility lighting. Juvenile birds are particularly vulnerable to light attraction, and grounded birds are vulnerable to mammalian predators or vehicle strikes.

4.2.2 Mammals

Several non-native terrestrial mammalian species were detected during the survey. Feral pigs (*Sus scrofa*) and small Indian mongoose (*Herpestes javanicus*) were seen throughout the Study Area, and tracks from dogs (*Canis familiaris*) were observed around some of the water reservoirs. Although not observed, other introduced mammals, such as cats (*Felis catus*), house mice (*Mus musculus*), and rats (*Rattus* spp.), are likely to occur within the Study Area.

The state and federally-endangered Hawaiian hoary bat is likely to transit, forage, or roost in the Study Area. This species will forage in open and semi-cluttered landscapes in a wide range of habitats and vegetation types (Bonaccorso et al. 2015). Bat activity has been shown to increase in forested edges and gulches (Grindal et al. 1999, Law and Chidel 2002, Jantzen 2012), which are present in the Study Area (see Photos 9 and 10 in Appendix B). Several of the trees within the Study Area (eucalyptus, Norfolk pine (*Araucaria heterophylla*), lychee) are over 15 feet (4.6 m) tall and have the potential to function as bat roost trees, per USFWS and DOFAW.

Hobdy conducted nighttime surveys for Hawaiian hoary at several locations within the Study Area in October 2012 (Hobdy 2013), September 2013 (Hobdy 2013), and May 2018 (Hobdy 2018) using an auditory bat detection device (Batbox IIID). Bats were not detected during the 2012 and 2013 survey (Hobdy 2012, 2013); however, activity was recorded during the 2018 surveys.

Kahana Solar Project

Figure 5
Listed Bird Species Recorded in the Study Area and Vicinity

MAUI COUNTY, HI

- Study Area
- Highway
- Existing County Road
- Existing Agricultural Access Road
- TMK Boundary
- Point Count Locations

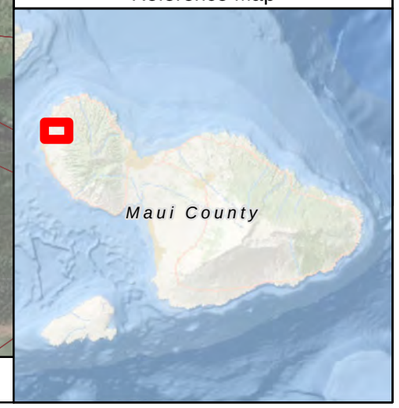
Waterbird Observations (Tetra Tech)

- Hawaiian goose
- Hawaiian stilt

TETRA TECH

Kahana Solar LLC

Reference Map



AKAHELE STREET
HONOAPIILANI HIGHWAY
KAPALUA AIRPORT
4-3-001:068
4-3-001:084
4-3-001:079
4-3-001:082
AREA 4
AREA 3
AREA 2
AREA 1
4-3-001:017
4-3-001:071

1:16,000 WGS 1984 UTM Zone 4N

0 0.25 0.5 1 Miles

NOT FOR CONSTRUCTION

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4.2.3 Insects and Spiders

Insects and spiders observed incidentally during the surveys are listed in Table 4.[5] Of these, only the globe skimmer (*Pantala flavescens*) and green darner (*Anax junius*) are native to the Hawaiian Islands. These two dragonflies are common in Hawai'i.

Table 4. Insects and Spiders Recorded in the Study Area During the Survey

Common Name	Scientific Name	Status
Big-headed ant	*Pheidole megacephala*	NN
Black witch moth	*Ascalapha odorata*	NN
Black saddlebags	*Tramea lacerata*	NN
Cabbage white butterfly	*Pieris rapae*	NN
Clouded sulphur	*Colias philodice*	NN
Dog dung fly	*Musca sorbens*	NN
Familiar bluet	*Enallagma civile*	NN
Globe skimmer	*Pantala flavescens*	I
Gray bird grasshopper	*Schistocerca nitens*	NN
Green darner	*Anax junius*	I
Gulf fritillary	*Agraulis vanillae*	NN
Ladybird beetle	*Coccinellidae* sp.	NN
Lantana scrub-hairstreak	*Strymon bazochii*	NN
Large orange sulphur	*Phoebis agarithe*	NN
Long-tailed blue	*Lampides boeticus*	NN
Monarch	*Danaus plexippus*	NN
Katydid	*Elimaea sp.*	NN
Praying mantis	*Mantis religiosa*	NN
Scarlet skimmer	*Crocothemis servilia*	NN
Spiny orb-weaver	*Gasteracantha cancriformis*	NN
Hawaiian garden spider	*Argiope appensa*	NN
Tiger mosquito	*Aedes albopictus*	NN
Valley carpenter bee	*Xylocopa sonorina*	NN
Western honeybee	*Apis mellifera*	NN
Yellow garden spider	*Argiope aurantia*	NN

Status: I = Indigenous, NN = non-native species.

[5] Scientific nomenclature follows Nishida (2002).

4.2.3.1 Blackburn's Sphinx Moth

No Blackburn's sphinx moth caterpillars or host plants for Blackburn's sphinx moth caterpillars were observed in the Study Area. The two native, larval host plants for Blackburn's sphinx moth (*Nothocestrum latifolium* and *N. breviflorum*) were also not found and are not likely to occur in the Study Area. Furthermore, no tree tobacco (*Nicotiana glauca*) plants, the common non-native host plant for the species, were observed in the Study Area. Several tree tobacco plants were observed approximately 0.3 miles (0.5 km) south of the main access road. No Blackburn's sphinx moth caterpillars or signs of caterpillars were observed on the tree tobacco plants recorded outside the Study Area.

USFWS has not designated critical habitat for the Blackburn's sphinx moth within the Study Area. The closest Blackburn's sphinx moth critical habitat unit (Kahana Pond) is located roughly 12 miles (19.3 km) southeast of the Study Area boundary.

4.2.3.2 Yellow-Faced Bees

No native yellow-faced bees were observed during the surveys. 'Ilima, which is considered the primary host plant for the endangered assimulans yellow-faced bee, was not found in the Study Area. Of the other potential yellow-faced bee host plants, 'akoko and 'a'ali'i were the only other species observed in the Study Area. These species occur as scattered individuals or small patches. Big-headed ants, an aggressive invasive species recognized as a serious threat to Hawaii's native invertebrates, were present in moderate numbers within the Study Area. Thus, Dr. Karl Magnacca concluded the Study Area is poor quality habitat for native yellow-faced bees. USFWS has not designated critical habitat for the endangered assimulans yellow-faced bee.

Hylaeus assimulans was found at Lāhainaluna, approximately 5 miles (8 km) south-southeast of the Study Area, in 1999 (Daly and Magnacca, 2003), *H. anthracinus* and *H. longiceps* have been found approximately 6 miles (9.6 km) north along the coast, and *H. facilis* was last seen on Maui in 1993 on the northwest slope of Haleakalā.

5.0 Conclusions and Recommendations

As described in Section 4, the majority of the plants and animals observed in the Study Area are introduced, non-native species. One state and federally-listed species (Hawaiian stilt) occurs in the Study Area. Several other listed wildlife species have the potential to occur in or transit through the Study Area, particularly the Hawaiian goose and Hawaiian hoary bat. Recommended measures to avoid and minimize impacts to state and federally-listed species that could occur in the Study Area are outlined below.

5.1 Plants

The majority of the plant species recorded in the Study Area (nearly 88 percent) are not native to the Hawaiian Islands; however, eighteen native plant species were recorded. Tetra Tech recommends the following measures to avoid and minimize potential impacts to native plants:

- To the maximum extent practicable, design the Project to avoid the ‘akoko individuals along the northern boundary of the Study Area.
- Although non-native weedy species are common in the Study Area, implement invasive species minimization measures to avoid the unintentional introduction or transport of new invasive species to the area. This includes utilizing on-site gravel, rock, soil when practicable, purchasing raw materials (e.g., gravel, rock, soil) from a local supplier when practicable; utilizing certified, weed-free seed mixes; and washing and/or visually inspecting (as appropriate) construction materials or equipment arriving from outside Maui for excessive debris, plant materials, and invasive or harmful non-native species. Consult with Maui Invasive Species Committee if needed.
- Follow the most recent Rapid ‘Ōhi‘a Death decontamination protocols from USFWS and DOFAW.
- Develop a vegetation management plan and emergency response plan (including fire) along with the Maui County permitting process which may reduce potential impacts to native plants.

5.2 Wildlife

Nearly all the animal species recorded in the Study Area are not native to the Hawaiian Islands. However, the ‘apapane, Hawai’i amakihi, and endangered Hawaiian stilt occur in the area and other listed wildlife have the potential to occasionally pass through the Study Area. In addition to the species-specific measures detailed in subsections 5.2.1 through 5.2.5, Tetra Tech recommends the following general measures to avoid and minimize potential impacts to native wildlife:

- Establish a wildlife education and observation program for all construction and operational personnel. Staff would be trained to identify listed wildlife that may be found on-site (including Hawaiian goose, Hawaiian hoary bat, seabirds, waterbirds) and to take appropriate steps if listed wildlife species (including downed listed wildlife) are found.

5.2.1 Hawaiian Waterbirds

Although their preferred habitat is not present within the majority of the Study Area, listed Hawaiian waterbirds are likely to fly through and occasionally occur within the Study Area given the water resources (i.e. water reservoir) located within and immediately adjacent to the Study Area. To avoid direct take of these endangered species during Project construction and operation, Tetra Tech recommends the following based on avoidance and minimization measures provided by USFWS (2019a):

- In areas where Hawaiian waterbirds are known to be present, post and implement speed limits and inform onsite personnel and contractors of their presence.
- Avoid creating areas with standing water. Design stormwater retention areas to drain within 48 hours of end of a storm event and keep retention areas free of emergent vegetation, to avoid attracting listed waterbirds.
- If listed waterbirds are found in the Study Area during active construction, cease all activities within 100 feet (30 m) of the bird, and do not approach the bird(s). If a nest is discovered, contact USFWS and DOFAW. If a nest is not discovered, work may continue after the bird leaves the area of its own accord.
- Avoid conducting ground disturbing activities within 100-feet (30 m) of the top of bank of the existing reservoirs. If ground disturbing activities are required within 100-feet (30 m) of the top of bank of the existing reservoirs, have a biologist that is familiar with Hawaiian waterbirds conduct nest surveys within the 100-foot buffer before any work is conducted and after any subsequent delay in work of 3 or more days (during which birds may attempt nesting).

If a nest of active brood is found:

- Contact the USFWS within 24 hours for guidance.
- Establish and maintain a 100 foot (30.5 m) buffer around all active nests and/or broods until the chicks/ducklings have fledged. Do not conduct potentially disruptive activities or habitat alteration within this buffer.

5.2.2 Hawaiian Goose

Although their preferred habitat is not present within the majority of the Study Area, suitable foraging and nesting habitat for the Hawaiian goose exists at the water reservoir located within the Study Area. The Hawaiian goose may also fly through the Study Area. If this species lands within the Study Area, construction and operation activities could potentially impact them. Tetra Tech recommends the following avoidance measures (USFWS 2019a):

- If Hawaiian geese are found in the Project Study Area during active construction, cease all activities within 100 feet (30 m) of the bird, and do not feed, approach, or disturb the birds. Work may continue after the bird leaves the area of its own accord.

- In areas where Hawaiian geese are known to be present, post and implement speed limits and inform onsite personnel and contractors of their presence.

- If Hawaiian geese are observed within the construction work area during the breeding season (August through April), halt work and have a biologist familiar with the nesting behavior of Hawaiian geese survey for nests in and around the work area prior to the resumption of any work. Repeat surveys after any delay of work of 3 or more days (when birds may attempt to nest).

- If a nest is discovered within a 150 foot (45.7 m) radius of proposed work, cease all work and contact USFWS and DOFAW immediately. If a nest is not discovered, work may continue after the bird leaves the area of its own accord.

- Avoid creating areas with standing water. Design stormwater retention areas to drain within 48 hours of end of a storm event.

- After construction, Hawaiian geese may be attracted to freshly mowed grass as the Project will require vegetation control during operations. Tetra Tech recommends continued implementation of wildlife education and observation program and enforcement of speed limits during operation. Contact DOFAW if Hawaiian geese are observed in the Project Area during operations.

5.2.3 Seabirds

The Study Area does not provide suitable nesting or foraging habitat for the three listed Hawaiian seabirds. However, individuals may fly over the Study Area at night and may be attracted to construction lights at night. Tetra Tech recommends the following measures to avoid and minimize potential impacts to listed seabirds:

- Restrict construction activity to daylight hours during the seabird peak fallout period (September 15–December 15) and avoid the use of nighttime lighting that could attract seabirds.
- If project construction requires any nighttime construction with lighting, shield construction lighting, direct lighting downward, and fit lighting with non-white lights if construction safety is not compromised, to minimize the attractiveness of construction lights to seabirds.
- If nighttime construction occurs during the seabird peak fallout period, have a biological monitor present in the construction area between approximately 0.5 hour before sunset to 0.5 hour after sunrise to watch for the presence of seabirds. If the biological monitor observes a seabird,

and the seabird appears affected by the lighting, the monitor should notify the construction manager to reduce or turn off construction lighting until the individual(s) move out of the area.

- If a grounded seabird is found, contact the Maui Nui Seabird Recovery Project at (808) 573-2473.
- For operational on-site lighting, use fixtures that will be shielded and directed downward to prevent upward radiation, and fitted with non-white light bulbs to the extent possible. The lighting should also be triggered by a motion detector, unless otherwise directed by Maui Electric Company or code compliance. Lighting should be situated so that light does not shine on and reflect off the solar panels.

5.2.4 Hawaiian Hoary Bat

Given the forested habitat within and immediately adjacent to the Study Area the Hawaiian hoary bat is likely to occur within the Study Area. To avoid direct take of this endangered species during Project construction and operation, Tetra Tech recommends the following based on avoidance and minimization measures provided by USFWS (2019a):

- Avoid trimming or removing woody vegetation (trees or shrubs) taller than 15 feet (4.5 m) between June 1 and September 15, when juvenile bats are not yet capable of flying and may be roosting in the trees, resulting in the potential to be impacted.
- To prevent entanglement, do not use barbed wire for fencing.

Tetra Tech recommends that if some trimming or removing woody vegetation taller than 15 feet is necessary between June 1 and September 15, consult with USFWS and DOFAW to ensure impacts to the Hawaiian hoary bat are avoided.

5.2.5 Yellow-Faced Bees

No native yellow-faced bees were observed during the surveys. Because the Study Area is poor-quality habitat for native yellow-faced bees, it is extremely unlikely that any native yellow-faced bees would be present. No avoidance or minimization measures are recommended for yellow-faced bees.

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APPENDIX A

REPRESENTATIVE PHOTOGRAPHS OF THE KAHANA SOLAR STUDY AREA

Kahana Solar Project

Figure A-1
Photo Location Map

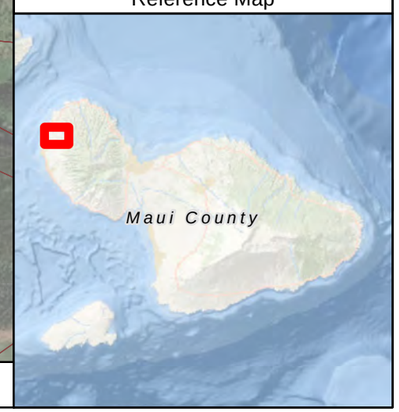
MAUI COUNTY, HI

- Study Area
- Photo Points
- Highway
- Existing County Road
- Existing Agricultural Access Road
- TMK Boundary

TETRA TECH

Kahana Solar LLC

Reference Map



AKAHELE STREET
HONOAPIILANI HIGHWAY
KAPALUA AIRPORT
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4-3-001:084
4-3-001:079
4-3-001:082
AREA 4
AREA 3
AREA 2
AREA 1
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NOT FOR CONSTRUCTION

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Photo 1. Small grove of large ʻaʻaliʻi (*Dodonaea viscosa*) within the Study Area. Several large ʻaʻaliʻi were documented in this area along the northern edge of the Study Area. Location: 20.958789, -156.647727. June 17 2020. Tt PP 5

Photo 2. ʻAkoko (*Euphorbia celastroides* var. *amplectens*) documented along the northern edge of the Study Area. Several plants had damage from unknown insect galls. Location: 20.960173, -156.648802. June 17 2020. Tt PP 4

Photo 3. Representative habitat in Study Area showing dominant molasses grass (*Melinis minutiflora*) and maunaloa vine (*Canavalia cathartica*) understory with mixed non-native trees. Location: 20.957353, -156.648706. June 19, 2020. Tt PP 48

Photo 4. Representative habitat within the Study Area looking south with molasses grass and Asian sword fern (*Nephrolepis brownii*) in the foreground and mixed non-native trees in the background. Location: 20.958113, -156.650794. June 17 2020. Tt PP 22

Photo 5. Overview of the Study Area looking west-northwest, showing dominant molasses grass grassland with mixed non-native trees. Location: 20.948968, -156.639007. June 17, 2020. Tt PP 17

Photo 6. Representative habitat within the Study Area looking west showing head high Guinea grass (*Urochloa maxima*) and mixed non-native trees. Location: 20.948686, -156.640053 . June 19 2020. Tt PP 41

Photo 7. Representative Gulch and gulch edge vegetation with Guinea grass and koa haole in the foreground and lychee (*Litchi chinensis*) and kukui (*Aleurites moluccana*) in the background. Location: 20.951688 , -156.648773. June 19 2020. Tt PP 47

Photo 8. Ruderal vegetation along the edges of the main access road. Vegetation includes a mixture of non-native weedy species. Location: 20.955355, -156.656447. June 20, 2020. Tt PP 50

Photo 9. Eucalyptus forested edge along southern boundary of the Study Area that has the potential be used for foraging and roosting by Hawaiian hoary bats. Location: 20.947128, -156.646416. June 19, 2020. Tt PP 33

Photo 10. Potential Hawaiian hoary bat foraging and roosting habitat found just to the east of the Study Area showing open grassland habitat with tall forested edges. Location: 20.954328, -156.644005. June 17, 2020. Tt PP 6

APPENDIX B

LIST OF PLANT SPECIES OBSERVED DURING SURVEYS OF THE KAHANA SOLAR STUDY AREA

Table B-1 provides a list of plant species observed in the Project Area by LeGrande Biological Surveys and Tetra Tech on June 16 - 22, 2020, and July 2 - 3, 2020. The plant names are arranged alphabetically by family and then by species into four groups: Ferns/Lycophytes, Gymnosperms, Monocots, and Dicots. The taxonomy and nomenclature of the ferns and lycophytes follow Palmer (2003), with recent name changes in accordance with Smith et al (2011). Flowering plants are in accordance with Wagner et al (1999, 2012), Wagner and Herbst (2003), Imada (2012), and Staples and Herbst (2005). If no common or Hawaiian name is known, only the scientific name is provided.

Status:

- E = endemic = native only to the Hawaiian Islands
- I = indigenous = native to the Hawaiian Islands and elsewhere
- P = Polynesian = introduced by Polynesians
- X = introduced/ non-native = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact (Cook's arrival in the islands in 1778)
- C = cultivated = cultivated or ornamental species not yet known to be reproducing and spreading by natural means

Table B-1. List of Plant Species Observed During Surveys for the Kahana Solar Project

Scientific Name and Authorship	Hawaiian/Common Name	Status
FERNS & LYCOPHYTES		
Aspleniaceae		
Asplenium nidus L.	ʻēkaha	I
Blechnaceae		
Blechnum appendiculatum Willd.		X
Dennstaedtiaceae		
Microlepia strigosa (Thunb.) C.Presl var. *strigosa*	palapalai, palai	I
Pteridium aquilinum (L.) Kuhn ssp. *Decompositum* (Gaudich.) Lamoureux ex J.A.Thomson	kīlau, kīlau pueo, paiʻā, bracken fern	E
Dryopteridaceae		
Cyrtomium caryotideum (Wall.) C.Presl	kāʻapeʻape	I
Lindsaeaceae		
Sphenomeris chinensis (L.) Maxon	palaʻa	I
Lomariopsidaceae		
Nephrolepis brownii (Desv.) Hovenkamp & Miyam.	sword fern	X

Scientific Name and Authorship	Hawaiian/Common Name	Status
Polypodiaceae		
Phlebodium aureum (L.) J.Sm.	laua'e haole, rabbit's-foot fern	X
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	laua'e, maile-scented fern	X
Psilotaceae		
Psilotum nudum (L.) P.Beauv.	moa	I
Pteridaceae		
Adenophorus tenellus (Kaulf.) Ranker	kolokolo, mahinalua	E
Adiantum hispidulum Sw.	rough maidenhair fern	X
Cheilanthes viridis (Forssk.) Sw.	green cliff brake	X
Pityrogramma austroamericana Domin	goldfern, goldback fern	X
Thelypteridaceae		
Cyclosorus parasiticus (L.) Farw.		X
GYMNOSPERMS		
Auracariaceae		
Araucaria heterophylla (Salisb.) Franco	Norfolk pine	C
Cupressaceae		
Cryptomeria japonica (L.f.) D.Don		X
Cupressus macrocarpa Hartw. Ex Gordon		X
MONOCOTS		X
Agavaceae		
Cordyline fruticosa (L.) A.Chev.	ki, ti	P
Araceae		
Epipremnum pinnatum (L.) Engl.	taro vine, pothos	X
Arecaceae		
Cocos nucifera L.	niu, coconut	P
Livistona chinensis (Jacq.) R.Br. ex Mart.	Chinese fan palm	X
Bromeliaceae		
Anas comosus (L.) Merr.	pineapple	X
Commelinaceae		

Scientific Name and Authorship	Hawaiian/Common Name	Status
Commelina diffusa Burm.f.	honohono, honohono wai	X
Heliconiaceae		
Heliconia latispatha Benth.	heliconia	X
Musaceae		
Musa sp. L.	banana	X
Orchidaceae		
Spathoglottis plicata Blume	Malayan ground orchid, Philippine ground orchid	X
Poaceae		
Andropogon virginicus L.	broomsedge	X
Bothriochloa pertusa (L.) A.Camus	pitted beardgrass	X
Cenchrus ciliaris L.	buffelgrass	X
Chloris barbata Sw.	swollen finger	X
Cynodon dactylon (L.) Pers	Bermuda grass, mānienie	X
Digitaria insularis (L.) Mez ex Ekman	sour grass	X
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	X
Melinis minutiflora P.Beauv.	molasses grass	X
Melinis repens (Willd.) Zizka	Natal redtop, Natal grass	X
Oplismenus hirtellus (L.) P.Beauv.	basketgrass	X
Paspalum conjugatum P.J.Bergius	Hilo grass, mau‘u Hilo	X
Paspalum urvillei Steud.	vasey grass	X
Sacciolepis indica (L.) Chase	Glenwood grass	X
Urochloa maxima (Jacq.) R.D.Webster	Guinea grass	X
Urochloa mutica (Forssk.) T.Q.Nguyen	California grass	X
DICOTS		
Acanthaceae		
Barleria cristata L.	Philippine violet	X
Thunbergia fragrans Roxb.	white thunbergia	X
Amaranthaceae		
Amaranthus spinosus L.	spiny amaranth	X
Anacardiaceae		
Mangifera indica L.	mango	X
Schinus terebinthifolius Raddi	Christmas berry	X

Scientific Name and Authorship	Hawaiian/Common Name	Status
Apiaceae		
Centella asiatica (L.) Urb.	Asiatic pennywort	X
Apocynaceae		
Plumeria sp.	plumeria	C
Araliaceae		
Polyscias guilfoylei L.	panax hedge	C
Schefflera actinophylla (Endl.) Harms	octopus tree, umbrella tree	X
Asclepiadaceae		
Asclepias physocarpa (E.Mey.) Schltr.	balloon plant	X
Calotropis gigantea (L.) W.T.Aiton	crown flower	X
Asteraceae		
Acanthospermum australe (Loefl.) Kuntze	spiny bur	X
Ageratina adenophora (Spreng.) R.M.King & H.Rob.	Maui pāmakani	X
Bidens pilosa L.	Spanish needle	X
Conyza bonariensis (L.) Cronq.	hairy horseweed	X
Crassocephalum crepidioides (Benth.) S.Moore		X
Emilia sonchifolia (L.) DC.	Flora's paintbrush	X
Pluchea carolinensis (Jacq.) G.Don	sourbush	X
Senecio madagascariensis Poir.	fireweed	X
Tridax procumbens L.	coat buttons	X
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	X
Youngia japonica (L.) DC.	Virginia pepperwort	X
Bignoniaceae		
Spathodea campanulata P.Beauv.	African tulip tree	X
Brassicaceae		
Lepidium virginicum L.	Virginia pepperwort	X
Buddlejaceae		
Buddleja asiatica Lour.	butterfly bush	X
Caricaceae		
Carica papaya L.	papaya	X
Chenopodiaceae		

Scientific Name and Authorship	Hawaiian/Common Name	Status
Atriplex suberecta I.Verd.	saltbush	X
Clusiaceae		
Clusia rosea Jacq.	autograph tree	X
Convolvulaceae		
Ipomoea indica (J. Burm.) Merr.	koali awahia	I
Ipomoea obscura (L.) Ker-Gawl.	obscure morning glory	X
Ipomoea ochracea (Lindl.) G.Don.	yellow morning glory	X
Cucurbitaceae		
Momordica charantia L.	bitter melon	X
Epacridaceae		
Leptecophylla tameiameiae (Cham. & Schltdl.) C.M.Weiller	pūkiawe	I
Euphorbiaceae		
Aleurites moluccana (L.) Willd.	kukui	P
Euphorbia celastroides Boiss. var. *amplectens* Sherff	‘akoko	E
Euphorbia hirta L.	hairy spurge	X
Ricinus communis L.	castor bean	X
Fabaceae		
Acacia confusa Merr.	Formosan koa	X
Canavalia cathartica Thouars	maunaloa	X
Chamaecrista nictitans (L.) Moench	partridge pea	X
Crotalaria micans Link	rattlepod	X
Crotalaria pallida Aiton	smooth rattlepod, pikakani	X
Crotalaria retusa L.	rattlepod	X
Desmanthus pernambucanus (L.) Thell.	slender mimosa	X
Desmodium incanum DC.	Spanish clover	X
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X
Desmodium triflorum (L.) DC.	three-flowered beggarweed	X
Indigofera suffruticosa Mill.	indigo	X
Leucaena leucocephala (Lam.) de Wit	koa haole	X
Macroptilium atropurpureum (DC.) Urb.	–	X
Pithecellobium dulce (Roxb.) Benth.	Manila tamarind, ‘opiuma	X

Scientific Name and Authorship	Hawaiian/Common Name	Status
Prosopis pallida Kunth	kiawe	X
Samanea saman (Jacq.) Merr.	monkeypod	X
Tephrosia candida Roxb. ex DC.		X
Lamiaceae		
Leonotis nepetifolia (L.) R.Br.	lion's ear	X
Lauraceae		
Cinnamomum burmanii (Nees) Blume	padang cassia	X
Lythraceae		
Cuphea carthagenensis (Jacq.) MacBr.	tarweed, Colombian cuphea	X
Malvaceae		
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X
Hibiscus sp.	hibiscus	C
Malva parviflora L.	cheese weed	X
Malvastrum coromandelianum (L.) Garcke ssp. *coromandelianum*	false mallow	X
Sida ciliaris L.	–	X
Sida spinosa L.	prickly sida	X
Melastomataceae		
Clidemia hirta (L.) D.Don var. *hirta*	Koster's curse	X
Tibouchina herbacea (DC.) Cogn.	cane tibouchina	X
Meliaceae		
Melia azedarach L.	Chinaberry	X
Menispermaceae		
Cocculus orbiculatus (L.) DC.	huehue	I
Myrtaceae		
Eucalyptus comaldulensis Dehnh.		X
Eucalyptus rudis Endl.		X
Metrosideros polymorpha Gaudich. var. glaberrima (H.Lév.) H.St.John	ʻōhiʻa lehua	E
Psidium guajava L.	guava	X
Syzygium cumini (L.) Skeels	Java plum	X
Nyctaginaceae		

Scientific Name and Authorship	Hawaiian/Common Name	Status
Boerhavia coccinea Mill.	–	X
Bougainvillea sp.	bougainvillea	C
Onagraceae		
Ludwigia octovalvis (Jacq.) P.H.Raven	primrose willow	P?
Oxalidaceae		
Oxalis corniculata L.	wood sorrel	X
Passifloraceae		
Passiflora edulis Sims	passion fruit, lilikoi	X
Passiflora suberosa L.	cork bark passion fruit	X
Passiflora subpeltata Ortega	white passion flower	X
Plantaginaceae		
Plantago lanceolata L	narrow-leaved plantain	X
Plumbaginaceae		
Plumbago auriculata Lam.	cape plumbago	C
Polygalaceae		
Polygala paniculata L.	root beer plant	X
Primulaceae		
Anagallis arvensis L.	scarlet pimpernel	X
Proteaceae		
Grevillea robusta A.Cunn. ex R.Br.	silk oak	X
Rosaceae		
Osteomeles anthyllidifolia (Sm.) Lindl.	ʻūlei	I
Rubus rosifolius Sm.	thimbleberry	X
Rubiaceae		
Morinda citrifolia L.	noni	P
Psydrax odorata (G.Forst.) A.C.Sm. & S.P.Darwin	alaheʻe	I
Rutaceae		
Citrus sp. L.	citrus	C
Santalaceae		
Santalum ellipticum Gaudich.	ʻiliahialoʻe, coast sandalwood	E
Sapindaceae		
Dodonaea viscosa Jacq.	ʻaʻaliʻi	I

Scientific Name and Authorship	Hawaiian/Common Name	Status
Litchi chinensis L.	lychee	C
Solanaceae		
Physalis peruviana L.	Cape gooseberry, pohā	X
Sterculiaceae		
Waltheria indica L.	ʻuhaloa	I
Thymelaeaceae		
Wikstroemia oahuensis (A.Gray) Rock var. oahuensis	ʻākia	E
Tiliaceae		
Triumfetta semitriloba Jacq.	Sacramento bur	X
Verbenaceae		
Lantana camara L.	lantana	X
Stachytarpheta jamaicensis (L.) Vahl	Jamaican vervain	X