

EXHIBIT "E-5"

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Biological Resources Survey Report for AES Lāwaʻi Solar and Storage Project, Island of Kauaʻi

Prepared for
CH2M

Prepared by
SWCA Environmental Consultants

June 2017

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**BIOLOGICAL RESOURCES SURVEY REPORT FOR
AES LĀWA'I SOLAR AND STORAGE PROJECT, ISLAND OF KAUA'I**

Prepared for

CH2M

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EXECUTIVE SUMMARY

CH2M requested that SWCA Environmental Consultants (SWCA) conduct a terrestrial biological resources assessment for the Lāwa'i Solar and Storage Project on the island of Kaua'i. This report summarizes the findings of the biological resources survey conducted by SWCA on May 1 and 2, 2017.

The biological resources survey was conducted by SWCA botanist Danielle Frohlich and biological field technician Bryson Luke. A pedestrian survey was conducted to record all vascular plant species and their relative abundance, as well as vegetation types. Fauna surveys consisted of a pedestrian survey in the morning hours (approximately 8:00 a.m. and 11:00 a.m.), when wildlife was most likely to be active. The survey area covers 250 acres and is located approximately 13 miles southeast of Līhu'e.

The vegetation types and plant species identified during the survey are not considered unique and are typical of lands previously used for agriculture. Six indigenous plant species were identified and are common throughout the Hawaiian Islands. All plant species observed in or near the survey area are not considered rare, and are not federally listed or state-listed threatened or endangered species, species proposed for listing, or a candidate species. Therefore, the proposed project is not expected to have a significant, adverse effect on terrestrial vegetation.

Twenty-two avifauna species were observed in the survey area; of these, only two species are indigenous or endemic (native) to the Hawaiian Islands. The endangered endemic Hawaiian moorhen (*Gallinula galeata sandvicensis*) was observed foraging within the reservoirs adjacent to the survey area. The indigenous black-crowned night-heron (*Nycticorax nycticorax*) was also observed foraging in the reservoirs. No migratory species were observed because the majority of migrant species are likely in their respective summering grounds outside of Hawai'i at the time of this survey. Recommendations to avoid and minimize impacts to these species are provided.

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1. INTRODUCTION

CH2M contracted SWCA Environmental Consultants (SWCA) to conduct a biological resources assessment at Lāwa'i, Kaua'i County, Hawai'i. The assessment was conducted as part of the environmental compliance efforts for the proposed Lāwa'i Solar and Storage Project by AES Distributed Energy (AES DE) and its affiliate AES Lāwa'i Solar, LLC. The biological resources assessment was performed by SWCA biologists Danielle Frohlich and Bryson Luke on May 1–2, 2017. The objectives of the survey were as follows:

- Identify and document the presence and distribution of plant species and vegetation communities within the project site.
- Identify and document the presence and relative abundance of bird, mammal, amphibian, reptile, and invertebrate macrofauna that occur within the project site.
- Identify any federally listed or state-listed candidate, threatened, or endangered species; species of concern; and/or rare (either locally or state-wide) species found within the project site.

2. DESCRIPTION OF SURVEY AREA

The survey area is on the south side of the island of Kaua'i approximately 13 miles southwest of the Līhu'e (Figure 1). The biological survey focused on an area covering approximately 250 acres that is part of a larger 1,062-acre property (tax map key [TMK] 2-6-003:001) owned by Alexander & Baldwin, Inc. Kaua'i County Highway 530, Kōloa Road, is the primary access route to the survey area, and a network of existing roads provides access within the survey area.

Mean annual rainfall for the survey area is approximately 55 inches (138.69 centimeters [cm]). Rainfall is typically highest in December and lowest in June (Frazier et al. 2016). The nearest National Oceanic and Atmospheric Administration (NOAA) weather recording station is the Omao station (OMAH1), which is less than 1 mile from the survey area. This station recorded lower-than-average rainfall for 2017 through the end of April (NOAA 2017).

The survey area is mostly flat and is currently used for local, small-scale cattle ranching; therefore most of the area consists of open pastures. The open pastures and the existing network of roads facilitated the survey efforts and enabled a comprehensive assessment of biological resources at the site.

There are several reservoirs located in close proximity to the survey area; two of these reservoirs (Aepoalua Reservoir and Aepoekolu Reservoir) are within the overall boundary, but are not part of the survey area (Figure 1). The spillways between the reservoirs, which are part of the survey area, were dry during the survey. SWCA thoroughly observed these spillways and determined that they do not hold water throughout the year; however, a jurisdictional delineation of Waters of the U.S. (including wetlands) is outside the scope of this survey. If the proposed project is expected to result in modification or other direct impacts to the reservoirs or spillways, it is recommended that a jurisdictional delineation be conducted.

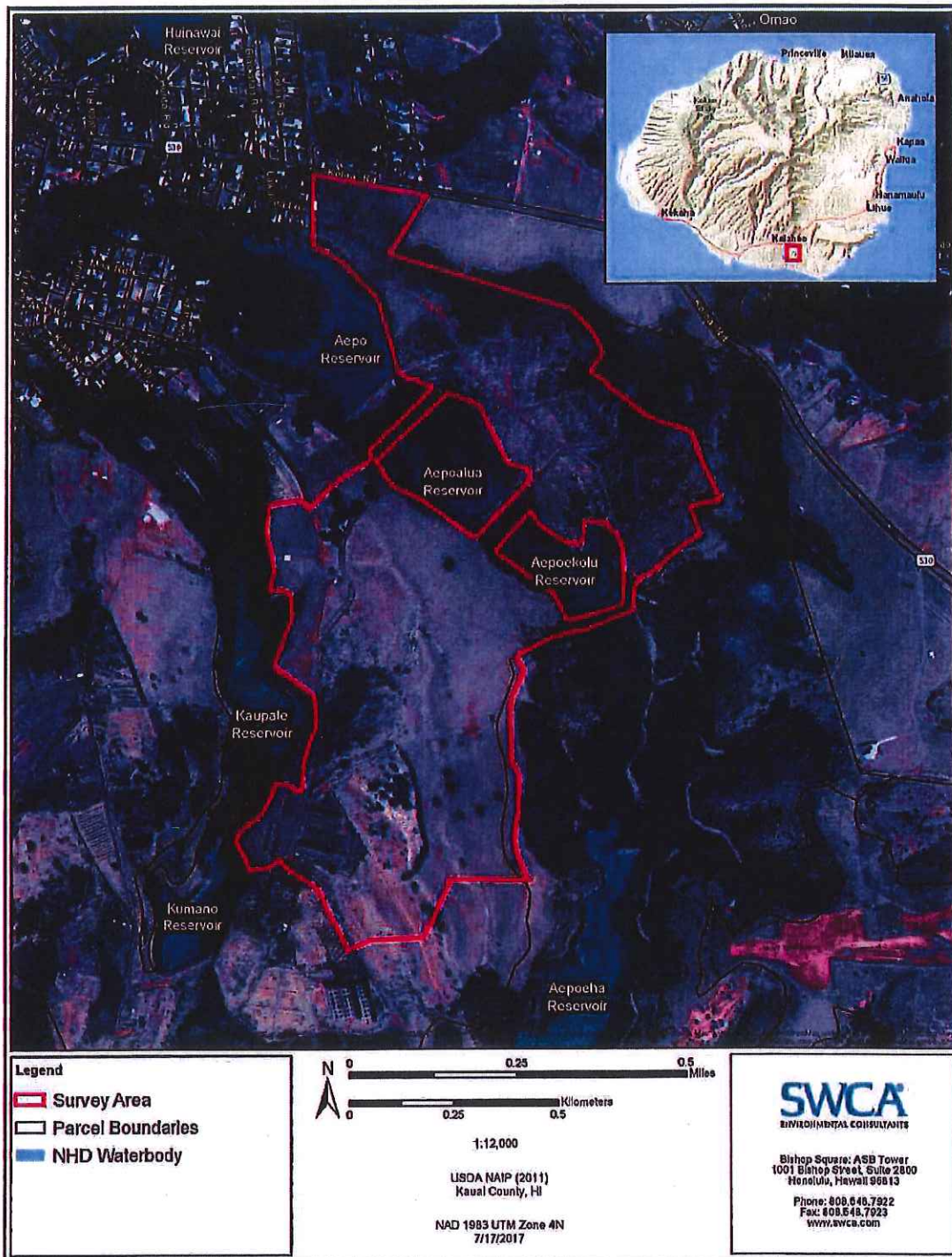


Figure 1. Lāwa'i Solar and Storage Project survey area.

3. METHODS

3.1. Flora

SWCA conducted a pedestrian flora (botanical) survey May 1–May 2, 2017, to document all vascular plant species and vegetation types. Areas more likely to support native plants (e.g., rocky outcrops and shady areas) were more intensively examined.

Plants recorded during the survey are indicative of the season (“rainy” versus “dry”) and the environmental conditions at the time of the survey. It is likely that additional surveys conducted at a different time of the year would result in minor variations in the species and abundances of plants observed.

3.2. Fauna

Fauna surveys consisted of pedestrian and vehicle surveys and examinations at observation points in areas of interest selected at specific habitat types to maximize the likelihood of detecting species. The majority of the survey effort was performed before 11:00 a.m. or after 4:00 p.m. when wildlife was most likely active. However, observations outside of this time window were also included. Field observations for fauna were conducted using 10 × 50–millimeter (mm) binoculars with a 6.5-degree field of vision. Visual and auditory observations were included in the survey. The radius of each observation point differed depending on the topography of the site but was generally 245 feet (75 meters [m]). All observed birds, mammals, reptiles, amphibians, fish, and invertebrate species were noted.

Surveys for the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) using acoustic detection hardware were not included in the project scope, but potential roosting and foraging habitat were noted when observed. Because of the survey area's proximity of designated critical habitat for the Kaua'i cave wolf spider (*Adelocosa anops*) and Kaua'i cave amphipod (*Spelaeorchestia koloana*), any cave habitat was noted, if observed. Potential habitat for other protected species was also noted.

4. RESULTS

4.1. Flora

No federally listed or state-listed threatened, endangered, proposed listed, candidate, or rare native Hawaiian plant species were observed. In all, 87 plant species were recorded in the survey area during the survey. Of these, only six species are indigenous to the Hawaiian Islands, and none of these species are considered rare (Wagner et al. 1999). Appendix A provides a list of all plant species observed by SWCA biologists in the survey area.

The vegetation types in the survey area are pasture, ruderal, and mixed non-native forest.

4.1.1. Pasture Vegetation

The survey area is covered mainly by the pasture vegetation type, which is found throughout the middle portions of the site and is surrounded by the ruderal and mixed non-native forest vegetation types (Figure 2). Pasture lands are enclosed tracts of land grazed by domesticated livestock, and the vegetation of these areas consists mainly of palatable grasses interspersed with other herbaceous plants. Woody species are

generally uncommon to rare in these areas. The most common grass species in the pasture vegetation type is Guinea grass (*Urochloa maxima*). Also commonly seen are wiregrass (*Eleusine indica*), Axonopus compressus, and swollen fingergrass (*Chloris barbata*). Abundant and common herbaceous species found in the pasture vegetation type include bur bush (*Triumfetta rhomboidea*), sensitive plant (*Mimosa pudica* var. *unijuga*), ōwī (*Stachytarpheta cayennensis*), and tree tickfool (*Desmodium triflorum*). Maunaloa vine (*Canavalia cathartica*), a perennial legume, is occasionally seen vining over other species in the area.

4.1.2. Ruderal Vegetation

This vegetation type is found on fallow land, along the edges of roads or grazed land, and in other disturbed areas. Ruderal vegetation is found in areas which are infrequently maintained, if at all, and most of the plant species found in this vegetation type are non-natives adapted to colonizing disturbed areas. The most common tree and shrub species in these areas are castor bean (*Ricinus communis*), Java plum (*Syzygium cumini*), and albizia (*Falcataria moluccana*). Guinea grass is the most common herbaceous species seen, and it is the dominant species throughout this vegetation type in the survey area.

4.1.3. Mixed Non-Native Forest

Mixed non-native forest is characterized by a mix of non-native trees with a minimal understory (Figure 3). The vegetation is heterogeneous and includes a matrix of albizia, Java plum, African tulip (*Spathodea campanulata*), Christmas berry (*Schinus terebinthifolius*), silk oak (*Grevillea robusta*), lemon-scented gum (*Corymbia citriodora*), and paperbark (*Melaleuca quinquenervia*). The dominant tree species vary by location within the site, and many appear to have been originally planted at one time, perhaps as shade trees for coffee (*Coffea arabica*), which persists in occasional groves. The vine species maile pilau (*Paederia foetida*), huehue haole (*Passiflora suberosa*), and maunaloa vine (*Canavalia cathartica*) climb through the midstory in many areas. Understory plants that are widely scattered in this vegetation type include Guinea grass and elephant's-foot (*Elephantopus mollis*).

In addition to the aforementioned vegetation types, occasional groves of persisting cultivated species such as macadamia (*Macadamia integrifolia*), coconut (*Cocos nucifera*), banana (*Musa* hybrid), coffee, and traveler's palm (*Ravenala madagascariensis*) are seen in localized regions of the survey area.



Figure 2. The pasture vegetation type surrounded by mixed non-native forest.



Figure 3. Mixed non-native forest vegetation type, which borders pasture areas throughout the survey area.

4.2. Fauna

Pedestrian surveys were conducted in the survey area. Additional observation points were taken at each vegetation type, and reservoirs in proximity to the survey area were especially scrutinized to maximize the likelihood of observing protected waterbirds. Only one endangered species, the Hawaiian moorhen (*Gallinula galeata sandvicensis*) was observed. In all, 22 avifauna species, four mammal species, five reptile and amphibian species, and 13 insect and other invertebrate species were recorded in or near the

survey area. Of these, three species are indigenous or endemic (native) to the Hawaiian Islands and 39 are introduced (non-native). No migratory species were observed because the majority of migrant species are likely in their respective summering grounds outside of Hawai'i at the time of this survey.

No critical habitat is designated within the survey area. However, critical habitat for the Kaua'i cave wolf spider and Kaua'i cave amphipod is located approximately 2.4 kilometers (km) (1.5 miles) east of the survey area.

4.2.1. Avifauna

In all, 22 bird species were documented (Table 1). Of these, only the Hawaiian moorhen or 'ālae 'ūla, is federally listed and state listed as an endangered species. Hawaiian moorhen were observed foraging in Aepo Reservoir, Aepoalua Reservoir, and Kumano Reservoir during the survey (See Figure 4 and Figure 5). No juveniles or nests of Hawaiian moorhen were detected. In addition to the Hawaiian moorhen, endangered Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian stilt (*Himantopus mexicanus knudseni*), and Hawaiian goose or nēnē (*Branta sandvicensis*) are also likely to occur in the area, specifically in or near the reservoirs. Hawaiian stilt may be present in any areas with shallow water. Hawaiian geese favor open pasture with short grasses.

Seabirds, including the endangered Hawaiian petrel (*Pterodroma sandwichensis*), threatened Newell's shearwater (*Puffinus newelli*), and proposed endangered band-rumped storm-petrel (*Oceanodroma castro*) may fly over the survey area at night while travelling to and from their upland nesting sites to the ocean. These species nest inland in the mountainous interior of Kaua'i (Ainley et al. 1997; Mitchell et al. 2005). No suitable nesting sites for these species are present in the survey area.

Seven bird species in the survey area are protected under the Migratory Bird Treaty Act (MBTA). Other migratory bird species that could occur in the survey area during other months of the year include the Pacific golden plover or kolea (*Pluvialis fulva*) and wandering tattler (*Tringa incana*).



Figure 4. Hawaiian moorhen foraging at Aepoalua Reservoir.

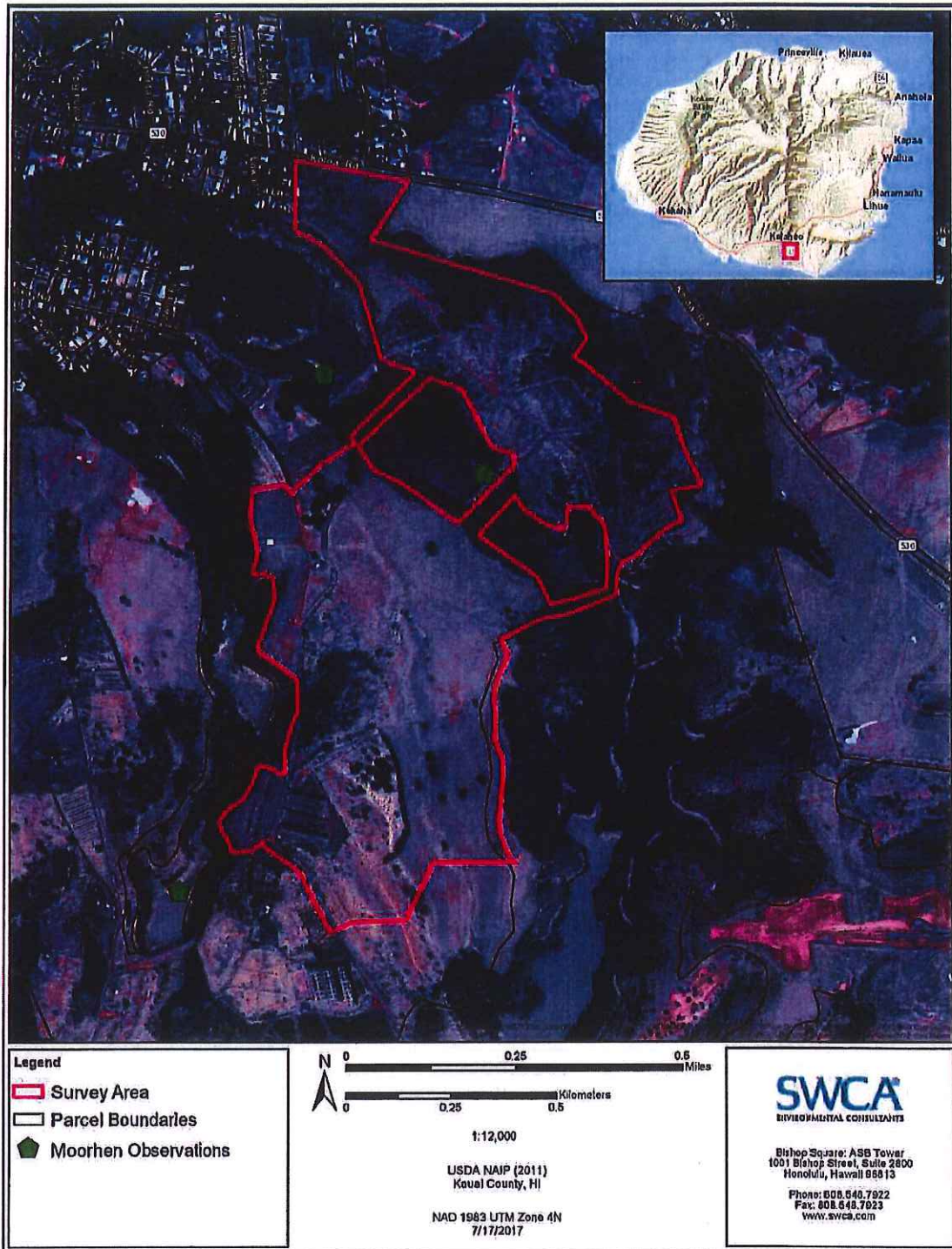


Figure 5. Survey area boundaries and Hawaiian moorhen observations.

Table 1. Avifauna Observed by SWCA In and near the Survey Area

Common Name	Scientific Name	Status*	MBTA†
Black francolin	<i>Francoelinus francolinus</i>	NN	
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	I	X
Cattle egret	<i>Bubulcus ibis</i>	NN	X
Chestnut munia	<i>Lonchura atricapilla</i>	NN	
Common mynah	<i>Aoridotheres tristis</i>	NN	
Eurasian skylark	<i>Alauda arvensis</i>	NN	X
Hawaiian moorhen	<i>Gallinula galeata sandvicensis</i>	E, End	
House finch, yellow var.	<i>Haemorrhous mexicanus</i>	NN	X
House sparrow	<i>Passer domesticus</i>	NN	
Hummer	<i>Garrulax canorus</i>	NN	
Japanese bush warbler	<i>Horornis diphone</i>	NN	
Japanese white-eye	<i>Zosterops japonicus</i>	NN	
Mourning dove	<i>Zenaida macroura</i>	NN	X
Northern cardinal	<i>Cardinalis cardinalis</i>	NN	X
Red junglefowl (chicken)	<i>Gallus gallus</i>	NN	
Red-crested cardinal	<i>Paroaria coronata</i>	NN	
Ring-necked pheasant	<i>Phasianus colchicus</i>	NN	
Rose-ringed parakeet	<i>Psittacula krameri</i>	NN	
Spotted dove	<i>Streptopelia chinensis</i>	NN	
Western meadowlark	<i>Sturnella neglecta</i>	NN	X
White-rumped shama	<i>Copsychus malabaricus</i>	NN	
Zebra dove	<i>Geopelia striata</i>	NN	
Total species		22	7

* Status: E = endemic, I = Indigenous, M = migrant, End = Endangered, NN = non-native established species.

† MBTA = Protected by the Migratory Bird Treaty Act.

4.2.2. Mammals

Four mammal species were observed during the survey. Current land use at the survey area is a mix of agriculture and pasture. Cattle (*Bos taurus*) graze in two large pastures within the survey area. In addition, horse (*Equus caballus*), mule (*Equus asinus* × *Equus caballus*), and a house mouse (*Mus musculus*) were observed during the survey. Signs of pig (*Sus scrofa*) in the form of pig-wallows, tracks, and scat were also observed, although no pigs were seen during the survey. Other species of mammal likely to be present in the survey area include feral cat (*Felis catus*), dog (*Canis lupus familiaris*), and rat (*Rattus* sp.). Hawaiian hoary bat may also occur in the survey area.

The endangered Hawaiian hoary bat is the only native terrestrial mammal species that is still extant within the Hawaiian Islands (U.S. Fish and Wildlife Service [USFWS] 1998). Surveys for Hawaiian hoary bats

using acoustic detection hardware were not conducted, but areas of suitable habitat for foraging or roosting were noted during the survey.

Hawaiian hoary bats are insectivores and are regularly observed foraging over streams, reservoirs, and wetlands (U.S. Department of Agriculture 2009). Bats may be attracted to insects in riparian vegetation or emerging from the water. Aepo Reservoir, Aepoalua Reservoir, Aepooha Reservoir, and Kumano Reservoir are located in or within 1,000 feet (305 m) of the survey area, and all held water during the survey. These locations could serve as potential Hawaiian hoary bat foraging habitat. Aepoekolu Reservoir and Kaupale Reservoir are also within 1,000 feet of the survey area, but were dry during the survey.

Hawaiian hoary bats typically roost in dense canopy foliage or in the subcanopy when the canopy is sparse, with open access for launching into flight (U.S. Department of Agriculture 2009). Hawaiian hoary bats have been observed roosting in albizia, coconut, eucalyptus (*Eucalyptus robusta*), ironwood (*Casuarina equisetifolia*), lychee (*Litchi* sp.), and macadamia trees, and could roost in these tree species in the survey area. Although not yet documented as a Hawaiian hoary bat roost trees, miho (*Thespesia populnea*) and hau (*Hibiscus tiliaceus*) possess characteristics of roosting trees, and are commonly found along the banks of reservoirs in the survey area. These trees could be used as a day or night roost when bats are present.

4.2.3. Reptiles and Amphibians

Five species of reptile and amphibian were observed during the survey. These include the red-eared slider (*Trachemys scripta elegans*), brown anole (*Anolis sagrei*), green anole (*Anolis carolinensis*), cane toad (*Bufo marinus*), and bullfrog (*Rana catesbeiana*). Cane toad tadpoles were observed in Aepo Reservoir and Aepoalua Reservoir. No terrestrial reptiles or amphibians are native to Hawai'i.

4.2.4. Insects and Other Invertebrates

Thirteen species of insects and other invertebrates were observed during this survey. These consist of the black witch moth (*Ascalapha odorata*), cabbage moth (*Artogeia rapae*), monarch butterfly (*Danaus plexippus*), citrus swallowtail (*Papilio xuthus*), honey bee (*Apis mellifera*), Chinese dragonfly (*Crocothemis servillia*), green darner (*Anax junius*), grasshopper (*Schistocerca nitens*), house fly (*Musca domestica*), Asian tiger mosquito (*Aedes albopictus*), giant African snail (*Achatina fulica*), rosy wolf snail (*Euglandina rosea*), and the two-striped slug (*Veronicella cubensis*). None of the species observed are federally listed or state-listed endangered or protected species.

Although it does not exist in the survey area, the designated critical habitat for the Kaua'i cave wolf spider and Kaua'i cave amphipod is located approximately 2.4 km (1.5 miles) from the survey area. Both species are found only in the Kōloa region of Kaua'i in subterranean spaces, cracks, and caves. The caves supporting these species have almost 100% humidity, and any roots growing through the surface of the cave must be non-toxic to insects. Given the proximity of the critical habitat to the survey area, SWCA searched for potential cave habitat during the survey, but no cave habitat was evident.

5. DISCUSSION AND RECOMMENDATIONS

5.1. Flora

Overall, the vegetation in the survey area is disturbed from previous and current land use activities. The vegetation types and species identified are not considered unique. More than 93% of the plant species seen are not native to the Hawaiian Islands. The six native species observed are indigenous (found in Hawai'i and elsewhere) and are common throughout the Hawaiian Islands. No threatened or endangered plants were found during the survey, and no designated plant critical habitat occurs in the area. Therefore, the proposed project is not expected to have a significant, adverse effect on flora (botanical) resources.

Weedy, non-native plant species are common in the survey area. Most of these weedy species are widespread in Hawai'i, and their control is not expected to result in a significant decrease in their number or distribution. However, construction activities are known to spread invasive species to new areas through the movement of vehicles and materials. For this reason, SWCA recommends the following invasive species minimization measures to avoid the unintentional introduction or transport of new terrestrial invasive species to Kaua'i:

- All construction equipment and vehicles arriving from outside Kaua'i should be washed and inspected before entering the project area.
- Construction materials arriving from outside of Kaua'i should also be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful non-native species (plants, amphibians, reptiles, and insects).
- Inspection and cleaning activities should be conducted at a designated location. The inspector should be a qualified botanist and/or entomologist that is able to identify invasive species that are of concern relevant to the point of origin of the equipment, vehicle, or material.
- When possible, raw materials (e.g., fill materials) should be purchased from a local supplier on Kaua'i to avoid introducing non-native species not present on the island.

5.2. Fauna

5.2.1. Federally Listed and State-Listed Species

Based on available habitat and known occurrences near the survey area, six threatened and/or endangered species may occur within the survey area. These species include the Hawaiian duck, Hawaiian coot, Hawaiian moorhen, and Hawaiian stilt (collectively referred to as waterbirds), and the Hawaiian goose and Hawaiian hoary bat. In addition, threatened and endangered seabirds, such as the Hawaiian petrel, Newell's shearwater, and the band-rumped storm-petrel (collectively referred to as seabirds), may pass over the survey area as they transition from the ocean to upland nesting sites. The Kaua'i cave wolf spider and Kaua'i cave amphipod and their habitat were not detected during the survey. Other threatened and endangered fauna were considered initially but were dismissed from further analysis because of a lack of suitable habitat or because the survey area is out of their habitat range.

Waterbirds

The Hawaiian moorhen was the only waterbird detected during the survey. Hawaiian moorhens favor freshwater areas with dense stands of emergent vegetation near open water, slightly emergent vegetation mats, and water depths of less than 3.3 feet (1 m). They nest on open ground, in wet meadows, and on

banks of waterways and in emergent vegetation over water. Their nesting areas typically have standing water less than 24 inches (60 cm) deep (Bannor and Kiviati 2002; USFWS 2011).

Hawaiian coot, although not observed in the survey area during this survey, could be present in and around nearby reservoirs because they prefer freshwater ponds or wetlands, brackish wetlands, and human-made impoundments. They forage in water less than 12 inches (30 cm) deep and nest in open water with emergent aquatic vegetation or heavy stands of grass (Brisbin et al. 2002; Schwartz and Schwartz 1949; USFWS 2011).

The Hawaiian stilt was not observed during the survey, but could be present in and around nearby reservoirs. The Hawaiian stilt uses a variety of aquatic habitats, but they prefer to loaf in open mudflats, sparsely vegetated pickleweed mats, and open pasturelands. Specific water depths of 5 inches (13 cm) or less are required for optimal foraging (USFWS 2011). Nest sites are frequently separated from feeding sites and are adjacent to or on low islands within bodies of fresh, brackish, or salt water.

The Hawaiian duck was not detected during the survey, but could be present in and around nearby reservoirs. The Hawaiian duck utilizes natural and human-made lowland wetlands, flooded grasslands, river valleys, mountain streams, montane pools, forest swamplands, aquaculture ponds, and agricultural areas. On Kaua'i, many ducks nest along montane streams but use lowland areas for feeding and loafing (Engilis et al. 2002; USFWS 2011).

The following best management practices (BMPs) are recommended during construction to avoid impacts to listed waterbirds:

- If a nest with eggs or chicks/ducklings is discovered, work should cease within 100 feet (30 m) of the nest until the chicks/ducklings have fledged.
- Nests or broods found in the project area before or during construction should be reported to the USFWS within 48 hours.
- If an endangered Hawaiian waterbird is present or flies into the area during ongoing activities, all activities within 100 feet (30 m) of the bird should cease, and the bird should not be approached. Work may continue after the bird leaves the area of its own accord.

The breeding season of the Hawaiian stilt occurs from February through August. Breeding of the Hawaiian moorhen, Hawaiian coot, and Hawaiian duck is not limited to a particular breeding season, and nests, broods, or hatchlings could be present at any time throughout the year (Table 2).

Table 2. Life History Information for the Four Endangered Waterbird Species Observed or Likely to be Present in the Survey Area

Common Name	Scientific Name	Breeding Season	Incubation	Fledging	Reference
Hawaiian moorhen	<i>Gallinula galeata sandvicensis</i>	Year-round, mostly from March to August	19–22 days	Several weeks	Mitchell et al. (2005), Bannor and Kiviati (2002)
Hawaiian coot	<i>Fulica alai</i>	Year-round, peaks in March and September	25 days	75 days (American coot)	Pratt and Brisbin (2002), Brisbin et al. (2002), Mitchell et al. (2005)
Hawaiian stilt	<i>Himantopus mexicanus knudseni</i>	Mid-February through August	23–26 days	At least 27 days	Robinson et al. (1999), USFWS (2011)
Hawaiian duck	<i>Anas wyvilliana</i>	Year round, mostly from March to June	26–30 days	After 65 days	Engilis et al. (2002)

Hawaiian Goose

The Hawaiian goose may also be present on occasion, and could fly over the survey area. The Hawaiian goose is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands, and has negligible dependence on freshwater habitat. Hawaiian geese use various habitat types ranging from beach strand, shrubland, and grassland to lava rock (Banko 1988; Banko et al. 1999). Hydroseeding can attract Hawaiian geese to feed.

The following BMPs are recommended during construction to avoid impacts to the Hawaiian goose:

- All regular on-site staff should be trained to identify the Hawaiian goose, and they should know what appropriate steps to take if Hawaiian geese are present on-site. Training would not be necessary if a biological monitor is present for the duration of the construction.
- If a Hawaiian goose is found in the area during ongoing activities, all activities within 100 feet (30 m) of the bird should cease, and the bird should also not be approached. If a nest is discovered, the USFWS must be contacted. If a nest is not discovered, work may continue after the bird leaves the area of its own accord.

Seabirds

Major threats to the endangered Hawaiian petrel, the band-rumped storm-petrel, and the threatened Newell's shearwater include the attraction of adults and newly fledged juveniles to bright lights while transiting between their nest sites and the ocean. Juvenile birds are particularly vulnerable to light attraction and are sometimes grounded when they become disoriented by lights (Mitchell et al. 2005). Many of these grounded birds are vulnerable to mammalian predators or being struck by vehicles. The following recommendations are provided to avoid and minimize light attraction of these seabirds to the survey area:

- Construction activity should be restricted to daylight hours as much as practicable during the seabird peak fallout period (September 15–December 15) to avoid the use of nighttime lighting that could attract seabirds.
- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction (Reed et al. 1985; Telfer et al. 1987). A selection of acceptable seabird-friendly lights can be found online at the Kauai Seabird Habitat Conservation website (2013).
- Outside lights that are not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15–December 15).

Mammals

One protected mammal species, the Hawaiian hoary bat, may forage or roost in the survey area. Direct impacts to bats would only occur if a juvenile bat that is too small to fly but too large to be carried by a parent was present in a tree that was cut down. Although the chances of adversely affecting Hawaiian hoary bats as a result of the proposed project are likely small, the following measures are recommended as conservative impact avoidance measures:

- Any fences that are erected as part of the project should have barbless top-strand wire to prevent entanglements of the Hawaiian hoary bat on barbed wire. No fences in the survey area were

observed with barbed wire during the survey; however, if fences are present, the top strand of barbed wire should be removed or replaced with barbless wire.

- No trees taller than 15 feet (4.6 [m]) should be trimmed or removed as a result of this project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees.

Implementation of these guidelines, which have been promulgated by the USFWS (1998), is expected to avoid all direct impacts to Hawaiian hoary bats.

Kaua'i Cave Wolf Spider and Kaua'i Cave Amphipod

The Kaua'i cave wolf spider and Kaua'i cave amphipod and their habitat were not detected during the survey. The Kaua'i cave wolf spider and the Kaua'i cave amphipod are cave-dwelling arthropods restricted to the Kōloa Basin on the island of Kaua'i where they are found in lava tubes and other cave-bearing rock formations. The Kaua'i cave wolf spider has only recently been regularly encountered in a single cave where 16 to 28 individuals have been found during regular monitoring visits (USFWS unpublished data from 1996 through 2005). During recent visits, the Kaua'i cave amphipod has been regularly observed in three caves in numbers typically ranging from eight to 40; more than 300 individuals have been encountered in one of these caves. Population estimates do not exist for these arthropods.

If an entrance to lava tubes or cave-bearing rock formations is discovered, the USFWS and the Department of Land and Natural Resources should be notified within 24 hours. Heavy machinery should keep a minimum distance of 100 feet (30 m) away from the entrance to prevent potential disturbance to any underground lava tube or cave. Staff should also stay a minimum of 5 feet (1.5 m) from any entrance to prevent disturbance to the lava tube or cave entrance.

5.2.2. Migratory Bird Treaty Act

SWCA observed seven bird species in the survey area that are federally protected under the MBTA. These species are the black-crowned night-heron (*Nycticorax nycticorax*), cattle egret (*Bubulcus ibis*), Eurasian skylark (*Alauda arvensis*), house finch (*Haemorrhous mexicanus*), mourning dove (*Zenaida macroura*), northern cardinal (*Cardinalis cardinalis*), and the western meadowlark (*Sturnella neglecta*). The Pacific golden plover and wandering tattler, also protected under the MBTA, were not observed during the survey, but they are likely to occur in the survey area during certain periods of the year. Construction at the site may temporarily displace some of these bird species, but long-term effects are not expected. These birds (likely limited to a few individuals) are expected to find suitable foraging habitat in nearby areas. The temporary displacement of these individuals at the project site is not expected to affect the survival of individuals or the overall species populations.

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Appendix A.

**Checklist of Plants Observed at the Lāwaʻi Solar and
Storage Site, May 1–2, 2017**

Appendix A. Checklist of Plants Observed at the Lāwā'i Solar and Storage Site, May 1–2, 2017

Table A1 provides an inventory checklist of plant species observed by SWCA May 1–2, 2017, at the survey area. The plant names are arranged alphabetically by family and then by species into two groups: monocots and dicots. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999), Wagner and Herbst (2003), and Staples and Herbst (2005). Recent name changes are those recorded in Wagner et al. (2012).

Table A1. Checklist of Plants Observed in the Lāwā'i Solar and Storage Project Survey Area May 1–2, 2017

Family	Scientific Name and Authorship	Status	Hawaiian and/or Common Name
MONOCOTS			
Arecaceae	<i>Adonidia merrillii</i> (Becc.) Becc.	X*	Manila palm
Arecaceae	<i>Cocos nucifera</i> L.	P	niū, ololani, coconut
Cyperaceae	<i>Cyperus polystachyos</i> Rottb.	I	
Cyperaceae	<i>Cyperus rotundus</i> L.	X	nut grass, kili'o'opu, mau'u mokae
Musaceae	<i>Musa</i> hybrid	X*	banana
Poaceae	<i>Axonopus compressus</i> (Sw.) P.Beauv.	X	
Poaceae	<i>Bothriochloa pertusa</i> (L.) A.Camus	X	pitted beardgrass
Poaceae	<i>Chloris barbata</i> Sw.	X	swollen fingergrass, mau'u lei
Poaceae	<i>Cynodon dactylon</i> (L.) Pers.	X	Bermuda grass, mānienie, mānienie haole
Poaceae	<i>Digitaria ciliaris</i> (Retz.) Koeler	X	Henry's crabgrass, kūkaepua'a
Poaceae	<i>Digitaria setigera</i> Roth	I	kūkaepua'a, mau'u kūkaepua'a, itchy crabgrass
Poaceae	<i>Eleusine indica</i> (L.) Gaertn.	X	wiregrass, mānienie alii
Poaceae	<i>Eragrostis amabilis</i> (L.) Wight & Am.	X	lovegrass
Poaceae	<i>Paspalum conjugatum</i> P.J.Bergius	X	Hilo grass, mau'u Hilo, sour paspalum
Poaceae	<i>Paspalum fimbriatum</i> Kunth	X	Panama paspalum, fimbriate paspalum, Colombia grass
Poaceae	<i>Phyllostachys aurea</i> Carrière ex Rivière & C.Rivière	X	
Poaceae	<i>Schizachyrium condensatum</i> (Kunth) Nees	X	little bluestem, beardgrass
Poaceae	<i>Sporobolus indicus</i> (L.) R.Br.	X	West Indian dropseed, smutgrass
Poaceae	<i>Urochloa maxima</i> (Jacq.) R.D.Webster	X	Guinea grass
Stralitzaceae	<i>Ravenala madagascariensis</i> Sonn.	X*	traveler's palm
Zingiberaceae	<i>Alpinia zerumbet</i> (Pers.) B.L.Burtt & R.M.Sm.	X	shell ginger

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Family	Scientific Name and Authorship	Status	Hawaiian and/or Common Name
DICOTS			
Acanthaceae	<i>Justicia betonica</i> L.	X	white shrimp plant, squirrel's-tail
Amaranthaceae	<i>Amaranthus spinosus</i> L.	X	spiny amaranth, pakai kukū
Amaranthaceae	<i>Amaranthus viridis</i> L.	X	slender amaranth, pakai, 'āheahea, pākaikai, pakapakai (Nī'ihau)
Anacardiaceae	<i>Mangifera indica</i> L.	X	mango, manakō, manakō meneke, meneke
Anacardiaceae	<i>Schinus terebinthifolius</i> Raddi	X	Christmas berry, wilela'iki, nani o Hilo (Moloka'i)
Apiaceae	<i>Ciclospermum leptophyllum</i> (Pers.) Sprague ex Britton & P. Wilson	X	fir-leaved celery
Apocynaceae	<i>Thevetia peruviana</i> (Pers.) K. Schum.	X	be-still tree
Araliaceae	<i>Schefflera actinophylla</i> (Endl.) Harms	X	octopus tree, umbrella tree
Asteraceae	<i>Ageratum conyzoides</i> L.	X	maile hohono, maile honohono, maile kua
Asteraceae	<i>Bidens pilosa</i> L.	X	Spanish needle, beggartick, kī, kī nehe, kī pipili, nehe
Asteraceae	<i>Calyptocarpus vialis</i> Less.	X	
Asteraceae	<i>Elephantopus mollis</i> Kunth	X	elephant's-foot
Asteraceae	<i>Emilia fosbergii</i> Nicolson	X	pualele (Nī'ihau)
Asteraceae	<i>Parthenium hysterophorus</i> L.	X	false ragweed, Santa Maria
Asteraceae	<i>Pluchea carolinensis</i> (Jacq.) G. Don	X	sourbush, marsh fleabane
Asteraceae	<i>Sphagnetocola trilobata</i> (L.) Pruski	X	wedelia
Asteraceae	<i>Synedrella nodiflora</i> (L.) Gaertn.	X	nodeweed
Asteraceae	<i>Xanthium strumarium</i> var. <i>canadense</i> (Mill.) Torr. & A. Gray	X	cocklebur, kīkānia
Bignoniaceae	<i>Spathodea campanulata</i> P. Beauv.	X	African tulip tree, fountain tree
Corvolvulaceae	<i>Ipomoea obscura</i> (L.) Ker Gawl.	X	morning glory
Euphorbiaceae	<i>Euphorbia heterophylla</i> L.	X	kaliko, spurge
Euphorbiaceae	<i>Euphorbia hirta</i> L.	X	hairy spurge, garden spurge, koko kahiki
Euphorbiaceae	<i>Euphorbia hypericifolia</i> L.	X	graceful spurge
Euphorbiaceae	<i>Macaranga tanarius</i> (L.) Müll. Arg.	X	
Euphorbiaceae	<i>Phyllanthus debilis</i> Klein ex Willd.	X	niruri

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Family	Scientific Name and Authorship	Status	Hawaiian and/or Common Name
Euphorbiaceae	<i>Ricinus communis</i> L.	X	castor bean, pā'aila, ka'apehā, kamākou, kōi, lā'au 'aila
Fabaceae	<i>Canavalia cathartica</i> Thouars	X	maunaloa
Fabaceae	<i>Chamaecrista nictitans</i> subsp. <i>patellaria</i> var. <i>glabrata</i> (Vogel) H.S.Irwin & Barnaby	X	partridge pea, lauki
Fabaceae	<i>Desmodium tortuosum</i> (Sw.) DC.	X	Florida beggarweed
Fabaceae	<i>Desmodium triflorum</i> (L.) DC.	X	tick trefoil, tick clover
Fabaceae	<i>Falcataria moluccana</i> (Miq.) Barnaby & J.W.Grimes	X	
Fabaceae	<i>Indigofera suffruticosa</i> Mill.	X	indigo, 'inikō, 'inikoa, kōiū
Fabaceae	<i>Leucaena leucocephala</i> (Lam.) de Wit	X	koa haole
Fabaceae	<i>Mimosa pudica</i> var. <i>unjuqa</i> (Duchass. & Walp.) Griseb.	X	sensitive plant, sleeping grass, pua hihāhā
Fabaceae	<i>Neonotonia wightii</i> (Wight & Arn.) Lackey	X	
Fabaceae	<i>Pithecellobium dulce</i> (Roxb.) Benth.	X	'opiuma
Lythraceae	<i>Cuphea carthagenensis</i> (Jacq.) J.F.Macbr.	X	tarweed, Colombian cuphea
Malvaceae	<i>Hibiscus tiliaceus</i> L.	I	hau
Malvaceae	<i>Sida rhombifolia</i> L.	X	
Malvaceae	<i>Sida spinosa</i> L.	X	prickly sida
Malvaceae	<i>Thespesia populnea</i> (L.) Sol. ex Correa	I	milo, portia tree
Malvaceae	<i>Urena lobata</i> L.	X	aramina
Moraceae	<i>Ficus microcarpa</i> L.f.	X	Chinese banyan, Malayan banyan
Myrtaceae	<i>Corymbia citriodora</i> (Hook.) K.D.Hill & L.A.S.Johnson	X	lemon-scented gum
Myrtaceae	<i>Eucalyptus robusta</i> Sm.	X	swamp mahogany
Myrtaceae	<i>Melaleuca quinquenervia</i> (Cav.) S.T.Blake	X	paperbark
Myrtaceae	<i>Psidium cattleianum</i> Sabine	X	strawberry guava, waiawī 'uia'uia
Myrtaceae	<i>Psidium guajava</i> L.	X	common guava, kuawa, kuawa ke'oke'o, kuawa lemi, kuawa momona, puawa
Myrtaceae	<i>Syzygium cumini</i> (L.) Skeels	X	Java plum
Onagraceae	<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven	P?	primrose willow, kāmole, alohalua, kāmole lau lī'i, kāmole lau nui
Passifloraceae	<i>Passiflora suberosa</i> L.	X	huehue haole
Phytolaccaceae	<i>Rivina humilis</i> L.	X	coral berry, rouge plant

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Family	Scientific Name and Authorship	Status	Hawaiian and/or Common Name
Plantaginaceae	<i>Plantago major</i> L.	X	broad-leaved plantain, common plantain, faukahi, kūhēkūi
Polygalaceae	<i>Polygala paniculata</i> L.	X	milkwort
Proteaceae	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	X	silk oak, silver oak, he oak, 'oka kilika, ha'ikū ke'oke'o
Proteaceae	<i>Macadamia integrifolia</i> Maiden & Betche	X	
Rubiaceae	<i>Coffea arabica</i> L.	X	Arabian coffee
Rubiaceae	<i>Paederia foetida</i> L.	X	māle pilau, māle kā kahiki
Rubiaceae	<i>Richardia scabra</i> L.	X	
Rubiaceae	<i>Sherardia arvensis</i> L.	X	field madder, spurwort
Rutaceae	<i>Citrus</i> sp.	X*	
Solanaceae	<i>Solanum americanum</i> Mill.	! ?</td <td>glossy nightshade, pōpōlo, 'olohua, polopolo, pōpolohua (Ni'ihau)</td>	glossy nightshade, pōpōlo, 'olohua, polopolo, pōpolohua (Ni'ihau)
Sterculiaceae	<i>Waltheria indica</i> L.	!?	'uhaloa, 'āia'āia pū Ioa, hala 'uhaloa, h'aloa, kanakaloa
Tiliaceae	<i>Triumfetta rhomboidea</i> Jacq.	X	bur bush
Verbenaceae	<i>Lantana camara</i> L.	X	lākana, lā'au kakakala, lanakana (Ni'ihau), mikinōia hihū, mikinōia hohono, mikinōia kūkū
Verbenaceae	<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	X	ōwī, ōī
Verbenaceae	<i>Verbena litoralis</i> Kunth	X	vervain, ōwī, ōī, ha'uoi (Ni'ihau), ha'uōwī (Ni'ihau)

LEGEND: P-Polynesian introduced, P?- probably Polynesian introduced but possibly introduced in historic times, I- indigenous, I?- probably indigenous but possibly naturalized, E- endemic, E?- probably endemic but possibly naturalized (see pg. 126–127 in Wagner et al. 1999), X- non-native, X*- non-native cultivated.