Draft Environmental Assessment for Use of Wolbachia-based Incompatible Insect Technique for the Suppression of Nonnative Southern House Mosquito Populations on Kaua‘i

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PREPARED BY

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DRAFT ENVIRONMENTAL ASSESSMENT FOR USE OF WOLBACHIA-BASED INCOMPATIBLE INSECT TECHNIQUE FOR THE SUPPRESSION OF NONNATIVE SOUTHERN HOUSE MOSQUITO POPULATIONS ON KAUAʻI

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SUMMARY

Project Name:	Environmental Assessment for use of *Wolbachia*-based Incompatible Insect Technique for the suppression of nonnative southern house mosquito populations on Kauaʻi
Project Short Name:	Kauaʻi mosquito suppression
Trigger(s):	Use of State or County lands or Use of State or County funds, use of Federal funds
Island(s):	Kauaʻi
Judicial District(s):	Fifth Circuit
Tax Map Keys (TMKs):	1-4-001:001; 1-4-001:003; 1-4-001:010; 1-4-001:011; 1-4-001:012; 1-4-001:013; 1-4-001:014; 1-4-001:019; 1-4-001:020; 1-4-001:999; 1-4-003:004; 1-4-003:005; 1-4-003:006; 1-4-003:007; 1-4-003:008; 1-4-003:009; 1-4-003:010; 1-4-003:011; 1-4-003:012; 1-4-003:013; 1-4-003:014; 1-4-003:016; 1-4-003:017; 1-4-004:001; 1-4-004:002; 1-4-004:003; 1-4-004:004; 1-4-004:005; 1-4-004:006; 1-4-004:007; 1-4-004:008; 1-4-004:009; 1-4-004:010; 1-4-004:011; 1-4-004:012; 1-4-004:013; 1-4-004:014; 1-4-004:016; 1-4-004:017; 1-4-004:018; 1-4-004:019; 1-4-004:020; 1-4-004:021; 1-4-004:024; 1-4-004:027; 1-4-004:028; 1-4-004:029; 1-4-004:030; 1-4-004:031; 1-4-004:032; 1-4-004:033; 1-4-004:035; 1-4-004:036; 1-4-004:037; 1-4-004:038; 1-4-004:039; 1-4-004:040; 1-4-004:041; 1-4-004:042; 1-4-004:043; 1-4-004:044; 1-4-004:045; 1-4-004:046; 1-4-004:047; 1-4-004:048; 1-4-004:049; 1-4-004:050; 1-4-004:051; 1-4-004:052; 1-4-004:053; 1-4-004:054; 1-4-004:055; 1-4-004:056; 1-4-004:057; 1-4-004:058; 1-4-004:059; 1-4-004:060; 1-4-004:061; 1-4-004:062; 1-4-004:063; 1-4-004:064; 1-4-004:065; 1-4-004:066; 1-4-004:067; 1-4-004:068; 1-4-004:069; 1-4-004:070; 1-4-004:072; 1-4-004:073; 1-4-004:074; 1-4-004:075; 1-4-004:076; 1-5-001:001; 1-5-001:017; 1-7-001:001; 1-8-001:001; 3-8-001:001; 3-9-001:001; 4-2-001:002; 5-4-001:001; 5-7-001:001; 5-8-001:001; 5-8-002:002; 5-9-001:001; 5-9-001:002; 5-9-001:003; 5-9-001:016; 5-9-001:017; 5-9-001:021; 5-9-001:023
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PROJECT SUMMARY

Hawaiʻi's native forest bird species have undergone precipitous declines and extinctions since the arrival of humans to the archipelago, particularly Europeans; 39 of the 56 native Hawaiian honeycreepers have gone extinct and 11 of the remaining 17 species are endangered or threatened. Although several factors have led to declines of these remaining species, the main threat to Hawaiian honeycreepers is currently avian malaria (*Plasmodium relictum*) and avian pox (*Avipoxvirus* spp.); nonnative diseases that are principally spread by the nonnative southern house mosquito (*Culex quinquefasciatus*). Until recently, there were no viable means available to control mosquito vectors at the landscape scale within natural areas in Hawaiʻi.

The Incompatible Insect Technique (IIT) has been successfully implemented in 14 countries worldwide to control mosquitoes that carry human diseases, including four cities in the United States. The technique uses lab-raised male mosquitoes carrying a select strain of *Wolbachia*, a bacterium that naturally occurs in at least 65% of insect species. When male mosquitoes, which do not bite or transmit diseases, are released into a target habitat and mate with wild female mosquitoes that either contain different or no strains of *Wolbachia*, the eggs fail to develop owing to the cytoplasmic incompatibility of the differing *Wolbachia* strains of the male and female mosquitoes. The development of IIT for mosquito-borne diseases that affect humans presents a unique opportunity to use this tool to control mosquitoes that spread avian diseases to native forest bird species in Hawaiʻi. This approach does not employ genetic engineering and does not involve or result in the genetic modification of either mosquitoes or bacteria.

The State of Hawaiʻi Department of Land and Natural Resources (DLNR) and U.S. Fish and Wildlife Service (USFWS) proposes employing IIT to reduce mosquito populations within approximately 59,204 acres (23,959 hectares) of forest reserves, state parks, and private lands in the Kōkeʻe and Alakaʻi Wilderness areas of Kauaʻi to protect birds from mosquito-borne diseases in key higher-elevation native forest bird habitat. This effort is consistent with the statutory missions and responsibilities of the DLNR and USFWS. The multi-stakeholder project would raise and sequentially mass-release male mosquitoes that carry a strain of *Wolbachia* that is incompatible with natal females. Extensive pre- and post-release monitoring would be implemented to monitor the effectiveness of releasing incompatible male mosquitoes on the wild mosquito populations. A similar unconnected project has been proposed for implementation by the National Park Service and DLNR on the island of Maui[1]. To comply with their respective obligations under the National Environmental Policy Act (NEPA) and Hawaiʻi's environmental review process pursuant to Hawaiʻi Revised Statutes (HRS) Chapter 343, the USFWS and DLNR are preparing a joint environmental assessment (EA) to address the impacts of the release of male mosquitoes with incompatible *Wolbachia* in the Kōkeʻe and Alakaʻi Wilderness areas. This EA provides background information concerning IIT and outlines the proposed action, potential impacts, and strategies to avoid and minimize potential negative effects of the proposed release of incompatible male mosquitoes within the project area on Kauaʻi.

[1] See: https://files.hawaii.gov/dbedt/erp/Doc_Library/2023-04-08-MA-FEA-Suppression-of-Mosquitoes-on-East-Maui.pdf

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ABBREVIATIONS AND ACRONYMS

4WD	four-wheel-drive
biocontrol	biological control
CI	Cytoplasmic Incompatibility
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DSP	Division of State Parks
EA	Environmental Assessment
HRS	Hawaiʻi Revised Statutes
IIT	Incompatible Insect Technique
KFBRP	Kauaʻi Forest Bird Recovery Project
KISC	Kauaʻi Invasive Species Committee
KRCP	Kōkeʻe Resource Conservation Program
KWA	Kauaʻi Watershed Alliance
LZ	Landing Zone
NEPA	National Environmental Policy Act
SHPD	State Historic Preservation Division
TMK	Tax Map Key
TNC	The Nature Conservancy
UAS	Unmanned Aerial Systems
U.S.	United States
USFWS	U. S. Fish and Wildlife Service

1 INTRODUCTION

To comply with their respective obligations under the National Environmental Policy Act of 1969, as amended (NEPA), the Council on Environmental Quality (CEQ) NEPA Regulations (40 CFR 1500-1508), Department of the Interior NEPA Regulations (43 CFR 46), and the Hawaiʻi Revised Statutes (HRS) Chapter 343, the U.S. Fish and Wildlife Service (USFWS) and Hawaiʻi Department of Land and Natural Resources (DLNR) are preparing a joint environmental assessment (EA) to address the release of male mosquitoes with incompatible *Wolbachia* (Incompatible Insect Technique, or IIT) in the Kōkeʻe and Alakaʻi Wilderness areas on Kauaʻi (Figure 1). The NEPA and HRS Chapter 343 regulations state that an agency shall prepare an EA for a proposed action that is not likely to have significant effects or when the significance of the effects is unknown. Project area lands are managed by DLNR Division of Forestry and Wildlife (DOFAW), DLNR Division of State Parks (DSP), and private parties (see Table 1). The DLNR and USFWS are joint lead agencies for this EA. The USFWS is considering provisional financial assistance for aspects of the mosquito suppression project. For the conservation of listed forest birds, this agency is therefore joint lead agency for this EA.

This EA analyzes environmental consequences associated with the implementation of the proposed action and the no-action alternative. Additional alternatives considered but dismissed are described in Appendix A. The proposed action presented in this EA is the suppression of the nonnative southern house mosquito (*Culex quinqufasciatus*) in 23,959 ha (59,204 acres) of forest bird habitat on Kauaʻi (Figure 1) through the release of male, *Wolbachia*-incompatible southern house mosquitoes (hereafter referred to as incompatible male mosquitoes, described in Sections 2.4 and 2.5). Breeding interactions between released male and wild female mosquitoes are anticipated to result in a reduction of the mosquito population on this portion of Kauaʻi. This EA provides background information concerning IIT and outlines the proposed action, potential impacts, and strategies to avoid and minimize any negative effects of the proposed release of incompatible male mosquitoes within the project area on Kauaʻi. This document has been prepared consistent with the NEPA, NEPA implementing regulations, and the HRS Chapter 343 and provides compliance for project implementation under both Acts and associated regulations.

The no-action alternative evaluates conditions as they would occur in the foreseeable future if the DLNR did not release incompatible male mosquitoes to manage southern house mosquito populations in forest bird habitat on Kauaʻi. Current management strategies focused on larval habitat source reduction are limited to fencing to exclude ungulates, particularly feral pigs, that create wallows and hollows in tree fern stems that are utilized by mosquitoes as breeding habitats. This strategy, however, does not address other cryptic larval habitat over the landscape. The DLNR and USFWS assume that under the no-action alternative, no new actions to control invasive southern house mosquito would be implemented. DLNR and USFWS also assume that the southern house mosquitoes would continue to persist in forest bird habitat, including federally designated critical habitat for ʻakikiki and akeke'e on Kauaʻi, and would continue to act as a vector for mosquito-borne diseases.

The DLNR manages 22 natural areas[2] comprising the most ecologically intact habitats on Kauaʻi with the intent of safeguarding these habitats and species, as well as the cultural heritage associated with them. The proposed project would occur on 34,921 acres (14,132 hectares) within 10 DLNR managed natural areas on the island (Table 1). These natural areas include forest reserves, natural area reserves, state parks, wildlife sanctuaries, and wilderness reserves. This project is consistent with the statutory missions and responsibilities of the DLNR. This EA has been prepared to comply with DLNR obligations under HRS Chapter 343.

Table 1. The Reserves that Comprise the Proposed Project Area

Name of Reserve	Land Management Agency	Total Size of Reserve (acres)	Acres within Project Area	Designation
Hāʻena State Park	DSP	184	<1	State Park
Haleleʻa Forest Reserve	DOFAW	14,994	1,206	Forest Reserve
Hono O Nā Pali Natural Area Reserve	DOFAW	3,570	3,570	Natural Area Reserve
Kōkeʻe State Park	DSP	4,359	3,438	State Park
Kuia Natural Area Reserve	DOFAW	1,606	691	Natural Area Reserve
Līhuʻe-Kōloa Forest Reserve	DOFAW	10,845	598	Forest Reserve
Nā Pali Coast State Wilderness Park	DSP	4,883	4,619	State Wilderness Park
Nā Pali-Kona Forest Reserve	DOFAW	13,085	9,637	Forest Reserve
Nā Pali-Kona Forest Reserve/Alakaʻi Wilderness Preserve	DOFAW	9,940	9,940	Forest Reserve/ Preserve
Puʻu Ka Pele Forest Reserve	DOFAW	13,973	1,222	Forest Reserve
Private	None	N/A	24,283	Private
Total	-	77,439	59,204	

[2] Sourced from:
https://dlnr.hawaii.gov/ecosystems/nars/kauai-2/
https://dlnr.hawaii.gov/forestry/frs/reserves/kauai/

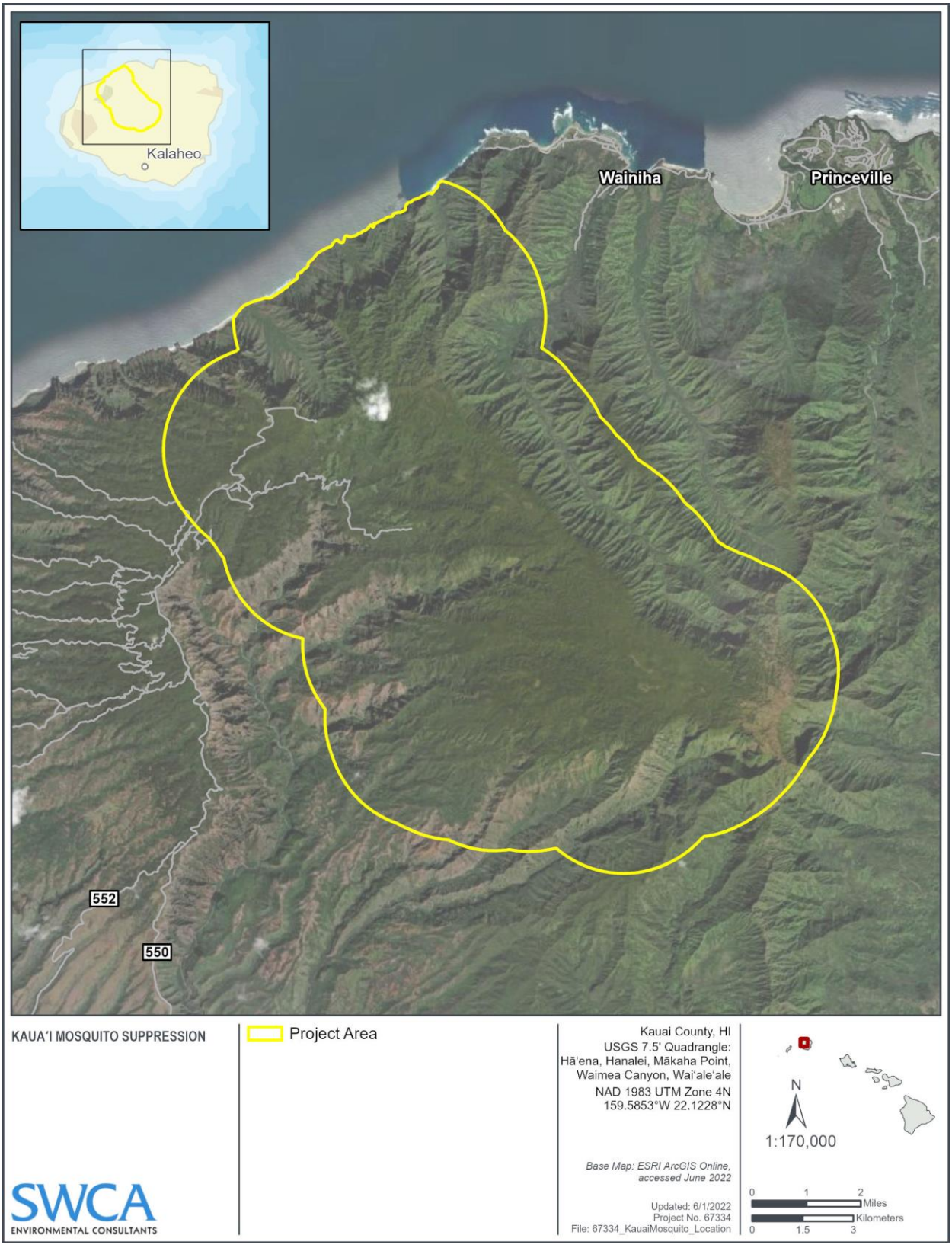

Figure 1. Project Area.

1.1 Applicable Laws, Executive Orders, and Supporting Guidelines

The suppression of nonnative mosquito populations from the project area is consistent with several laws requiring resource managers to conserve and restore wildlife and habitats under their jurisdiction. The proposed action would be carried out in compliance with the various Federal and state laws listed below.

The USFWS mission is to work with others to "conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people." The threat that introduced species pose to habitat and native wildlife makes addressing their impacts one of the USFWS's top management priorities.

1.1.1 Federal

Migratory Bird Treaty Act of 1918 (MBTA), as amended. The MBTA prohibits the incidental take of MBTA-protected bird species, a list of which may be found at 50 C.F.R. §10.13. Under the MBTA, "take" means to "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). Bird species can be protected under the MBTA even if they do not migrate, and no matter their origin.

National Environmental Policy Act of 1969 (NEPA), as amended. NEPA requires that Federal agencies evaluate the impacts of their proposed actions on the human environment, that these impacts be considered by the decision maker(s) prior to implementation, and that the public be informed of these impacts. This EA was prepared in compliance with NEPA (42 USC Section 4231, *et seq.*), the CEQ NEPA Regulations, 40 CFR Section 1500 – 1508, and the DOI NEPA Regulations (43 CFR 46).

The Fish and Wildlife Act of 1956 (16 U.S.C. 742a–742j, not including 742 d–l, 70 Stat. 1119), as amended, gives general guidance requiring the Secretary of the Interior to take steps "required for the development, management, advancement, conservation, and protection of fish and wildlife resources."

Endangered Species Act of 1973, as amended (16 U.S.C. 1531–1544, 87 Stat. 884). The Endangered Species Act (ESA) requires that all Federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA (Sec.2[c]).

Presidential Executive Order 13112 on Invasive Species (February 3, 1999): Section 2(a)(2), on Federal agency duties, states: "Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (1) prevent the introduction of invasive species; (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (3) monitor invasive species populations accurately and reliably; (4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (5) conduct research on invasive species and develop technologies to prevent introduction and provide for

environmentally sound control of invasive species; and (6) promote public education on invasive species and the means to address them." Executive Order 13112 defines "invasive species" as "an alien species [a species that is not native with respect to a particular ecosystem] whose introduction does or is likely to cause economic or environmental harm or harm to human health."

Presidential Executive Order 13751 on Invasive Species (December 5, 2016): This order amends Executive Order 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species. This order maintains the National Invasive Species Council (Council) and the Invasive Species Advisory Committee; expands the membership of the Council; clarifies the operations of the Council; incorporates considerations of human and environmental health, climate change, technological innovation, and other emerging priorities into Federal efforts to address invasive species; and strengthens coordinated, cost-efficient Federal action.

National Historic Preservation Act of 1966 (54 U.S.C. 300101 et seq.) (NHPA). The NHPA requires that Federal agencies: (1) evaluate the effects of any Federal undertaking on historic properties; (2) consult with the State Historic Preservation Office; and (3) consult with appropriate American Indian tribes or Native Hawaiians. Cultural resources are examined under NEPA, and the NHPA regulations encourage coordination of the NHPA compliance process with the NEPA process.

1.1.2 State

Hawai'i Environmental Policy Act (Hawai'i Revised Statutes [HRS] Chapter 343). HRS Chapter 343 was passed to "integrate the review of environmental concerns with existing planning processes of the State and Counties and alert decision makers to significant environmental effects, which may result from the implementation of certain actions" (HRS Section 343-1). Nine triggers are defined for when a proposing or approving agency must prepare an EA. This EA was prepared in compliance with HRS Chapter 343.

Hawai'i Revised Statues Chapter 195D. The purpose of HRS Chapter 195D is "to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems." A list of Endangered and Threatened species is defined under the Hawai'i Administrative Rules, including several of Kaua'i's forest birds described in this EA. HRS Chapter 195D-5 explains that all state agencies would carry out conservation programs that further the protection of such species.

DOFAW Mission. The mission of DOFAW is to protect, manage, and restore natural and cultural resources in collaboration with the people of Hawai'i. The threat that invasive species pose to habitat and native wildlife makes addressing their impacts one of the DOFAW's top management priorities.

In 2017, the Hawai'i Invasive Species Council (HISC) passed Resolution 17-2 "Supporting Evaluation and Implementation of Technologies for Landscape-scale Control of Mosquitoes, With a Focus on Mitigating Both Human and Wildlife Health Risks" https://dlnr.hawaii.gov/hisc/files/2013/02/HISC-Reso-17-2-Mosquitoes.pdf

1.2 Purpose and Need of the Environmental Assessment

The purpose of the proposed action is to prevent extinction of Hawaiian forest birds on Kauaʻi by reducing avian disease caused by mosquito populations (avian malaria). To achieve his, we must substantially suppress the abundance of nonnative southern house mosquito populations in threatened and endangered forest bird habitat on the island of Kauaʻi. The need for nonnative mosquito suppression is evidenced by Hawaiian forest bird recovery plans and documented by research showing that the ʻakekeʻe and ʻakikiki would be driven to extinction within the next decade unless we take immediate action (USFWS 2006, USFWS 2021, Paxton et al. 2022). Mosquito populations and avian malaria have recently expanded into higher elevation habitat, which is the last refugia for these endangered avian species. This expansion of nonnative mosquitoes, and the diseases they carry and transmit, is contributing to the rapid decline of endangered species and their inability to recover. Immediate management actions are needed to prevent the extinction of listed Hawaiian forest birds on Kauaʻi.

Potential funding sources for the proposed action may include, but are not limited to, multiple funding sources that are intended to contribute to the stabilization and recovery of threatened and endangered bird species on Kauaʻi. The proposed action may be awarded funds and include activities performed by the State, the USFWS, and contractors. Potential sources of financial aid include, without limitation, Recovery Challenge grants, Section 6 funds, State Wildlife Grants, Biden Infrastructure Law, Inflation Reduction Act fund, Stewardship grants, Migratory Bird Conservation Act grants, Recovery Challenge grants, America the Beautiful Challenge grants, funds awarded via the Pacific Island Fish and Wildlife Office or the Science Applications Program, and other similar funding programs.

1.3 Project Location and Description

The project area is comprised of 59,204 acres (23,959 hectares) of Kauaʻi (Figure 1). This area encompasses the Kōkeʻe State Park, Hono o Nā Pali Natural Area Reserve, Kuʻia Natural Area Reserve, Nā Pali Coast State Wilderness Park, Nā Pali-Kona Forest Reserve, the Alakaʻi Wilderness Preserve, and private lands (Table 1, Figure 2). The Kōkeʻe State Park, Nā Pali-Kona Forest Reserve, and the Alakaʻi Wilderness Preserve overlap with extant native forest bird habitat, including critical habitat for ʻakekeʻe and ʻakikiki on the island of Kauaʻi (Paxton et al. 2016; species accounts provided below). Designating the project area was developed collaboratively between USFWS, University of Hawaiʻi-Pacific Cooperative Studies Unit-Kauaʻi Forest Bird Recovery Project (KFBRP) and the DLNR. The project area includes a buffer zone to account for mosquito dispersal and incorporates lower elevation areas outside the current range of forest birds to target mosquitoes that may emigrate from these lower elevation areas into this forest bird habitat.

1.4 Resource Issues to be Analyzed

The resources considered in this EA are threatened and endangered species, wildlife, vegetation and cultural resources, public health and safety, recreation and wilderness air quality, greenhouse gas emissions and climate change, and environmental justice. These resources were selected

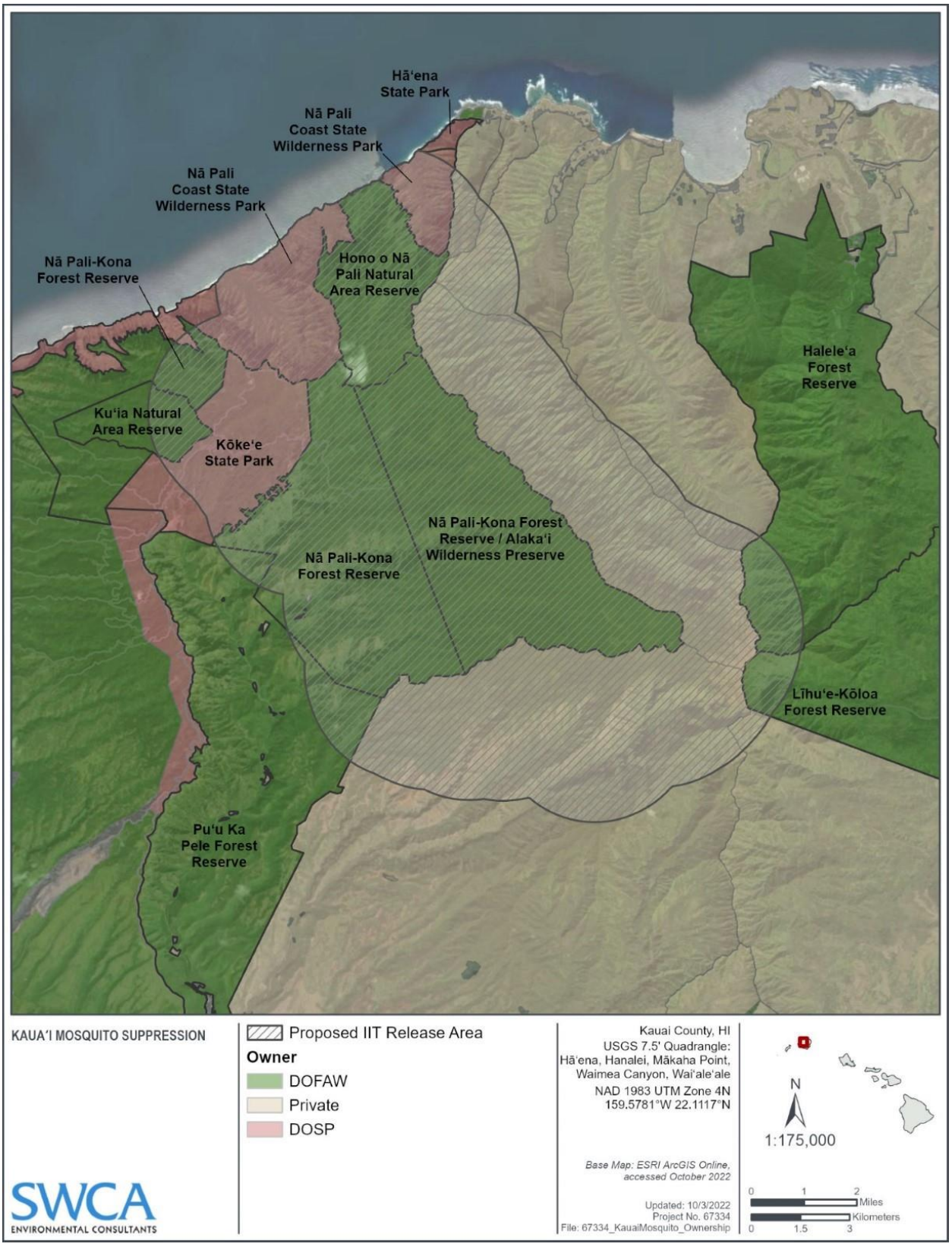

Figure 2. Land ownership in the project area.

based on their potential to be impacted by the proposed action or no-action alternative. Consistent with NEPA and HRS Chapter 343, potential direct, indirect, and cumulative impacts to these resources are described for the proposed action and no-action alternative. Resources considered but excluded from further consideration are presented in Appendix A.

2 PROJECT BACKGROUND

The following section provides background information on Kauaʻi forest birds and their cultural importance along with mosquito ecology and avian diseases.

2.1 Kauaʻi Forest Birds

The Hawaiian archipelago is the most isolated landmass on Earth. This isolation, combined with the geographical diversity and enormous range of ecosystems, resulted in the wide-scale evolution of genera and species of plants and animals that are found nowhere else (known as endemic) (Ziegler 2002). One of the most spectacular examples of the evolutionary process of adaptive radiation (related species that evolve to fill separate ecological niches) in Hawaiʻi is that of the Hawaiian honeycreepers, an endemic lineage of forest birds. Honeycreepers constitute approximately 56 species evolved from a single species of rosefinch that reached either Niʻihau or Kauaʻi approximately 5.7 million years ago (Lerner et al. 2011), a relatively short span of time in evolutionary terms. The striking diversity of feeding preferences and bill morphology within Hawaiian honeycreepers is thought to have evolved in response to the array of ecosystems present within the archipelago. As a result, each honeycreeper species specializes in feeding on either nectar, fruits, seeds, snails, or insects, while other species have generalist diets that incorporate a range of food sources (Pratt 2005).

Like many isolated island archipelagos, the pre-human biota of Hawaiʻi evolved in the absence of terrestrial mammals and numerous lineages of plants, insects, and diseases that are present on continental landmasses. As such, much of the native flora and fauna of Hawaiʻi was poorly adapted for the habitat alterations and rapid and mass introduction of alien species that followed the arrival of humans to the archipelago, particularly the Europeans. Wide-scale extinction and declines of Hawaiian honeycreepers is the result of the combined impact of the loss of lowland forest habitat; the introduction of avian malaria- and avian pox-carrying mosquitoes, particularly the southern house mosquito; the invasion of predators such as ship rats (*Rattus rattus*) and feral cats (*Felis catus*); competition from introduced birds; and the ongoing spread of invasive plants and feral ungulates (e.g., feral pigs [*Sus scrofa*]) (Pratt 2005). Today, only 17 of the original estimated 56 honeycreeper species persist (39 species are extinct). Of these 17, the USFWS lists 10 as endangered and one as threatened (Atkinson and LaPointe 2009, USFWS 2022).

On Kauaʻi, six honeycreeper species (the Kauaʻi endemics ʻakekeʻe [*Loxops caeruleirostris*], ʻakikiki [*Oreomystis bairdi*], ʻanianiau [*Magumma parva*], and Kauaʻi ʻamakihi [*Chlorodrepanis stejnegeri*], as well as ʻapapane [*Himatione sanguinea*], and ʻiʻiwi [*Drepanis coccinea*]); one endemic thrush (puaiohi [*Myadestes palmeri*]); and one endemic flycatcher species (Kauaʻi ʻelepaio [*Chasiempis sclateri*]), are restricted to intact areas of native forest in higher elevation areas of the island. ʻAkekeʻe, ʻakikiki and puaiohi are federally endangered, ʻiʻiwi is threatened

(USFSW 2022), and these species as well as the non-listed ʻanianiau and Kauaʻi ʻamakihi are undergoing declines in population size and range owing to the upward elevational range increase of southern house mosquito and the avian diseases they vector (Paxton et al. 2016, 2020).

Current management of montane native forest birds and their habitat on Kauaʻi is primarily carried out by the KFBRP, the Kauaʻi Watershed Alliance (KWA), Kōkeʻe Resource Conservation Program (KRCP), Kauaʻi Invasive Species Committee (KISC) and DOFAW. The KWA is a partnership of 11 government and private organizations, including The Nature Conservancy, Kamehameha Schools, and the National Tropical Botanical Garden. Management activities include the monitoring of native forest bird populations, ungulate control through public hunting, eradication of feral ungulates within fenced management units, invasive plant control, habitat restoration via outplanting, and trapping of invasive rodents and cats. KFBRP carries out species specific management actions for the forest birds such as rodent control, monitoring, and research. DOFAW and KWA members manage ecosystem-level actions such as fencing, ungulate control, outplanting, and invasive plant control.

2.1.1 Cultural Importance of Forest Birds

From a Native Hawaiian worldview, each native forest bird species is unique and precious. Not only do they play an essential role in maintaining the native ecosystem, but they also factor prominently into several aspects of traditional Hawaiian customs, practices, and beliefs. Native forest birds are woven into the creation stories of the islands and appear in numerous traditional songs, sayings, and stories as representations of natural, spiritual, and human phenomena. Native forest birds are regarded as conduits for *akua*, the divine, functioning as the *kinolau*, or physical manifestations of deities. Among some families, they are *ʻaumakua* or family gods (Paxton et al. 2022).

The ethnohistorical literature associated with native birds, *kia manu* (birdcatchers), and the project area is extensive (see Appendix B: Cultural Impact Assessment). Numerous oral traditions describe kia manu who lived and gathered feathers within the project area (Wichman 1998). Traditional place names within and near the project area are additionally rich in references to native birds, indicating the presence of particular bird resources and their significance (Gomes 2016).

Traditional Hawaiian featherwork exemplifies the importance of native forest birds to traditional Hawaiian society. Forest bird feathers were used for creating regal garments and accessories such as *ʻahuʻula* (capes), *mahiole* (helmets), *kāhili* (standards), and *lei hulu* (feather garlands) donned by Hawaiian nobility. Their brilliant feathers linked the chiefly *aliʻi* class with the upland realm of the gods, the *wao akua* (Appendix B). Though feather work practitioners no longer use the feathers of native birds, the knowledge of producing feather creations still exists and is still practiced. Contemporary Hawaiian feather workers use their creations to bring attention and awareness to the plight of native forest birds (see Appendix B).

Although many of Hawaiʻi's native forest birds have gone extinct, one way they remain relevant to contemporary Hawaiian culture is through classic and beloved *mele* (songs that preserve their legacy). The mele *Manu ʻŌʻō* is one example. The ʻōʻō bird has long been presumed extinct but the memory of the bird lives on with this song, which has become a Hawaiian music and hula classic (Appendix B).

As evidenced in Hawaiian language newspaper articles of the nineteenth century, Native Hawaiians noticed declining native bird populations and were very concerned for the survival of native bird species. One such writer, Penukahi, anthropomorphized native birds by referring to them as, "the natives of the uplands" and relating that they were childhood playmates (T.N. Penukahi *Ke Au Okoa* June 29, 1871). Translation assumed to be Mary Kawena Pukui, Hawaiian Ethnological Notes Newspapers). The interviewees of the current project's cultural impact assessment speak about native forest birds in a similar manner, regarding them as equal members of our island communities, deserving of every right to live as humans do.

2.2 Mosquito Ecology

Mosquitoes are a group of 3,600 species of small flies (Order Diptera) in the family Culicidae that collectively play important ecological roles as pollinators, food sources for vertebrate and invertebrate predators, and as vectors for human and wildlife diseases (Becker et al. 2020). Species within this family are either native or have been accidentally introduced to every major landmass except Antarctica (Mullen and Durden 2009). While it is believed that several thousand mosquito species feed on the blood of animals, only a small proportion of mosquito species are known to act as vectors of human and wildlife diseases (Mullen and Durden 2009). For example, only 12 of the 200 species of mosquitoes known to occur within the continental U.S. and its territories are disease vectors (CDC 2022a). Of these biting species, only females possess proboscises that allow them to blood feed. By contrast, male's proboscises are adapted to primarily feed on plant nectar and secretions, and do not feed on blood (Mullen and Durden 2009). Therefore, male mosquitoes cannot transmit disease.

Six biting species of mosquitoes have been accidentally introduced to Hawai'i by humans, beginning with the southern house mosquito to Lahaina on Maui in 1826 (Dine 1904). The southern house mosquito and the floodwater mosquito (*Aedes vexans nocturnus*) are night-biting, while the remaining four species are active during the day: yellow fever mosquito (*Aedes aegypti*), Asian tiger mosquito (*Aedes albopictus*), the bromeliad mosquito (*Wyeomyia mitchellii*), and the Asian bush mosquito (*A. japonicus japonicus*) (Leong and Grace 2009). The target species of this proposed project, the southern house mosquito, is native to West Africa but has been introduced throughout tropical and warm temperate regions of the world by humans (Belkin 1962, Vinogradova 2000). Southern house mosquitoes are typically found within and near human settlements but will naturalize in remote natural areas on tropical and subtropical oceanic island systems such as Hawai'i (Becker 1995, LaPointe et al. 2009). The species has significant global impacts on human and wildlife health owing to its role as the primary vector of lymphatic filariasis, West Nile Virus (*Flavivirus* sp.), avian malaria (*Plasmodium relictum*), and avian pox (*Avipoxvirus* spp.) (LaPointe et al. 2012, Samy et al. 2016).

The southern house mosquito is present on all the main Hawaiian Islands as well as Midway Atoll in the Northwestern Hawaiian Islands. Although the species was detected on Kure Atoll in 2016 following a high wind event, a collaborative control effort by DLNR and Department of Health Vector Control Branch staff resulted in its eradication from the atoll in 2019. On the main Hawaiian Islands, this species occurs from sea level to approximately 4,921 feet (1,500 meters) elevation (LaPointe 2000). Population densities vary across this elevational gradient with high, more stable densities of mosquitoes occurring at lower elevations and lower densities at mid

(approximately 1,968-3,280 feet [600-1,000 meters]) and higher elevations (approximately 4,265-4,921 feet [1,300-1,500 meters]) that are subject to seasonal fluctuations (LaPointe 2000).

In lowland areas of Hawaiʻi, population densities of southern house mosquito have been shown to expand with increasing land development and associated breeding sites (McClure et al. 2018). Within higher elevation areas, that principally contain native forest and shrubland, southern house mosquitoes lay their eggs in feral animal wallows, water-filled cavities in native tree ferns (*Cibotium* spp.) that are created by feral pigs, natural tree holes, and in pools in intermittent streams (Goff and van Riper 1980, Aruch et al. 2007, Reiter and LaPointe 2009, Atkinson et al. 2014). The ability of southern house mosquito to survive within a wide range of habitats across a diversity of altitudinal gradients has resulted in this mosquito species acting as the primary vector for avian malaria and avian pox, which was likely transmitted from infected nonnative bird species following the introduction of this mosquito to Hawaiʻi (Warner 1968).

2.3 Avian Diseases

Forest birds on Kauaʻi, the oldest of the main Hawaiian Islands, are particularly vulnerable to the combined effects of climate change, disease, and other invasive species as almost all areas of the island occur below ~5,000 feet (1,500 meters). Historically, mosquito breeding and disease development was rare above ~3,300 feet (1,000 meters) on Kauaʻi because upland forests on the island experienced approximately 3˚Celcius (5.4˚ Fahrenheit) cooler temperatures compared to similar elevations on Maui and Hawaiʻi Island (LaPointe et al. 2010). Recent analysis of long-term survey data for seven of the eight native forest bird species on Kauaʻi, however, found that six species had significantly declined in abundance over the past 25 years within the uppermost elevations of their available habitat on Kauaʻi (Paxton et al. 2016), concurrent with increases in prevalence of mosquitoes and avian malaria in forest bird habitat (Atkinson et al. 2014). The two rarest of these species, ʻakikiki and ʻakekeʻe, have undergone dramatic declines in recent years and are at risk of imminent extinction (Paxton et al. 2022). Future increases in temperature within forest bird habitat on Kauaʻi may also further degrade habitat through the increased upward expansion of invasive plants (e.g., strawberry guava; *Psidium cattleianum*) and invasive animals (e.g., pigs and rats).

Avian malaria and pox have been particularly devastating to Hawaiian honeycreepers as these birds evolved in the absence of these diseases. The results of studies that have experimentally infected honeycreeper species with avian malaria provide the clearest evidence regarding the impacts of these avian diseases. For example, Atkinson et al. (1995) demonstrated that 90% of ʻiʻiwi exposed to a single infected mosquito bite died, while Atkinson et al. (2000) found that 65% of Hawaiʻi ʻamakihi (*Chlorodrepanis virens*) died following a single mosquito bite. Those Hawaiian honeycreepers with low resistance to both avian malaria and pox, such as ʻiʻiwi, are now primarily limited to forests above ~3,300 feet (1,000 meters) on Kauaʻi, and ~5,000 feet (1,500 meters) elevation on Maui and Hawaiʻi Island. The cooler temperatures above these elevations act to constrain mosquito breeding and malaria development (Atkinson and LaPointe 2009). The results of modelling studies, however, suggest that these high elevation refugia are at risk from the upslope movement of disease transmitting mosquitoes due to rising mean temperatures resulting from climate change (Atkinson et al. 2014, Benning et al. 2002, Fortini et al. 2015, Liao et al. 2015).

2.4 Management of Mosquitoes Using the Wolbachia-based Incompatible Insect Technique

Wolbachia is a genus of bacteria that naturally occurs within the cells of approximately 65% of all insect species (Hilgenboecker et al. 2008). A unique feature of *Wolbachia* is that if individuals of the same insect species that contain different strains of the bacteria mate, or if the female supports no *Wolbachia*, the sperm of the male may be unable to fertilize the egg of the female insect (technically called cytoplasmic incompatibility) (Kozek and Rao 2007).

As discussed in Section 2.2, the southern house mosquito is currently present across Hawai‘i and already naturally carries a strain of *Wolbachia*. The strain of the *Wolbachia* bacterium used to generate incompatible male mosquitoes for this project likewise occurs naturally in the Asian tiger mosquito. No new organisms would therefore be introduced to Hawai‘i by this project. *Wolbachia* cannot live within vertebrate cells and cannot be transferred to humans even through the bite of a mosquito that carries it (Popovic et al. 2010). Residents of Hawai‘i are commonly bitten by the Asian tiger mosquito, which is distributed statewide and has remained one of the most abundant mosquitoes at lower elevations since its establishment in the islands in 1896. Residents of Hawai‘i are also commonly bitten by the southern house mosquito, which likewise naturally carries *Wolbachia* and occupies both lower elevation and upper elevation habitats across the state. People in Hawai‘i therefore are regularly bitten by mosquitoes containing *Wolbachia*, including the strain that would be used in the proposed action. No adverse effects have ever been reported in humans, nor is there a biological mechanism allowing adverse effects to occur.

There is no indication that mosquitoes released as a part of this project would be any better at transmitting disease to humans or wildlife than those mosquitoes already present on the landscape (Popovici et al. 2010). The southern house mosquito does not transmit any human diseases in Hawai‘i. In contrast, the southern house mosquito is already a remarkably efficient vector of the avian malaria parasite, with an estimated 85–97% of southern house mosquitoes being susceptible to infection and transmission (LaPointe et al. 2005). Increasing the vector competence (i.e., the ability to transmit disease) of the southern house mosquito is therefore highly unlikely and ecologically insignificant when compared to the known risk of allowing these mosquitoes to continue to proliferate on the landscape.

The southern house mosquitoes that currently occur in Hawai‘i carry a strain of *Wolbachia* referred to as wPip and different populations of the Asian tiger mosquito carry strains called wAlbA and wAlbB. To produce the incompatible male southern house mosquitoes for this project, a laboratory line of Hawai‘i mosquitoes was generated with the wAlbB strain of *Wolbachia*. This was accomplished through a multi-step process that involved rearing Hawai‘i mosquitoes in the lab and removing the wPip *Wolbachia* from their bodies with common antibiotics. The wAlbB strain of *Wolbachia* was then transferred into the eggs of these *Wolbachia*-free Hawai‘i mosquitoes. The resulting mosquitoes are a Hawai‘i line of southern house mosquitoes containing wAlbB *Wolbachia*, which are reared for several generations and carefully tested. All this work was done in sterile laboratory conditions.

The success of the suppression program is predicated on releasing only male southern house mosquitoes. As *Wolbachia* is maternally inherited, no local establishment of wAlbB southern

house mosquitoes is likely to occur. Regardless, as no organisms (mosquito or *Wolbachia*) used in this proposed project are novel to Hawaiʻi, local establishment would not constitute introduction of any foreign species.

Wolbachia-induced cytoplasmic incompatibility was first used to control populations of mosquitoes (*Culex pipiens fatigans* now: *C. quinquefasciatus*) in a village in Myanmar (Burma) in the 1960s (Laven 1967). Since this initial research, IIT has been developed and can be applied via the mass rearing and release of males of an insect species that contain a strain of *Wolbachia* that is either not present or is a different strain from those present within wild females. Small-scale field trials have demonstrated that when sufficiently large numbers of laboratory-raised male insects are released, the wild population of the target insect species decline because mating events result in no offspring. The release of *Wolbachia*-infected male mosquitoes has no effect on humans (see Section 4.5) or native wildlife because male mosquitoes are exclusively pollinators and do not bite.

Insectivorous native Hawaiian taxa may opportunistically consume mosquito species (including southern house and Asian tiger mosquitoes). There is no evidence that the *Wolbachia* species consumed would cross the gut barriers and survive in the hemolymph or blood or recombine with *Wolbachia* from other prey consumed. *Wolbachia* cannot live in vertebrates and thus cannot affect the ʻopeʻapeʻa (Popovici et al. 2010). Hawaiʻi's native fauna evolved over millions of years and thus species of native Hawaiian wildlife did not historically rely on mosquitoes as part of their prey base. The suppression of southern house mosquito would not deplete the mousquitos available for prey given the coexistence of *Aedes* mosquitoes.

It is important to note that IIT as a technique does not involve any genetic engineering and therefore does not result in any "genetically modified organisms" (GMOs). No part of the genome of either mosquitoes or the *Wolbachia* bacteria would be modified, and GMOs would not be released on Kauaʻi in any form. According to the U.S. Environmental Protection Agency (EPA), a GMO is "a plant, animal, or microorganism that has had its genetic material (DNA) changed using technology that generally involves the specific modification of DNA, including the transfer of specific DNA from one organism to another"; this process is often referred to as genetic engineering. The EPA does not regulate or recognize IIT as producing genetically engineered products or GMOs.

For discussion of unintended release of incompatible female mosquitoes, horizontal transfer of *Wolbachia*, and horizontal gene transfer, please refer to Appendix A: Issues, Potential Impact Topics, and Alternatives Considered but Dismissed from Detailed Analysis.

2.4.1 Incompatible Insect Technique

There is a substantial body of data that demonstrate the the IIT approach is safe, targeted, and results in no adverse effects to humans or the environment (Laven 1967; Moreira et al. 2009; Atyame et al. 2011; Atyame et al. 2015; Kittayapong et al. 2019; Zheng et al. 2019; Crawford et al. 2020; Beebe et al. 2021). The potential benefits of IIT in the management against human diseases and their insect vectors have led to a growing body of research on the utility of *Wolbachia* for population control in mosquito-borne diseases. While this project is the first proposed use of incompatible male mosquitoes with *Wolbachia* for conservation purposes, and

the first time the approach would be used in Hawai‘i, there is a substantial body of data that demonstrate the approach is safe, targeted, and results in no adverse effects to humans or the environment (e.g., Laven 1967; Moreira et al. 2009; Atayme et al. 2015; Kittayapong et al. 2019; Zheng et al. 2019; Crawford et al. 2020; Beebe et al. 2021).

Crawford et al. (2020) trialed the use of incompatible yellow fever mosquitoes in a proof-of-concept study in Fresno County, California. They released 14.4 million male mosquitoes within a 724-acre (293-hectare) area. This release resulted in, on average, a 95% reduction in the mosquito population during the peak mosquito breeding season.

Mains et al. (2016) developed multiple *Wolbachia* strains to artificially infect Asian tiger mosquitoes that were released at a field site in Lexington, Kentucky. The researchers monitored mosquito populations before and after the release of *Wolbachia*-infected mosquitoes. The release of these incompatible male mosquitoes resulted in a considerable reduction of mosquito egg hatch rates in treated compared to untreated areas, suggesting that the release of *Wolbachia*-infected mosquitoes was effective at reducing mosquito populations during the experiment. O’Connor et al. (2012) released *Wolbachia*-infected male Polynesian tiger mosquitoes (*Aedes polynesiensis*) on Toamaro Island in French Polynesia and compared results with nearby Horea Island. The release of the incompatible male mosquitoes resulted in a 24% reduction in fertile eggs at the treatment site (Toamaro Island) compared to the non-treatment or control site (Horea Island).

2.5 Potential use of the Wolbachia-based Incompatible Insect Technique in Hawai‘i

Until now there was no feasible method for controlling southern house mosquitoes at the landscape level within natural areas in Hawai‘i. Existing management strategies have been limited to installing fencing that excludes ungulates, particularly feral pigs, that create wallows and hollows in tree fern stems, which are subsequently used by mosquitoes as breeding habitat, and small-scale Bti (*Bacillus thuringiensis israelensis*) broadcast. The use of IIT for the control of mosquitoes within native forest bird habitat as part of the proposed action therefore has the potential to reverse the decades of population declines recorded for the remaining native forest bird species and bolster the available habitat for these species. The successful implementation of this novel technique could potentially reduce the populations of southern house mosquitoes, which transmit mosquito-borne avian diseases in native forest bird species and would represent a paradigm shift for DLNR’s management of mosquitoes within forest bird habitats.

IIT is neither novel nor an experiment, but the application of an established method for controlling insect populations. This method has been used for decades to protect human health in over fourteen countries, including elsewhere in the United States, and is not being “tested” in Hawai‘i. IIT is a highly effective and safe technique with a strong record of peer-reviewed studies and successful applications around the world. What is new about this proposed project, however, is that it has not previously been employed in Hawai‘i, nor for the purpose of wildlife conservation. As such, protocols would be developed for its use in Kaua‘i’s native forest and other local conditions.

The IIT method requires consistent releases of incompatible male mosquitoes to maintain suppression of mosquito populations; this method can be used on a landscape-scale over long periods of time. This repetition is by no means unusual, as it is common for management projects to require repeated actions over long periods to maintain the success and meet the goals of the project. For example, fencing to keep out invasive hoofed mammals (e.g., goats, pigs, and deer) from sensitive habitats requires regular inspection and maintenance, and rat control requires continuous trapping and/or bait applications. Controlling weeds or invasive insects similarly requires repeated visits to affected sites, sometimes for many decades after an infestation is discovered. In general, conservation and resource management in Hawaiʻi can be labor intensive, costly, and takes time.

In recognition of the potential of IIT to benefit native forest bird populations, the Birds, Not Mosquitoes Project, a collaboration between state, federal, university, and non-profit partners, was established to evaluate planning and implementation for landscape level control of mosquitoes in Hawaiʻi. The specific purpose of the Birds, Not Mosquitoes Project is to coordinate and advance efforts to develop, permit, test, register, and implement a *Wolbachia*-carrying southern house mosquito for population suppression to reduce disease prevalence in native forest birds, as well as to advance the approach such that it can also be used for the benefit of human health in Hawaiʻi. Collaborators on the project include the following government agencies, universities, and non-governmental organizations:

- American Bird Conservancy
- Coordinating Group on Alien Pest Species
- Hawaiʻi Department of Agriculture
- Hawaiʻi Department of Health
- Hawaiʻi Department of Land and Natural Resources
- Island Conservation
- Kauaʻi Forest Bird Recovery Project
- Maui Forest Bird Recovery Project
- Michigan State University
- National Park Service
- Office of Native Hawaiian Relations
- Pacific Rim Conservation
- The Nature Conservancy
- U.S. Geological Survey
- University of Hawaiʻi
- University of Kentucky
- U.S. Fish and Wildlife Service

The use of IIT for mosquito control has been recommended by both executive and legislative branch leadership across the state.

In 2017, the Hawaiʻi Invasive Species Council (HISC) passed Resolution 17-2 "Supporting Evaluation and Implementation of Technologies for Landscape-scale Control of Mosquitoes, With a Focus on Mitigating Both Human and Wildlife Health Risks"
https://dlnr.hawaii.gov/hisc/files/2013/02/HISC-Reso-17-2-Mosquitoes.pdf

In 2019, House Resolution (HR) 297, later Act 106, passed the Hawaiʻi State Legislature and directed the "[Department of Agriculture] to review the *Aedes aegypti* mosquito with *Wolbachia* bacteria, including *Aedes aegypti* mosquitoes originating from Hawaiʻi stock that could be imported for landscape scale mosquito control, and render a determination to place it on the appropriate animal import list." The resolution required the DOH, DOA and DLNR to collaborate on a report to the Legislature with recommendations for appropriate vector control programs. https://www.capitol.hawaii.gov/slh/Years/SLH2019/SLH2019_Act106.pdf

In 2021, House Resolution (HR) 95 subsequently passed the Hawaiʻi State House urging DLNR, DOA, DOH and UH to implement a mosquito control program using *Wolbachia* to reduce mosquito population levels throughout the state:
https://www.capitol.hawaii.gov/sessions/session2021/bills/HR95_HD1_.htm

On September 7, 2022, the Kauaʻi County Council passed Resolution No. 2022-31 "Resolution Urging Federal, State, and County Elected Officials to Support the Funding and Implementation of the Use of Mosquito Birth Control to Bring Kauaʻi's Native Forest Birds Back From Near-Extinction and Towards Abundance."
https://www.kauaigovonline.org/WebLink/DocView.aspx?id=3280034&dbid=0&repo=LF-IMAGING

On May 12, 2023, the Kauaʻi County Council passed Resolution 2023-43, "Resolution Urging Federal, State, and County Elected Officials to Support Funding and Implementation of Mosquito Birth Control Measures to Mitigate the Rapid Decline of Native Bird Species."

Funding for the proposed action is expected to be provided by state, Federal, and private organizations including DLNR, American Bird Conservancy, USFWS, National Fish and Wildlife Foundation, and the Hawaiʻi Invasive Species Council.

2.5.1 Required Permits and Approvals

In June 2022, the State of Hawaiʻi Board of Agriculture approved the addition of the southern house mosquito to the Chapter 4-71, Hawaiʻi Administrative Rules (HAR) "Non-Domestic Animal Import Rules" list of restricted animals (Part A) and set permit conditions to allow the importation and field release of male southern house mosquitoes containing incompatible strains of *Wolbachia* bacteria. In October 2022, the Hawaiʻi Department of Agriculture (HDOA), Plant Quarantine Branch issued a permit to DLNR to allow for the import and release of southern house mosquitoes for mosquito control projects.

The Environmental Protection Agency (EPA) regulates incompatible male mosquitoes as a "biopesticide" product. The EPA defines biopesticides as "naturally occurring substances that control pests (biochemical pesticides), microorganisms that control pests (microbial pesticides),

and pesticidal substances produced by plants containing added genetic material (plant-incorporated protectants) or PIPs." Many biopesticides registered by the EPA can be used in and around lands cultivated for certified organic food production if the ingredients also meet U.S. Department of Agriculture standards.

A Federal Insecticide Fungicide Rodenticide Act (FIFRA) Section 18 application was submitted by the HDOA to the EPA, in collaboration with the USFWS and DLNR, to request an emergency exemption from Section 3 pesticide registration, given the imminent extinction risks to threatened and endangered forest bird species. The Section 18 process results in temporary product registration and a label that identifies appropriate product use, application rates, restrictions, safety, and quality control requirements. On April 25, 2023, the EPA approved the Section 18 and issued Specific Emergency Use Directions for use of *Wolbachia pipientis* wAlbB in *Culex quinquefasciatus* (DQB Strain) (Appendix C: Federal Insecticide, Fungicide, and Rodenticide Act Section 18 Specific Emergency Use Label for Imcompatable Insect Technique Application and U.S. EPA Letter of Authorization). As control projects are initiated for the southern house mosquito, HDOA, DLNR and USFWS would then collect and share post-application monitoring data with the EPA to contribute towards a formal Section 3 pesticide registration package.

3 ALTERNATIVES

This chapter describes the No-action Alternative (Alternative 1) and the Proposed Action (Alternative 2) for reducing mosquito populations and, thus, avian malaria transmission to threatened and endangered forest birds in the Kōkeʻe and Alakaʻi Wilderness areas of Kauaʻi. Avoidance and minimization conservation measures are included in the proposed action. Other potential alternatives were identified during internal and public scoping but were dismissed from detailed analysis in this EA as described in "Appendix A: Issues, Impact Topics, and Alternatives Dismissed from Detailed Analysis."

3.1 Alternative 1 (No-Action Alternative)

Under the no-action alternative, releases of incompatible male mosquitoes would not occur. Although ongoing conservation and other management activities would continue in the project area (e.g., fencing, construction of field camps, removal of nonnative ungulates and predators, and invasive plant control), native forest birds would continue to be adversely affected by their primary threat, avian malaria, because the mosquitoes that carry this disease would remain uncontrolled and are anticipated to continue to spread into the remaining forest bird habitat. Under the no-action alternative, the ʻakikiki is predicted to go extinct by 2025 and the ʻakekeʻe by 2034 (Paxton et al. 2022). The ʻakikiki and ʻakekeʻe have experienced 11% and 15% yearly declines, respectively, since the 1980sand currently have very limited ranges, and therefore could be extinct sooner than projected (Paxton et al. 2020; Paxton et al. 2022).

3.2 Alternative 2 (Proposed Action)

DLNR and the other partners are proposing the sequential and continued release of lab-raised male southern house mosquitoes that carry a strain of *Wolbachia* that is incompatible with those

strains that are present within the wild mosquito population. It is important to note that male mosquitoes do not bite humans or animals. The southern house mosquito is typically most active at dusk through to the middle of the night (Subra 1981). The mosquitoes would be released from the ground and air within 59,204 acres/23,959 hectares on Kaua‘i (Project Area; Figure 1). The section below describes the proposed action with sufficient detail necessary to analyze the impacts that may occur from the action.

3.2.1 Goals and Objectives of the Project

The overarching goals of the project are to:

- Suppress breeding of southern house mosquitoes within the project area.
- Reduce the populations of southern house mosquitoes to prevent the extinction of some native forest bird species within the project area, and to promote the recovery and health of native forest bird species within the project area.

The objectives of the project are to:

- Implement releases of incompatible male mosquitoes within the project area.
- Conduct pre- and post-release monitoring to assess changes in southern house mosquito populations and integrate data to inform project planning and future releases.
- If applications of incompatible male mosquitoes are determined to be effective in suppressing southern house mosquito populations, integrate releases of incompatible males into long-term management of the project area, using adaptive management to maintain or adjust efficiency and efficacy.

3.2.2 Environmental Compliance

The project would comply with all applicable Federal laws, regulations, Executive Orders, state statutes, and administrative rules, such as those pertaining to management of Forest Reserves, Natural Area Reserves, the Alaka‘i Wilderness Area, State Parks, and threatened and endangered species. Additional Federal and state permits and processes that would be required for the proposed action are listed in Table 2.

Table 2. Required Relevant Permits and Approvals

Permit or Approval	Responsible Agency
Section 7, Endangered Species Act	USFWS
Section 106, HRS 6E, Historic Preservation	USFWS and DLNR-SHPD
Import Permit	HDOA
Section 18 Approval/Section 3 Registration	EPA
DLNR-Division of State Parks Special Use Permit	DLNR-DSP

Permit or Approval	Responsible Agency
Section 7, Endangered Species Act	USFWS
Section 106, HRS 6E, Historic Preservation	USFWS and DLNR-SHPD
HEPA and NEPA	USFWS and DLNR

3.2.3 Mosquito Procurement

Incompatible male mosquitoes would initially be raised in the continental U.S. and then transported to Hawai‘i, with shipping frequency depending on the project release schedule. To ensure that Hawai‘i’s mosquito genetics are >99% contained within an incompatible male mosquito, only males that have been backcrossed over at least seven generations with a population of mosquitoes originating from Hawai‘i stock would be used for this project. Southern house mosquitoes originating from Hawai‘i have been collected and provided to partners on the continental U.S. to establish incompatible lines for use in Hawai‘i. In October 2022, DLNR was granted a permit by the Hawai‘i Department of Agriculture, Plant Quarantine Branch to import incompatible male southern house mosquitoes, and DLNR must adhere with all relevant import permit conditions, as well as State of Hawai‘i administrative rules and statutes relating to restricted animals and microorganisms. Approval for DLNR to import and complete direct releases of incompatible male mosquitoes into the environment has been approved by the State of Hawai‘i Board of Agriculture (June 2022). DLNR is also exploring future options for establishing a state-run mosquito-rearing facility in Hawai‘i; mosquito sources could also originate from a similar but state-run mosquito-rearing facility in the future. Should DLNR pursue this option, the appropriate regulatory permits and documentation (environmental reviews and facility compliance) would be necessary.

3.2.4 Release Area Prioritization

No new roads, trails, or helicopter landing zones (LZs) would be created to support this project; only existing facilities and access points would be used. Release areas would be prioritized based on ease of access, availability of support resources, presence of southern house mosquitoes, and proximity to core endangered forest bird populations. Project management units would be demarcated by access roads and trails, and vegetation types. In terms of ease of access, some higher priority areas would include accessible fence lines, roads, trails (Figure 3), and field camps used for other resource management activities (described below in Section 3.2.4.1). Field camps accessible by road may be of higher priority than those accessible by helicopter. Available times to occupy camps would be coordinated through the appropriate management agency.

3.2.4.1 FIELD CAMPS

There are several established field camps in the project area that are used regularly by KWA, KFBRP, and DLNR staff to support ongoing forest bird recovery and management activities. These field camps are small, situated on flat sites, and are primarily located within forest habitat. Some of these field camps are accessible by roads and trails, while access to more remote camps requires helicopter transport. Wai‘alae cabin in the Alaka‘i Wilderness Preserve is available for public use and is occasionally used by resource management and research staff. Additional field

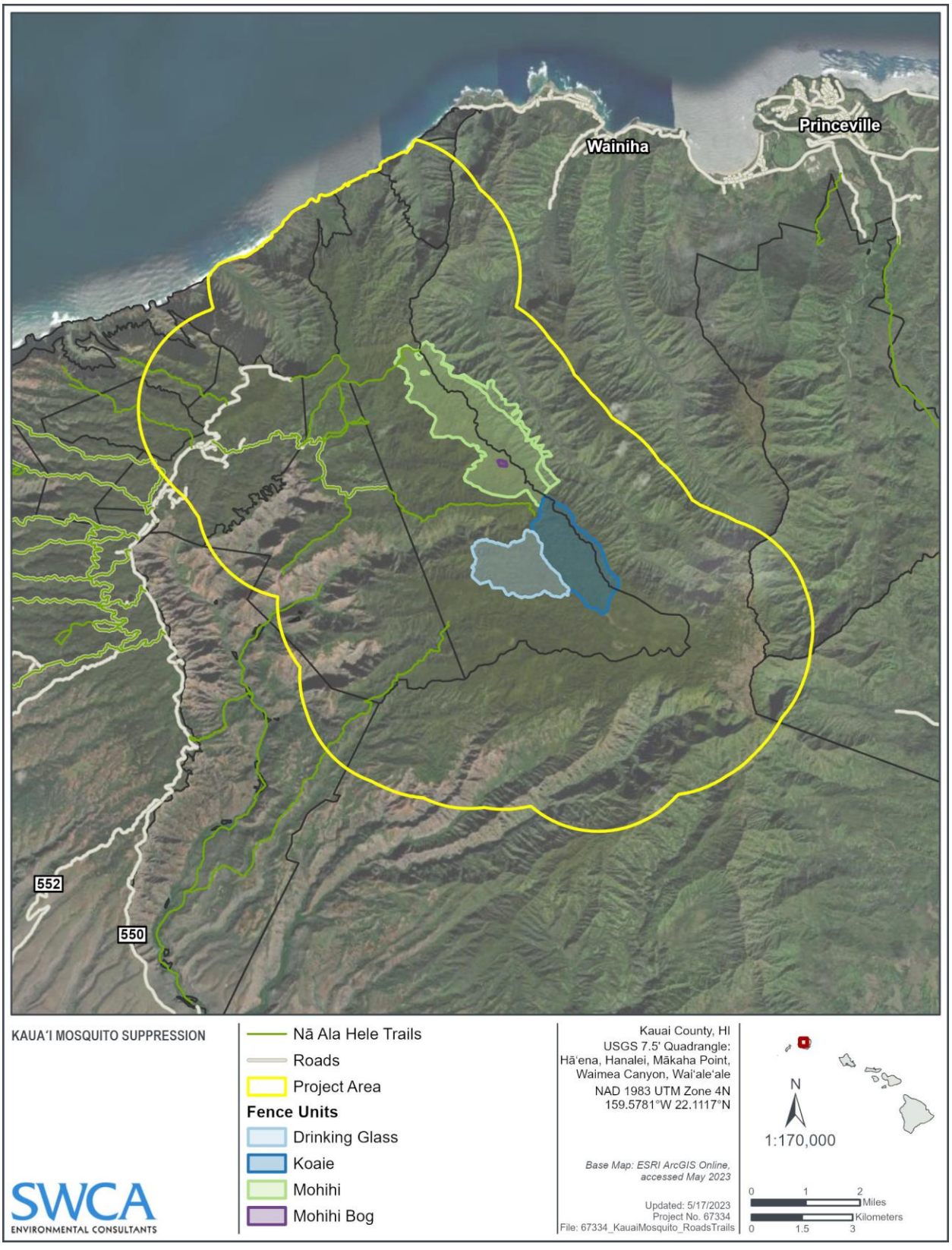

Figure 3. Project area roads and trails.

camps would likely be developed to support the construction of ungulate exclusion fences within Mōhihi Watershed, and for upgrades to fences within the Drinking Glass and Koaiʻe units. Established field camps and these potential additional field camps may be used to support the release of incompatible male mosquitoes into remote areas. No new field camps would be created solely for this project. Waiʻalae cabin may be used occasionally, but no other publicly available cabins or campsites are anticipated to be used.

Available times to occupy field camps would be coordinated through the appropriate management agency. The proposed action would increase the frequency of use of some of these field camps because the camps that support forest bird recovery and management activities are typically used most in the spring and summer seasons, whereas mosquito releases would occur year-round. All foreign material brought into the camps would be removed when exiting the camp.

3.2.5 Frequency, Application Rate, and Timing of Release

The goal of the proposed action is to reduce the distribution and abundance of the mosquito population within the project area to reduce avian disease and contribute to the stabilization and recovery of threatened and endangered avian species on Kauaʻi. Many previous successful IIT projects resulted in mosquito population declines of 90% or more (Beebe et al. 2021, Crawford et al. 2020, and Zheng et al. 2019). A similar decline would ensure that there would be very few remaining mosquitoes capable of biting and infecting threatened or endangered forest birds with avian malaria. Population densities of mosquitoes are dependent on precipitation patterns, habitat availability, and temperature. Adults, eggs, and larvae develop faster and in higher densities within warmer low-elevation areas (Ahumada et al. 2004). Estimates range from an abundance of approximately 600 mosquitoes per acre near sea level on Hawaiʻi Island where monthly temperatures average 70–75° F, to an abundance of five mosquitoes per acre at an elevation of approximately 4,000 feet where temperatures average 55–60° F (Samuel et al. 2011, Atkinson et al. 2014). Estimates assume an equal sex ratio of males to females; therefore, the number of prescribed incompatible mosquitoes released would be based on approximately one-half of the estimated mosquito population. Incompatible males would need to outcompete wild males; thus, it is desirable to release males in such numbers as to "overflood" the wild males. Statistical models suggest that 10 to 20 incompatible males for every wild male mosquito in the population may be required to achieve population suppression (McClure 2020).

The timing and volume of releases of incompatible male mosquitoes would be determined by mark release recapture research completed in advance of control applications and in compliance with the FIFRA Section 18 Specific Emergency Use Directions (Appendix C). Subsequent release actions and frequency would be based on the results of mosquito population monitoring (described below), including overflooding ratios observed on the landscape as calculated based on pre and post release trapping data. Releases may occur weekly to monthly in the project area. Releases may be more frequent initially, with the interval between releases increasing depending on the season and efficacy of applications. The quantity of incompatible mosquitoes released for this project would likely be less than other IIT mosquito projects that have occurred in urban areas throughout the world (involving yellow fever mosquitoes) because the southern house mosquito population density on Kauaʻi is believed to be lower than yellow fever mosquito population densities in these urban areas. In addition, the uppermost elevations in the project area

may have even fewer mosquitoes than estimated by Samuel et al. (2011) and population suppression in these areas may only require infrequent releases of incompatible mosquitoes. Alternatively, suppression at lower elevations may be sufficient to reduce or eliminate the threat of disease at the higher elevations by eliminating the individuals that could disperse uphill.

3.2.6 Release Methods

Four methods would be used to release the incompatible male mosquitoes within the project area depending on available technology and factors such as weather and staff capacity:

1. Pedestrian release
2. Helicopter aerial release
3. Fixed-wing aircraft aerial release
4. Drone aerial release

It is anticipated that 1,300 feet (400 meters) between release points may be sufficient to achieve mosquito suppression, however, data gathered during initial applications (see Section 3.2.7 below) would be used to inform the release program. These release methods are described in more detail below.

Incompatible male mosquitoes may be released directly or in small biodegradable packages designed to open on contact with the canopy or forest floor. Packages would be composed of weed-free, environmentally friendly material derived from plants. The material used would have been heat treated during the manufacturing process, which reduces the likelihood of introduction of any foreign contaminants or invasive species, similar to other plant-based media products commonly used in forestry/reforestation projects. Although many thousands of release packages would be dropped across the project area throughout the duration of the project, the small packages would be spread diffusely, and the biodegradable material would decompose quickly, and are expected to pose no risk to the environment.

From a visitor experience standpoint, the release packages are unlikely to be observed by members of the public. The appearance of these packages is not yet entirely known and would depend on how they are designed to fall and land (i.e., on the ground or in trees). To fit into a release mechanism employed by a drone, the release packets would likely only be a few inches wide and light in mass. The visibility of the packages to members of the public would depend on two primary factors, 1) public access to the project area, and 2) spacing of releases. Most of the project area is not publicly accessible. Public users are unlikely to encounter release packages because the package is biodegradable and the proposed 1,300 feet (400 meter) spacing between release points would make encountering packages very unlikely. Chances of the public finding the remainder of a release packages before degradation would be equivalent to finding an object only a few inches wide within an area of dense forest approximately the size of 30 football fields. The rate of decay of the packages will dictate how many packages within an area one could observe at any given moment, but this decay rate is likely very high given the typical rainfall patterns in the project area, making the chance of observing multiple packages unlikely.

3.2.6.1 PEDESTRIAN RELEASE

Pedestrian release of incompatible male mosquitoes would occur along existing roads via four-wheel-drive (4WD) vehicles or via pedestrian hiking trails and fence line corridors. The appropriate DLNR permit process would be followed, where necessary. Most trails, access roads, and LZs would not require vegetation maintenance in addition to what is already maintained to support the KFBRP and other ongoing DLNR programs. Vegetation clearing around infrastructure, camps, trails, fence lines, and LZs is a standard management practice approved under DLNR Chapter 343 exemptions filed with the Hawaiʻi Office of Planning and Sustainable Development[3]. No new roads or trails would be created for this project.

All helicopter operations would be conducted by contracting a private helicopter company and would utilize existing LZs, some of which would require small amounts of vegetation maintenance of these areas, as for other resource management purposes. Existing remote campsites (described in Section 3.2.4.1) would be utilized for field crews and require routine maintenance or vegetation clearance, as for other resource management purposes.

For each release event, which is anticipated to last one day, efforts would be made to minimize traffic (the number of technicians and vehicles or helicopter flights) required to travel to the release sites and field camps. An established camp would be used if an overnight stay is required.

3.2.6.2 HELICOPTER AERIAL RELEASE AND FIXED-WING AIRCRAFT AERIAL RELEASE

The helicopter aerial release and fixed-wing aircraft aerial release methods are still under development in Hawaiʻi and elsewhere and have not, to date, been used in practice. The intent of these methods is to provide improved access to remote parts of the project area. The methods deployed would be informed by known similar operations. Although helicopter aerial release has been used to apply liquid pesticide for the control of invasive pines, miconia, and little fire ants on the island of Maui; Australian tree fern on Kauaʻi; and native seed dispersal for reforestation projects, the release mechanism has yet to be developed for deployment of incompatible male mosquitoes.

Helicopters would be used to aid in the dispersal of incompatible male mosquitoes in inaccessible areas of the project area by flying predetermined transects spaced from 328–1,640 feet (100–500 meters), within the project area with a helicopter fitted with a mosquito release mechanism. The release mechanism would be attached to the aircraft by ground teams at the airport or at a temporary helibase. The helicopter would then fly to the release areas where incompatible male mosquito releases would occur at a minimum of 50 feet (15 meters) above the tree canopy; release would be triggered remotely by either the pilot or a spotter. The helicopter would likely spend 15 seconds or less hovering over each mosquito release location. The helicopter could complete up to three operations per day. It is assumed that repeat visits to any given area would not likely occur more than twice per week, and this schedule would be refined over time based on monitoring of mosquito populations.

[3] See: http://oeqc2.doh.hawaii.gov/Agency_Exemption_Lists/State-Department-of-Land-and-Natural-Resources-Exemption-List-2020-03-03.pdf

For the fixed-wing aircraft aerial release, an airplane carrying a mosquito release mechanism would release mosquitoes from a system compatible with the aircraft. Incompatible male mosquito releases would be informed by mark release recapture data, ongoing monitoring, and aircraft performance and terrain characteristics. The specific release method is still under development.

3.2.6.3 DRONE AERIAL RELEASE

Unmanned Aerial Systems (UAS) or "drones" (the preferred term used in this document) may be used to disperse mosquitoes across the project area via a release mechanism compatible with the craft. Although the specific mosquito release mechanism is still under development, it is expected that it may be available by the time the project is ready for implementation. All Federal Aviation Administration (FAA) regulations and DLNR Best Management Practices for drones would be followed.

Drones would be launched from existing locations such as LZ's, campsites, and access points where infrastructure is preexisting and/or where resource management operations already occur. No vegetation clearing would be conducted for drone release, other than routine maintenance of trails, campsites, fence corridors, and trails. Operators of these drones would be positioned in areas where they can safely and effectively operate drones and maintain compliance with FAA regulations. Drones would be flown on a prescribed route, releasing incompatible male mosquitoes at pre-determined release locations. It is estimated that drones would fly approximately 50–100 feet (15–30 meters) above the tree canopy during mosquito releases but no higher than 500 feet (~150 meters) Above Ground Level (AGL).

The drone operator would ensure that the drone and release mechanism are operating correctly and safely during each flight speed of 22 mph (following Bouyer et al. 2020) during mosquito releases and 62 miles per hour while in fixed wing mode when ferrying to and from release locations and the drone operator. Proposed release locations would be spaced 1,300 feet apart, so a drone flying at 22 mph would be able to release incompatible mosquitoes at 24 release locations in a 15-minute period. At 62 miles per hour, the ferry times for the various parts of the core area vary widely. For example, a drone would only need to travel for approximately 1.5 minutes to reach some release locations in State Park lands but would need more than 5 minutes to reach more remote natural areas in the project area.

The exact drone model(s) to be used is undetermined and depends on environmental conditions, agency approvals, and other factors. The choice of drone model affects the release rate as different models have varying flight speed capabilities and battery capacities. Available convertible fixed wing/multirotor drone models that could be used for this project can fly approximately 15 minutes in multirotor mode or 90 minutes during fixed wing mode before battery life is expended with a maximum payload (carrying weight). An example of a drone considered for the project includes the *Freefly Alta-X*, which the U.S. Forest Service uses to deploy aerial ignition pods across a landscape to fight wildfires. There is considerable overlap and similarities between other UAS payload operations, like aerial ignition, which would inform UAS mosquito release development.

This project would utilize aircraft with similar capabilities and further develop capacity for the mosquito deployment use-case. For example, the Freefly Alta-X paired with the Drone

Amplified IGNIS release mechanism is rated to cover 4,500 acres in 8 hours, dropping one ignition sphere per acre. The drone batteries are continuously charged and replaced to power the aircraft for the duration required. The Alta-X is rated to fly for approximately 30 minutes with a 10-pound payload allowing it to fly back and forth from the staging site to the treatment area as needed to refresh power and complete the dispensing mission. The flight speeds possible during releases of incompatible male mosquitoes depend on drone model used, weather conditions (e.g., wind speed) and optimal speeds for the release mechanism, which are still to be determined. The drones would likely spend 15 seconds or less hovering over each mosquito release location, and it is possible that drones would be able to release the mosquitoes without pausing.

The sound produced by a consumer-grade battery-powered rotary or fixed-wing drone at ground level is similar to loud highway noise (Table 3) (Schaffer et al. 2021). Most consumer-grade drones are far quieter than helicopters with some being up to 40 dBA quieter than a manned helicopter at roughly 328 feet AGL (Airborne Drones 2020). For this project, drones would fly at approximately 50–100 feet above the tree canopy (likely approximately 100–200 feet AGL) during mosquito releases. When multiple drones are in use, they would likely be releasing in different areas (such as one on state lands and one in the park) rather than releasing close to each other. Therefore, it is not anticipated that noise impacts would be compounded using multiple drones.

When ferrying to and from release locations, drones would fly no higher than 500 feet AGL. Drone noise levels for various heights above ground are presented in Table 3 and are based on a decrease of 6 dB for every doubling of distance from a sound perceiver. Along the same lines, the noise produced by a drone would likely blend in with the existing ambient noise levels of the project area at a lateral distance of approximately 0.25–0.5 mile depending on the height of flight (Airborne Drones 2020, Schaffer et al. 2021). Notably, the noise levels presented in this section are not actual measured noise levels; actual noise levels during mosquito releases would vary during specific operations depending on altitudes, topography, vegetation, speed, and drone power settings.

Table 3. Drone noise levels in decibals (dBA) at various heights.

Drone type	Height in Feet Above Ground Level (AGL) from Source			
	25 ft AGL	100 ft AGL	200 ft AGL	500 ft AGL
Consumer Multirotor	~ 68–75 dBA	~ 58–65 dBA	~ 52–59 dBA	~ 44–52 dBA
Small, fixed wing drone	~ 63–70 dBA	~ 53–60 dBA	~ 47–54 dBA	~ 40–47 dBA
Quiet Commercial Multirotor	~ 57–68 dBA	~ 47–58 dBA	~ 41–52 dBA	< 44 dBA

3.2.7 Pre- and Post-Release Monitoring

Pre- and Post-release monitoring are important components of the mosquito suppression project because they inform dispersal methods for ensuring the highest success. The cost of production, sorting, quality control and shipping of incompatible male mosquitoes is high. Monitoring to determine the most effective rate of application is critical to both ecological effectiveness and financial sustainability of the control program. Baseline mosquito monitoring has been

conducted by U.S. Geological Survey and KFBRP personnel in the project area (Kōkeʻe State Park, Alakaʻi Wilderness Preserve, Hono o Nā Pali Natural Area Reserve and Nā Pali-Kona Forest Reserve) since 2016 per the DLNR Chapter 343 Exemption List (revised November 10, 2020). Pre-release monitoring is currently being undertaken by KFBRP personnel who are using 4–8 Biogents Traps (BGs) and occasionally Biogents Gravid *Aedes* Traps (BG-GATs) at a variety of sites across the project area. Traps are placed along trails and other easily accessible areas and are being monitored nightly for up to a week at each site.

In 2021 and 2022, three sites within the project area were sampled by KFBRP for relative mosquito abundance for 8-10 six-night periods per site. The mosquito abundance data collected are currently being used by USFWS ecologists to develop a Bayesian model to assess the potential spread of incompatible males, spatial coverage of releases, effective overflooding ratios, and overall effectiveness of suppression efforts. Mosquito sampling has and would also be undertaken to conduct stable isotope and genomic studies to determine the migration patterns of mosquitoes across elevational gradients, and genetic screening for the avian malaria parasite, *Plasmodium relictum*. Larval habitat was and continues to be surveyed on dedicated routes for each visit to each of those sites, and opportunistically as KFBRP staff accessed different areas in the Alakaʻi Plateau for field work.

Ongoing monitoring following the release of incompatible male mosquitoes would likely utilize the same methods and trap types as the pre-release monitoring described above. Dedicated monitoring would be increased from pre-release monitoring levels during the initial trial phase of releases. Prior to and during the second phase of releases, monitoring would increase substantially with 50 traps placed in a control site and 100 traps in a treatment site. In addition to easily accessible areas, some of these traps would be placed in more remote backcountry sites. Each of the 150 total traps would be run one time per week during each week of monitoring.

A monitoring plan will be developed and include measures of success and certain provisions seeking unanticipated outcomes, such as unintended release of females. Monitoring would occur in a control area representative of forest bird habitat and the treatment site. At the conclusion of a given trapping interval (1–4 nights), specimens may be transported to a laboratory for analysis, and traps would either be redeployed or moved to another survey location. Although traps would target male and female southern house mosquitoes, limited bycatch of native and nonnative dipterans and other flying arthropods could also occur (bycatch released alive when possible).

While the methods and objectives are similar, post-release monitoring would differ from pre-release monitoring in that mosquito traps would be deployed simultaneously over a larger area, would be serviced with greater frequency, and would be required for as long as control efforts are ongoing. All monitoring data collected would be analyzed to improve project efficiency, serve as quality control for mosquito applications across the landscape, and to evaluate the success of suppression efforts by determining if the overflooding release ratio of wild to released mosquitoes described in Section 3.2.5 was achieved. Future mosquito releases will be based on monitoring results.

3.2.8 Implementation Schedule

After the NEPA and HRS Chapter 343 processes are completed, DOFAW anticipates moving forward with releases using the pedestrian method as quickly as possible. Implementation of the proposed action would be contingent on the availability of funding, resources, and personnel.

3.2.9 Avoidance and Minimization Measures

Table 4 summarizes the measures that would be implemented to avoid and minimize potential impacts on each resource from the project. Table 5 summarizes species-specific measures recommended by USFWS. Please see Appendix D, USFWS Avoidance and Minimization Measures and Biosecurity Protocols. All measures, recommendations, and protocols would be followed and adhered to under the proposed action (e.g., DOFAW 2011b; Loope 2016). Additionally, any activity with a DLNR permit will have all conditions prescribed by the permit followed, including following all rapid ‘ōhi‘a death (ROD) protocols, cleaning all equipment and apparel off-site, avoiding damage to potentially sensitive botanical, wildlife, or archaeological features, and prohibiting littering and open fires.

Table 4. Avoidance and Minimization Measures by Resource

Resource	Avoidance and Minimization Measures
Flora and Fauna (General Botany and Wildlife, includes other nonnative and native non--listed species)	Forest bird nesting season (February to June) would be considered for air-based releases and known nests would be avoided by ground personnel and aircraft whenever possible. In some highly sensitive areas, restrictions/limitations may be placed on helicopter use during the forest bird nesting season (February to June); alternative landing zone locations may be used to avoid known nesting sites. The use of ground transportation and aircraft would be minimized to the greatest extent possible to reduce disturbance to native fauna. All FAA rules for drone, helicopter, and fixed-wing aircraft operation would be followed and operators will hold all necessary certificates and licenses. Project personnel would, to the greatest extent possible, avoid the creation of stagnant water habitat. Project personnel would avoid activities that could increase the risk of wildfires and spread of ROD and invasive species. Existing biosecurity SOPs would be followed by trained and experienced project personnel. Drone and helicopter operations will follow best practice protocols established by the National Wildfire Coordinating Group. Following the Land Fire Protection Law, Chapter 185, Hawai‘i Revised Statute, DOFAW would cooperate with the Hawai‘i Fire

Resource	Avoidance and Minimization Measures
	Department and take measures to prevent, control, and extinguishment of wildland fires in the case of downed crewed aircraft or drone.
Threatened and Endangered Species	In addition to the general flora and fauna measures outlined above, the following guidelines would also be followed: Follow State of Hawai'i regulations concerning endangered species (Chapter 195D) and reserve lands (Chapter 183), as well as all regulations for state parks and wilderness preserves. Where possible, avoid known locations of Threatened and Endangered species. Communicate the location of threatened and endangered species populations on the margins of trails and landing zones to project personnel. Train personnel in the identification of all threatened and endangered species that are likely to be encountered within the project areas (e.g., avoid crushing rare plants). Ensure that all project personnel follow USFWS Avoidance and Minimization Measures when working near threatened and endangered species. Avoid damage to arthropod host plants during the clearance of vegetation along trails and at landing zones. Existing biosecurity SOPs would be followed by trained and experienced project personnel.
Public Health and Safety	Outreach campaigns/press releases, such as the ongoing Birds, Not Mosquitoes campaign, would be developed and supported as needed to address public comments or concerns received on the project. DOFAW would use established methods (e.g., posting flyers at trailheads and other publicly accessible sites within the project area, use of social media) to educate the public about the project and to address associated health and safety concerns.
Recreation	Provide public notice (e.g., signs at trailheads or other publicly accessible sites) of any changes in recreational use or access. The use of ground transportation and aircraft would be minimized to the greatest extent possible to reduce disturbance to recreationists. DOFAW would notify commercial helicopters of program activities (especially aircraft use) and recommended avoidance areas so that the aircrafts do not impact each other.

Resource	Avoidance and Minimization Measures
Cultural Resources (including historic sites)	The use of ground transportation, helicopters, fixed-wing aircraft, and drones would be minimized to the greatest extent possible to reduce noise disturbances to cultural practitioners. DOFAW would continue to provide notice of any changes in use or access to DOFAW-managed areas, including areas frequented by cultural practitioners, through social media announcements or updates on the DOFAW website. DOFAW also maintains a hunter email list that could be used to notify hunters about any changes to access or use of public hunting areas. If changes in public access do arise, DOFAW would consult with the ʻAha Moku representative for the area to ensure that dispersal and monitoring efforts are coordinated with cultural practitioners who may be using those areas to gather forest plants, hunt, or carry out other cultural practices. Due to the nature of the proposed project activities, it is anticipated that no cultural and historic sites will be physically impacted by project activities. Project personnel would avoid impacts to cultural sites by staying on designated roads and trails. Project related activities would be limited to existing routes of travel (fence line corridors, trails, and roads), established helicopter landing zones, and field camps already utilized for other resources management activities. No new roads, trails, landing zones, or camps would be created to support this project.

Table 5. USFWS Avoidance and Minimization Measures for Federal and StateThreatened and Endangered Species that are Known to Occur within the Project Area

Species	Threat Status	Avoidance and Minimization Measures
Puaohi (M*yadestes palmeri*), ʻAkikiki (*Oreomystis bairdi*), Akekeʻe (*Loxops careuleirostris*)	Endangered (Federal and State)	Project personnel will avoid conducting activities within forest bird habitat that: Promote the spread or survival of invasive species Increase mosquito populations or stagnant water habitat Increase wildfire threat to montane forest habitats
ʻIʻiwi (*Drepanis coccinea*)	Threatened (Federal); Endangered (State)	Remove tree cover during peak breeding season between January 1 and June 30.
Nēnē (Hawaiian goose; *Branta sandvicensis*)	Threatened (Federal); Endangered (State)	Nēnē would not be approached, fed, or disturbed. If nēnē are observed loafing or foraging within the project area during the breeding season (September through April), a biologist familiar with nēnē nesting behavior will survey for nests in and around the project area prior to resumption of any work. Project personnel will cease work and contact the Service if a nest is discovered within a radius of 150 feet of the project, or a previously undiscovered nest is found within 150-feet radius after work begins. In areas where nēnē are known to be present, reduced speed limits would be implemented, and project personnel and contractors would be informed about the potential presence of endangered species on-site.
Koloa maoli (Hawaiian duck; *Anas wyvilliana*)	Endangered (Federal and state)	In areas where waterbirds are known to be present, reduced speed limits would be implemented, and project personnel and contractors would be informed about the presence of endangered species on-site. If a nest is observed, a 100-foot buffer would be established and maintained around all active nests and/or broods until the chicks/ducklings have fledged.

ʻAkēʻakē (band-rumped storm-petrel; *Hydrobates castro*); ʻuaʻu (Hawaiian petrel; *Pterodroma sandwichensis*)	Endangered (Federal and State)	DLNR would undertake all aircraft flights during daylight hours, thereby avoiding interactions with night-flying seabirds. Project personnel will fully shield all outdoor lights at campsites so the bulb can only be seen from below.
ʻAʻo (Newell's shearwater; *Puffinus auricularis newelli*)	Threatened (Federal and State)	
Ōpeʻapeʻa (Hawaiian hoary bat; *Lasiurus cinereus semotus*)	Endangered (Federal and State)	Project personnel would not disturb, remove, or trim woody plants greater than 15 feet tall during the bat birthing and pup rearing season (June 1 through September 15). DLNR would undertake all aircraft flights during daylight hours, thereby avoiding interactions with night-flying ʻōpeʻapeʻa. Hovering in one place during drone operations would be minimized to limit the risk of disturbing day roosting ʻōpeʻapeʻa Where possible, helicopters would avoid rotor wash of the forest canopy.
Newcomb's snail (*Erinna newcombi*) (aquatic invertebrate)	Threatened (Federal and State)	Pedestrian activities would be limited to established trails and stream crossings in and around any aquatic environments.
Hawaiian picture-wing fly (*Drosophila musaphilia*)	Endangered (Federal and State)	Project personnel will avoid clearing forest vegetation within 200 feet of a site potentially occupied by endangered *Drosophila*

4 AFFECTED ENVIRONMENT AND IMPACTS

Following guidelines provided by the Council on Environmental Quality (CEQ), agencies must compare the impacts of the proposed action and alternatives with the existing and expected future conditions of the affected environment in the absence of the action, which is referred to as the no-action alternative. The CEQ guidelines for implementing NEPA state that agencies "may contrast the impacts of the proposed action and alternatives with the current and expected future conditions of the affected environment in the absence of the action, which constitutes consideration of a no-action alternative" (85 FR 43323). The current state of the environment, environmental consequences, and the potential effects of the proposed action and the no-action alternatives on each resource category are outlined in this chapter. Additional issues, impacts, and alternatives that were considered but dismissed from detailed analysis are provided in Appendix A.

The code of Federal Regulations (40 CFR § 1508.1(g) defines effects or impacts as "changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proosed action or alternatives." The implementation of NEPA requires an evaluation of direct impacts, indirect impacts, cumulative impacts and ecological impacts as a part of the decision-making process. The description of the affected environment and analysis of impacts follow the CEQ NEPA regulations, as amended in May of 2022 and the DOI NEPA regulations.

Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Cumulative impacts refer to the effects on the environment resulting from the incremental impact of the action when combined with other past, present, and foreseeable future actions, regardless of the agency or person undertaking those actions [40 CFR 1508.1(g)(3)]. Ecological impacts (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effects would be beneficial.

For this analysis, direct, indirect, and cumulative impacts were determined for several resources: threatened and endangered species, wildlife resources, vegetation resources, cultural resources, public health and safety, recreation and wilderness, air quality, greenhouse gas emissions and climate change, and environmental justice. The analysis identified ongoing or foreseeable future projects within the project area and incorporated them into the assessment, as summarized in Appendix E.

4.1 Threatened and Endangered Species

4.1.1 Affected Environment

Species that are listed under the Endangered Species Act (1973) and/or the Hawai'i Revised Statutes (Chapter 195D) are at risk of extinction over some or all their distributional range. In addition, the Migratory Bird Treaty Act (MBTA) prohibits the take of listed migratory bird species without prior authorization from the USFWS. The following section only includes impacts analyses for listed species that have potential to be impacted by the no-action alterative and proposed actions. For brevity, listed species that were considered but are unlikely to be impacted by the no-action alterative and proposed action are not included here. A list of these species is provided in Appendix F.

Based on a search of the USFWS rare plants database, 66 federally endangered and two threatened plant species have been recorded within the project area (Appendix F)[4]. Twenty-three of the endangered species are being actively managed as part of the Plant Extinction Prevention Program (PEPP). The remaining species potentially benefit from landscape-level management actions such as the installation of ungulate-proof fences and invasive species control efforts.

In addition to the three endangered (ʻakekeʻe, ʻakikiki and puaiohi) and one threatened (ʻiʻiwi) native forest bird species that have been previously mentioned, the following endangered fauna (Appendix F) are also recorded within the proposed project area: the two seabirds ʻakēʻakē (*Hydrobates castro*) and ʻuaʻu (*Pterodroma sandwichensis*); koloa maoli *(Anas wyvillania)*; nēnē (*Branta sandvicensis*); ōpeʻapeʻa (*Lasiurus cinereus semotus*); one Hawaiian picture wing fly species (*Drosophila Musaphilia*), and the aquatic Newcomb's snail *(Erinna newcombi*) (DLNR 2009a,b, 2011, DLNR 2014, PBR Hawaii 2018). The threatened Newell's shearwater (*Puffinus auricularis newelli*) has additionally been recorded in the project area (DLNR 2011).

Federally designated critical habitat for Newcomb's snail, and lowland wet, lowland mesic, montane mesic, montane wet, wet cliff, and dry cliff forest ecosystems (Appendix F) overlaps the project area. This includes critical habitat for two bird species (ʻakikiki and ʻakekeʻe), one Hawaiian picture wing fly species (*Drosophila musaphilia*), and 117 native vascular plant species (Figures 4 and 5 below).

4.1.2 Potential Impacts from No-Action Alternative

Under the no-action alternative, conditions would remain the same or like those that presently occur within the proposed project area. Current management actions within the project area would continue to be ineffective at controlling southern house mosquitoes and the avian diseases they transmit and carry. In the absence of meaningful interventions, the upslope migration of disease-vectoring southern house mosquito due to climate change is predicted to lead to the gradual loss and eventual elimination of safe habitat for listed forest bird species that are vulnerable to avian malaria and avian pox. Without the direct management of southern house mosquitoes, it is likely that the ʻakekeʻe and ʻakikiki would be driven to extinction within the next decade (Paxton et al. 2022). Populations of the threatened ʻiʻiwi would probably be extirpated on Kauaʻi but would still likely persist in remnant populations on Maui and Hawaiʻi Island at the end of the century (Fortini et al. 2015).

The continued decline of Hawaiian honeycreeper species that serve as pollinators and seed dispersers of threatened and endangered native plants could result in declines for native plant species due to lowered reproduction and seed dispersal. ʻIʻiwi, for example, is potentially the most important extant native bird pollinator as it has the longest bill and is therefore capable of pollinating larger flowered native species (Pender 2013). Numerous plant species (for example, many species of hāhā [*Cyanea* spp.] and ʻōhā wai [*Clermontia* spp.]) are now reliant on this species of bird because of the size of their flowers, which prevent all the remaining native and nonnative bird species from effectively pollinating them. In general, however, predicting which

[4] See Figure 1 for the project area. The area of analysis for the proposed action aligns with this project area except for bird and bat species that range beyond the project area. For these species, the wider island of Kauaʻi is the analysis area.

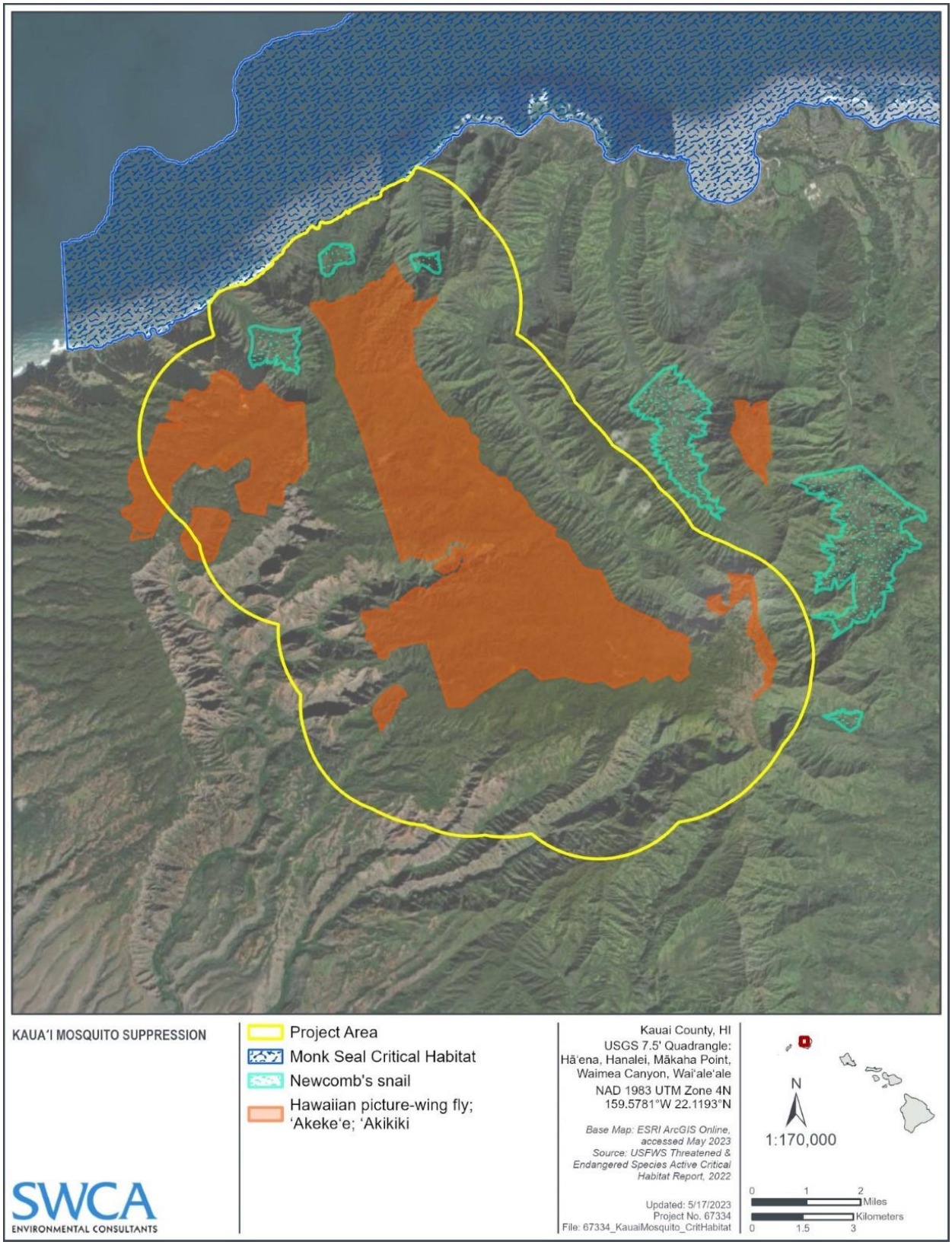

Figure 4. Federally designated critical habitat for fauna in and near the project area.

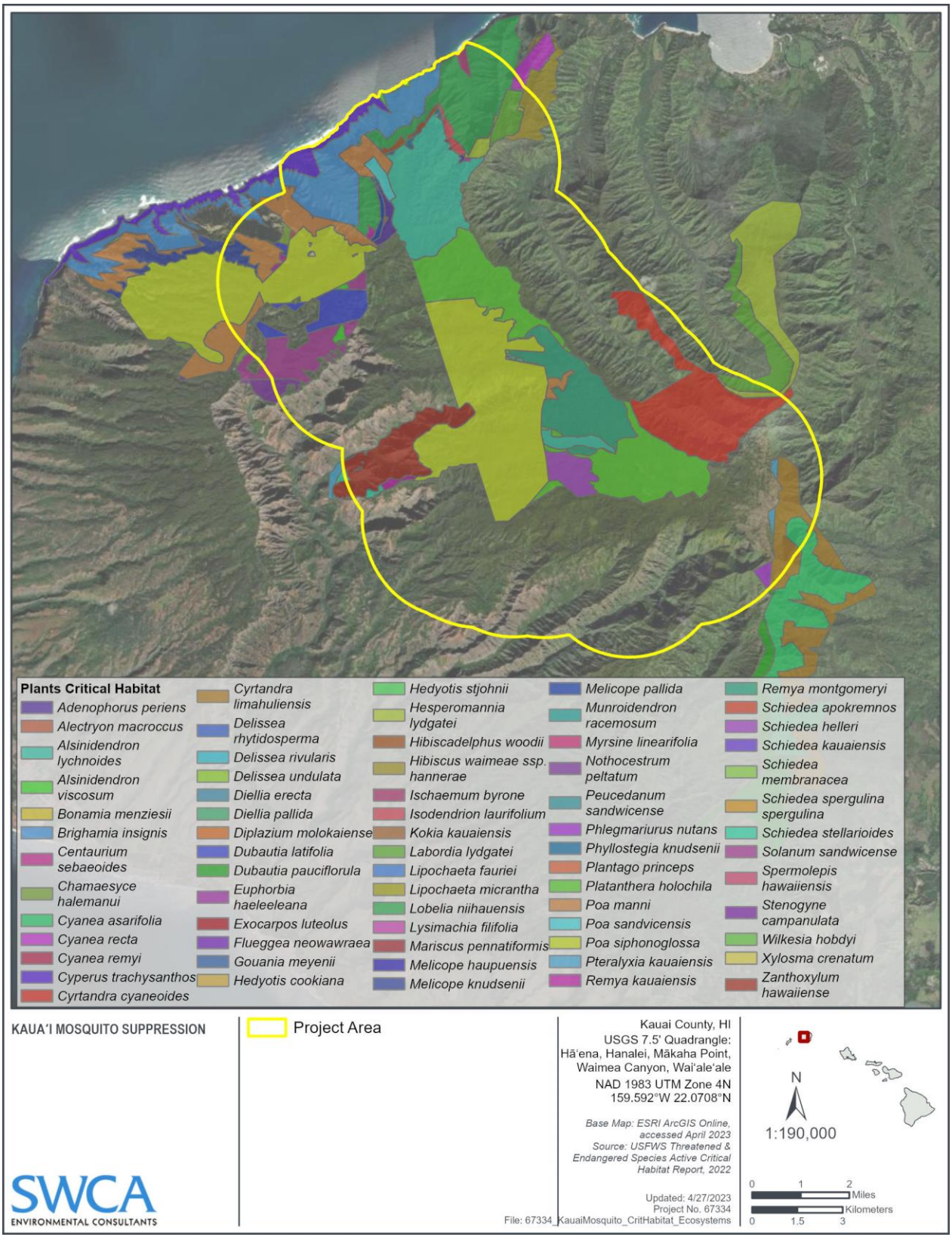

Figure 5. Federally designated critical habitat for plants in and near the project area.

species are most threatened from mutualistic breakdowns is complicated by a limited understanding of pollination and seed dispersal networks in Hawai‘i (Barton et al. 2021).

Ongoing management of the reserves that comprise the proposed project area by DOFAW and its partners, in addition to recreational activity by the general public within the project area, has the potential to unintentionally damage or disturb threatened and endangered plant and animal species. These activities include the construction and maintenance of ungulate exclusion fences, the control of feral ungulates in and outside of these fences, recreational hunting, ongoing monitoring of populations of threatened and endangered species, invasive plant control, wildfire management, and recreational hiking. Due to the lack of 4WD roads and trails, most of the proposed project area is accessed by DOFAW and its partners by helicopters that land at designated landing zones. Some of these landing zones also have campsites or permanent shelters and toilets (DLNR 2011). The use of helicopters has the potential to disturb wildlife through noise and damage native plants through rotor wash, including those that are threatened and endangered. All land management agencies that work within the reserves that comprise the proposed project area follow existing state and Federal biosecurity SOPs (Appendix D) to ensure that management activities limit the spread of invasive species to, within, and among the reserves (DOFAW 2011b).

4.1.3 Potential Impacts from Proposed Action

The impacts of the proposed action would be the same as those outlined in section 4.1.2 for the no-action alternative with the addition of the effects and impacts of reducing populations of southern house mosquito through the release of incompatible male mosquitoes within the proposed project area. The impacts of the proposed action are summarized below.

The control of southern house mosquito within the project area are expected to reduce populations of this invasive mosquito species and lower the incidence of avian malaria and avian pox transmission to listed Hawaiian birds, including the two endangered (‘akeke‘e and ‘akikiki) and one threatened (‘i‘iwi) Hawaiian honeycreeper species that occur within the proposed project area. Successful mosquito control through released incompatible mosquitoes has been successfully implemented in 14 countries throughout the world to control mosquitoes that carry human diseases, including four cities in the United States (O’Conner et al. 2012, Hoffmann et al 2014, Mains et al 2016, Schmidt et al. 2017, Crawford et al. 2020).

If all other limiting factors are simultaneously managed (e.g., competition with nonnative bird species, genetic impacts associated with small population sizes, mammalian predation, and habitat degradation from feral ungulates) (Freed et al. 2008, Camp et al. 2010, Mounce et al. 2015, Banko et al. 2019), the release of incompatible male mosquitoes and the resulting population reductions of disease-vectoring southern house mosquitoes could potentially stabilize populations of ‘akeke‘e,‘akikiki, and other honeycreepers and avian species of concern over sustained periods of time. This could prevent the global extinction of these species and allow their populations to expand within suitable habitat on Kaua‘i. Likewise, sustaining viable habitat where mosquitoes are suppressed for Kaua‘i honeycreepers would allow populations of this species to expand and, with available habitat on Maui and Hawai‘i Island, would ensure that this species maintains evolutionally and ecologically viable populations over the coming decades if all other limiting factors are also managed.

Tangible reductions in southern house mosquito and the incidence of avian malaria/avian pox, would have positive impacts including increased listed as well as native bird populations and thereby partial restoration of mutualisms (pollination and seed dispersal) for threatened and endangered plant species that are reliant on bird pollination and seed dispersal. The iʻiwi, for example, are potentially the most important extant native bird pollinator for large-flowered plant species. Increases in populations of this species may benefit the reproduction of listed bird pollinated plant species. An increase in pollination and seed dispersal of listed and other native plant species could potentially increase populations of these plant species if pollination and seed production are currently limited by the loss or drastic decline of avian mutualists.

Avian malaria is occasionally recorded in seabirds on Kauaʻi and has been implicated in the death of at least one threatened Newell's shearwater (Molly Bache, Save Our Shearwaters, 2022 pers. comm.). Although avian malaria appears to be rare in seabirds on Kauaʻi (André Raine, Archipelago Conservation and Research, 2022 pers. comm.), the control of southern house mosquitoes within the project area may reduce the limited cases of this disease that are recorded in the three threatened and endangered seabird species that occur within the project area.

Listed seabirds are active during the dusk to dawn hours (nighttime) when they may be in flight or outside of their burrows. The sounds and visual effects of the delivery methods that are proposed to occur durring the daylight after dawn and before dusk are not expected to impact seabirds in their burrows.

Reductions in southern house mosquito populations within the proposed project area are unlikely to tangibly impact foraging resources for ōpeʻapeʻa. This bat species has a generalist diet comprised of a diverse range of insect orders, principally feeding on larger insects such as beetles and moths, rather than tiny mosquitoes (Pinzari et al. 2019) because the bat did not evolve in an ecosystem that included mosquitoes as an available food resource.

The impacts of vegetation disturbance on endangered Hawaiian picture wing fly species are likely negligible. *Drosophila musaphilia* feeds on fungi and bacteria on decomposing plant material that is more likely to be on the forest floor, while *D. musaphilia* breeds in the sap fluxes from koa trees. As koa is common within the landscape, any trimming or damage of koa is unlikely to impact this picture wing fly species (USFWS 2012).

The impacts of the control of southern house mosquitos on the population dynamics of other invasive mosquitoes within and near the project area are unknown. There is very little existing research concerning the population dynamics of non-target mosquito species following the control or eradication of one or more mosquito species within an area. Any increase in the populations of non-target mosquito species in the project area resulting from the control of southern house mosquito would likely be due to increases of available habitat and resources for the non-target species. However, it is probable that the mosquito species, and particularly the females of the species present within the project area, are more likely limited by lack of blood hosts than by available habitat. Lafferty et al. (2018) found that Asian tiger mosquito went extinct on Palmyra Atoll following the eradication of black rats (*Rattus rattus*) while the ornithophilic (i.e., preferring birds) southern house mosquito persisted, suggesting that black rats were sustaining the persistence of the Asian tiger mosquitoes.

4.1.3.1 PEDESTRIAN RELEASE AND MONITORING

The pedestrian release of incompatible male mosquitoes and subsequent monitoring of the mosquito population may impact listed species from the following activities:

- The trampling and disturbance of listed native plants and invertebrates, and the disturbance of native forest birds within transport corridors such as roads, trails or fence-lines, or at discrete sites such as campsites, long-term monitoring sites, and LZs due to vehicle or personnel movement
- Secondary impacts from the dispersal and establishment of invasive species as a result of proposed project activities

Because of their relative scarcity across the landscape, there is a low risk that listed native insects, snails, or plants would be trampled or damaged by project vehicles or personnel within the project area. All releases of incompatible male mosquitoes and monitoring would be undertaken from existing transport corridors and sites. This increases the chances of avoiding species that are vulnerable to trampling (e.g., native gastropods, non-volant insects, and plants) by limiting activity within established corridors and sites. In addition, as these transport corridors and sites are frequently used by DOFAW and partner staff, the location of populations of listed plants and non-volant fauna species are often known and can be avoided during the project. Any unintentional damage or death of listed species as a result of trampling will be avoided by employing qualified personnel who adhere to SOPs (Tables 4 and 5; Appendix D) regarding the use of vehicles, trails, and other backcountry infrastructure. If these measures are taken, the impacts of elevated foot and vehicle traffic are expected to be negligible.

Vehicles and personnel within the project area may disturb wildlife during the project, particularly listed forest birds. This may result in brief flight responses but are unlikely to cause lasting impacts to these bird species due to the relative infrequency of the pedestrian field operations. These disturbances will be short duration and are unlikely to result in significant adverse impacts to these birds.

The release and monitoring of incompatible male mosquitoes would temporarily increase human and vehicle traffic within the proposed project area, which can transport invasive microorganisms (e.g., spores and soil containing bacterial cells), plant propagules (seeds and vegetative sections), and eggs or live individuals of animals either into or between sites in the project area. The potential impacts of spreading invasive species to the project area are varied, ranging from nominal effects such as the dispersal of ruderal weeds along the margins of existing trails through to consequential impacts such as the accidental spread of the fungal pathogens that cause rapid ʻōhiʻa death, which could negatively impact listed native plant species in the subcanopy. However, implementation of existing biosecurity SOPs by qualified personnel during project implementation, would be expected to negate the risk of spreading invasive species.

4.1.3.2 HELICOPTER AND FIXED-WING AIRCRAFT AERIAL RELEASE

Helicopters and fixed-wing aircraft are proposed for use to disperse incompatible male mosquitoes throughout parts of the project area that are inaccessible by other means. The potential impacts for listed species from the use of these aircraft are as follows:

- Disturbance of listed native birds from helicopter rotor wash, visual detection, and noise from helicopter and fixed-wing aircraft
- Collision of listed and other wildlife with helicopters and fixed-wing aircraft
- Death or injury of listed terrestrial invertebrates or plants due to crushing by helicopter skids and personnel, and helicopter rotor wash and exhaust within the immediate vicinity of LZs
- Potential dispersal of invasive species by helicopters and the personnel and equipment that they transport
- Potential death or injury of listed and other wildlife, or destruction of habitat, by wildfire caused by helicopters

Noise-related impacts from helicopter operations could potentially disturb threatened and endangered native birds, particularly forest birds. The average sound volume of a Hughes 500 helicopter, the most common model used for natural area access in Hawaiʻi, ranges from 76 to 90 decibels when passing 150 ft/45 meters at 85-125 knots above ground level (the zone in which helicopter longline operations would occur) (Newman et al. 1984). Noise from the helicopter, however, would be present within a particular area for relatively short periods of time (15 seconds or less). Studies of the effects of helicopters on native and nonnative forest birds in Hawaiʻi found that helicopter noise volumes of 75 decibels or greater impacted bird vocalizations (Gallardo Cruz et al. 2021), implying that the bird species could potentially be affected by helicopter operations that occur over sustained periods of time. Due to the operating height of the helicopter, rotor wash is unlikely to impact the forest canopy during flight and would instead be limited to the margins of LZs during take-off and landing during loading and personnel transport operations. This would greatly reduce any potential areas of impact for listed native wildlife from helicopter rotor wash to the immediate areas around LZs.

The duration and frequency of helicopter use will be the minimum necessary to complete aerial releases when drone-based or pedestrian releases are not a viable option. Minimizing flight times would reduce any potential adverse effects to native wildlife (both listed and non-listed) including noise and/or visual disturbances, rotor wash, or collisions, and is also crucial for fiscal and logistical project planning and implementation. There is a low potential that fixed-wing aircraft would disturb listed native wildlife (principally native birds) during take-off, flight, and landing within both the proposed project area and wider analysis area (wider island). These impacts are anticipated to elicit only short-term avoidance responses (i.e., flight) from listed and non-listed birds to the noise of the aircraft during flight operations. However, there is also a low possibility of listed bird species colliding with fixed-wing aircraft, particularly during aircraft take-off and landing (FAA 2021).

The potential for listed and non-listed bird species to collide with helicopters during dispersal and transport operations is extremely low due to the relative speeds at which helicopters fly. Similarly, there is also a low probability that listed and non-listed bird species would collide with fixed-wing aircraft either within the proposed project area or analysis area. Despite this low probability, collisions with larger bird species such as the threatened nēnē cannot be totally ruled out. For example, data from the FAA bird strike database (https://wildlife.faa.gov/search) for Līhuʻe Airport between 1990 and the end of 2022 indicate that bird strikes involving listed species are rare (~ 2% of the 1,164 strikes that identified the impacted species); koloa maoli and

Newell's shearwater accounted for all but one of the strikes that killed a nēnē. In addition, collisions between aircraft and birds also have the low potential to cause injury or death of personnel and material damage or loss of aircraft (See Section 4.5.3.2 for more detail). The project is therefore not anticipated to impact listed and non-listed species through bird strike due to the extremely low likelihood of occurrence, daytime only flight schedule, and infrequency of the actual project flights.

Listed and non-listed invertebrates and plants may also be killed or injured by personnel that are transported to LZs by helicopters and by the helicopter rotor wash, exhaust, and skids within and on the margins of LZs. The effects of these impacts are likely to be limited to occasional disturbances in discrete areas within the immediate vicinity of the LZs. However, these impacts would be reduced to negligible by employing qualified personnel who receive training regarding the listed species and host plants that are present within the proposed project area.

The dispersal of incompatible male mosquitoes throughout the project area would require the use of LZs for landing and taking off. Although no native vegetation is proposed for removal from the margins of the LZs, there is a low risk that threatened and endangered native plant species would be impacted by trampling and crushing by personnel within and immediately adjacent to these LZs, and from helicopter downdraft when approaching/departing LZs from low altitudes.

Helicopters and the project personnel and equipment that they transport could also potentially spread invasive microorganisms, plants, and animals into and within the project area on helicopter skids and contaminated footwear, clothing, and equipment. Through the implementation of avoidance and minimization measures and biosecurity SOPs (Tables 4 and 5; Appendix D), the effects of these adverse impacts would however be negligible.

The potential disturbance to listed native wildlife from helicopter and fixed-wing aircraft operations as part of the project would likely occur infrequently over short periods, which would reduce the potential lasting impacts for listed native flora and fauna. The indirect impacts to listed native species from accidentally dispersing invasive species during helicopter operations would effectively be avoided by the adoption of biosecurity SOPs (Appendix D). Overall, the impacts of helicopter and fixed-wing aircraft operations during the proposed project could be greatly minimized through limiting their use in favor of other dispersal measures. For helicopter operations specifically, the adoption of existing biosecurity SOPs would greatly reduce the potential dispersal of invasive species to and within the project area. If these measures are followed, the impacts from these operations would be greatly minimized.

Although helicopters and fixed-wing aircraft could ignite backcountry wildfires that could kill native wildlife and/or destroy critical habitat on which they rely, the potential for this is very low and does not exceed risks posed by standard resource management actions currently ongoing in the proposed project area. All crewed aircraft will be operated adhering to guidance and policies established by the FAA. Helicopter operations will additionally follow the best practice protocols established by the National Wildfire Coordinating Group, which provides guidance detailed in the Interagency Helicopter Operation Guide (NWCG 2016). DOFAW is mandated under the Land Fire Protection Law, Chapter 185, Hawaiʻi Revised Statute to take measures for the prevention, control, and extinguishment of wildland fires within all forest reserves and natural area reserves on Kauaʻi (DOFAW 2018). This agency is statutorily required to cooperate with county and Federal government fire control agencies to develop plans for wildfire prevention.

The Kauaʻi County Fire Department, in coordination with the DOFAW Fire Management Program, will respond to any on-site emergency, including downed helicopters and fixed-wing aircraft to ensure that there is no risk of wildfire.

4.1.3.3 DRONE RELEASE

Drones could be used to release incompatible male mosquitoes throughout the project area. This would require the use of existing 4WD roads, pedestrian trails, and LZs. Like the pedestrian release and monitoring described in section 4.1.3.1, the following impacts could occur during the drone operations:

- Crushing or trampling of listed plant or invertebrate species within and on the margins of 4WD roads by vehicles and pedestrians, and by project personnel on trails, campsites, and in and on the margins of LZs
- Disturbance of listed native wildlife, particularly native forest birds, from drone visual detection and noise and onsite presence of project personnel
- Collisions of listed and other species of wildlife with drones
- Potential dispersal of invasive species by project vehicles, personnel, and equipment
- Potential death or injury of listed and other wildlife, or destruction of habitat, by wildlife caused by drones

Species of listed native invertebrates and plants could potentially be disturbed, injured, or killed by pedestrians and vehicles within and on the margins of 4WD roads, pedestrian trails, campsites, and LZs during drone operations. These impacts, however, are likely to be limited and can be effectively managed as outlined in Tables 4 and 5 and Appendix D.

The use of drones could disturb listed diurnal fauna during release operations. Listed native forest birds are at the greatest risk of disturbance because they are active during daylight hours and occur within or near the forest canopy. No studies have been undertaken to determine how drones impact native forest bird behavior in Hawaiʻi. A recent study of helicopter noise found that the aircraft didn't impact bird vocalizations when sound levels were below 75 decibels (Gallardo Cruz et al. 2021). As drones are considerably quieter than helicopters, this study implies that their use would avoid significant adverse impacts to the behavior of listed native forest birds. Due to the height above canopy at which drones would operate, and the intermittent nature of these operations with drones spending very short periods of time in one area, we do not anticipate negative impacts from the sight or sound of drone operations.

Although the potential for collisions between drones and threatened and endangered fauna (principally birds) is very low, it cannot be fully ruled out (Rebolo-Ifrán et al. 2019). Species that fly well above the canopy in seasonal flocks, such as endangered nēnē during the summer months, are potentially at the greatest risk of colliding with drones due to the flock creating a larger collision area and the increased risk of distress responses (e.g., evasive flying maneuvers) within flocks. In the rare instance that a drone collides with a transiting bird, active avoidance measures would be used by pilots, which could include manually slowing forward flight to a stationary hover, manually decreasing altitude, or initiating an automated return home command to the aircraft.

Similar to the helicopter aerial releases described in Section 4.1.3.2, personnel and equipment involved with drone operations could potentially spread invasive organisms to and within the project area. These invasive organisms could have detrimental impacts on threatened and endangered native wildlife within the project area. These impacts, however, would be greatly reduced through adherence to avoidance and minimization measures and biosecurity SOPs (see Appendix D).

Additionally, drones could ignite backcountry wildfires that could kill native wildlife and/or destroy critical habitat on which they rely. However, the likelihood of this occurring is extremely low. All drones will be closely monitored by the operator and field teams while adhering closely to the guidance and policies established by the FAA. Drone operators under DOFAW operational control will be required to hold an up-to-date FAA 14 CFR Part 107 Remote Pilot Certificate and FAA Certificate of Waiver or Authorization. All drone operations will additionally follow best practice protocols established by the National Wildfire Coordinating Group, which provides guidance detailed in the Interagency Helicopter Operation Guide (NWGS 2016). As discussed in Section 4.1.3.2, DOFAW is required by law to take measures to prevent, control, and extinguishment of wildland fires within all forest reserves and natural area reserves on Kaua'i (DLNR, DOFAW 2018). The agency must cooperate with county and Federal fire control agencies to develop wildfire prevention plans and DOFAW's Fire Management Program will coordinate with Kaua'i County Fire Department to respond to any on-site emergency, including downed drones, to ensure that there is no risk of wildfire.

4.1.4 Cumulative Impacts

Foreseeable future activities within the project area (see Appendix E) include professional, subsistence and recreational hunting of feral ungulates, the management of other invasive mammals (primarily rats [*Rattus* spp.]) and invasive plant species, the installation and maintenance of ungulate proof fences, trail maintenance, camping for recreational and natural resource management purposes, tree harvesting along roadways, collection of material for cultural and research purposes, hiking, and the ongoing management of natural resources by organizations that partner with DOFAW (e.g., Kaua'i Forest Bird Recovery Project, The Nature Conservancy). As described in Appendix E, these activities would continue to occur in the future at existing or slightly increased levels.

4.1.4.1 PLANTS

Considering the past, present, and foreseeable future activities described in this section, the no-action alternative would not contribute additional impacts to rare or listed plants. Trends and impacts to the plants would be expected to remain the same. This includes the potential extirpation or extinction of native forest bird species due to uncontrolled avian malaria, which could potentially have a detrimental impact on native Hawaiian plants, including listed plants and plant species at risk due to the loss of pollinators. Compared to the no-action alternative, the proposed actions taken to suppress mosquito populations that carry avian malaria would support recovery of listed native Hawaiian birds, reducing the likelihood for extirpation or extinction of these species. This could potentially have a beneficial impact on the native Hawaiian plants, which rely on native forest birds for pollination. The proposed alternative would potentially have an adverse impact on listed plant species, designated critical habitat, and plant species at risk

from vegetation clearing and trampling and increased risk of invasion or spread of invasive plants or pathogens. However, with implementation of minimization and avoidance measures described in Table 4 and Appendix D, adverse impacts under the proposed alternative would be negligible for plants.

4.1.4.2 ANIMALS

Considering the past, present, and foreseeable future activities described in this section, the no-action alternative would not contribute additional impacts to rare or listed animal species. Trends and impacts from planned foreseeable actions would be expected to remain the same of similar to what is currently occuring. Under the no-action alternative, continued declines of rare and listed forest birds species is expected, potentially leading to extirpation or extinction of such species.

Compared to the no-action alternative, the proposed alternative could result in rare and listed wildlife being exposed to adverse impacts primarily in the form of noise or visual disturbance to wildlife from drones, helicopters, pedestrian activities, and generators; indirect impact of increased risk of invasive species introduction from failed biosecurity during field operations; potential for trampling of invertebrate species, and an increased risk of wildlife collision. The most pronounced risk of impacts from noise disturbance, risk of collision, or biosecurity lapses would occur in the vicinity of LZs, helibases, campsites, fence lines, roads, and trails. Adverse impacts would be intermittent and of short duration and would infrequently affect individual birds and other wildlife.

The impacts from the proposed action and the foreseeable actions can be effectively reduced to negligible levels using the avoidance and minimization measures outlined in Tables 4 and 5, and in Appendix D. Although there would be temporary and localized impacts to wildlife from mosquito release activities, the population and health of rare and listed species and their habitats would improve or remain stable. As previously described, the proposed action would directly reduce mortality of listed Hawaiian forest bird species due to the suppression of mosquitoes that spread avian malaria. The proposed action along with other planned foreseeable state and private management actions, including invasive plant control, feral ungulate control, and fence maintenance, would enhance survival of native forest bird species by reducing stressors. Over time, the populations of these listed bird species may increase due to the combined actions of the agencies and private partners to manage for avian malaria and other threats. Therefore, the overall cumulative increment of the proposed action would be substantially beneficial.

4.2 Wildlife Resources

4.2.1 Affected Environment

The project area[5] provides ecologically important habitat for non-listed native wildlife and nonnative game animals and other nonnative animal species. Non-listed native bird species that occur within the project area include the forest bird species ‘apapane, ‘anianiau, Kaua‘i ‘amakihi,

[5] See Figure 1 for the project area. The area of analysis for the proposed action aligns with this project area except for bird and bat species that range beyond the project area. For these species, the wider island of Kaua‘i is the analysis area.

and Kaua'i 'elepaio, black-crowned night heron ('auku'u*; Nycticorax nycticorax hoactli*), the Hawaiian short-eared owl (pueo*; Asio flammeus sandwichensis*), and the native seabird species black noddy (*Anous minutus*), brown booby (*Sula leucogaster*), great frigatebird (*Fregata minor palmerstoni*), red-tailed tropicbird (*Phaethon rubicaudai melanorhynchos*) and white-tailed tropicbird (*Phaethon lepturus dorothea*) (DLNR 2009a,b, 2011, 2014).

The natural areas that comprise the project area provide habitat for a range of non-listed invertebrates including four pinao (damselfly) species (*Megalagrion heterogamies*, *M. oresitrophum*, *M. orobates*, and *M. vagabundum*), the rare fabulous green sphinx moth (*Tinostoma smaragditis*), the moth *Omiodes monogramma*, moths in the genus *Hyposmocoma*, seed bugs in the genus *Nysius*, spiders in the genus *Tetragnantha*, and a long-legged fly *Sigmatineurum napali* (Gillespie 1992, Evenhuis et al. 1994, Parnham 2008, DLNR 2009a, Schmitz and Rubinoff 2010 a, b). The proposed project area is likely to provide habitat for many additional native insect and snail species.

Nonnative game animals that are present within the project area include three feral ungulate species (Columbian black-tailed deer [*Odocoileus hemionus columbianus*], goats [*Capra hircus*], and pigs) (DLNR 2009a, b, 2011, PBR Hawaii 2018). Recreational hunting of these game animals within State-managed lands is overseen by DOFAW's Wildlife Program under the auspices of HRS Title 13, Chapter 123.

Other invasive, nonnative mammals that are present within the project area include cats (*Felis catus*), rats (Norway rat [*Ratus norvegicus*], Pacific rat [*R. exulans*], and black or ship rat [*R. rattus*]), and mice (*Mus musculus*) (DLNR 2009a, b, 2011, 2014, PBR Hawaii 2018). Feral dogs (*Canis familiaris*) may also be present.

Nonnative game birds that likely occur within suitable habitat in the project area include ring-necked pheasant (*Phasianus colchicus*), green pheasant (*Phasianus versicolor*), white-winged pheasant (*Phasianu colchicus chrysomelas*), Erckels' francolin (*Francolinus erckelii*), Japanese quail (*Coturnix japonica*), chukar partridge (*Alectoris chukar*), gray francolin (*Francolinus pondicerianus*), black francolin (*Francolinus francolinus*), zebra dove (*Geopelia striata*), and spotted dove (*Streptopelia chinensis*) (DLNR 2011, 2014). The recreational hunting of these game birds on DLNR-managed land is administered by DOFAW's Wildlife Program according to HRS Title 13, Chapter 122.

A range of other nonnative bird species also occur within the project area. These include species listed under the Migratory Bird Treaty Act (MBTA) of 1918 such as barn owl (*Tyto alba*), cattle egret (*Bulbulcus ibis*), house finch (*Haemorhous mexicanus*), and northern cardinal (*Cardinalis cardinalis*). Other nonnative non-MBTA species that occur within the project area include Chinese hwamei (*Garrulax canorus*), common myna (*Acridotheres tristis*), house sparrow (*Passer domesticus domesticus*), Japanese bush warbler (*Cettia diphone*), scaly-breasted munia (*Lonchura punctulata*), red-crested cardinal (*Paroaria coronata*), warbling white-eye (*Zosterops japonicus*), and white-rumped shama (*Copsychus malabaricus*) (DLNR 2009b, 2011, 2014).

The isolated, higher elevation streams within the project area provide habitat for 'ōpae kala'ole (*Atyoida bisulcata*), an endemic native shrimp species, and four fish species: 'o'opu akupa (*Eleotris sandwicensis*) and three goby species: 'o'opu nakea (*Awaous stamineus*), 'o'opu alamo'o (*Lentipes concolor*), 'o'opu nopili (*Sicyopterus stimpsoni*) (DLNR 2009b, Parham et al.

2008). Introduced rainbow trout (*Oncorhynchus mykiss*) occur within the project area (DLNR 2014). In addition, two non-listed mollusk species, hīhīwai (*Neritina granosa*) and *Lymnaea aulacospira*, have been recorded within the Hono O Nā Pali Natural Area Reserve and may also occur elsewhere within the proposed project area (DLNR 2011).

4.2.2 Potential Impacts from No-Action Alternative

As outlined in Section 4.1.2, the upslope migration of disease-vectoring southern house mosquito due to climate change is predicted to lead to the gradual loss and eventual elimination of disease-free habitat for vulnerable native forest bird species. Three non-listed forest bird species present within the proposed project area are vulnerable to avian malaria and avian pox: ʻapapane, ʻanianiau, and Kauaʻi ʻamakihi. Populations of these species are expected to slowly decline by 2100 due to a drastic reduction of mosquito-free habitat (Benning et al. 2002, Fortini et al. 2015). Small populations of some species (e.g., ʻapapane and Kauaʻi ʻamakihi) may however persist in lower numbers due to potential disease resistance (Woodworth et al. 2005, Atkinson et al. 2013).

The ongoing impacts of this invasive mosquito species on native and nonnative wildlife, other than forest birds (native and nonnative insects, birds, fish, freshwater invertebrates, and nonnative mammals), are unknown.

The ongoing management and recreational activities within the reserves that comprise the proposed project area are summarized in Section 4.1.4.

4.2.3 Potential Impacts from Proposed Action

The impacts of the proposed action would be the same as those outlined in section 4.2.2 for the no-action alternative except for the effects of reducing populations of southern house mosquito through the release of incompatible male mosquitoes within the proposed project area. The impacts of the proposed action for non-listed wildlife are the same as for the proposed action described in Section 4.1.3. For brevity, only potential impacts that differ from those described in that section are summarized below.

The interactions between invasive mosquitoes and native insects and other non-avian native animals (fish, snails, bats) in Hawaiʻi are poorly understood. It is possible that native and introduced fish eat mosquito larvae, but the reduction in this mosquito species is unlikely to impact fish species due to the presence of other mosquito species and the abundance of introduced aquatic invertebrates (i.e., native fish and introduced trout are unlikely to be food limited).

4.2.3.1 PEDESTRIAN RELEASE AND MONITORING

As addressed in Section 4.1.3.1, incompatible male mosquitoes would be released on foot in accessible areas of the project area. Trailheads would be accessed using 4WD vehicles and all-terrain vehicles (ATVs). The potential impacts and mitigation measures for this increased pedestrian traffic for native wildlife are the same as described in Section 4.1.3.1.

4.2.3.2 HELICOPTER AND FIXED-WING AIRCRAFT AERIAL RELEASE

As outlined in Section 4.1.3.2, helicopters would be used to disperse incompatible male mosquitoes throughout parts of the project area that are inaccessible by other means. Helicopters are also likely to be used to ferry project personnel throughout the project area. The potential impacts and mitigation measures for native wildlife from the use of helicopters and fixed-wing aircraft during the course of the proposed project are the same as described in Section 4.1.3.2.

4.2.3.3 DRONE RELEASE

As outlined in Section 4.1.3.3, drones would be used to release incompatible male mosquitoes throughout the project area. This would require the use of existing 4WD roads, pedestrian trails, and LZs. The potential impacts and mitigation measures for native wildlife from the use of drones to disperse incompatible male mosquitoes during the proposed project are the same as described in Section 4.1.3.3.

4.2.3.4 CUMULATIVE IMPACTS

As described in Section 4.1.4, considering the past, present, and foreseeable future activities, the no-action alternative would not contribute additional impacts to the wildlife species beyond that of the ongoing and future known activities already occurring. Trends and impacts from planned foreseeable actions would be expected to remain the same of similar to what is currently occuring.

The proposed action would result in similar or identical cumulative impacts as described in section 4.1.4 for Federal and state listed wildlife. The proposed action would result in limited adverse cumulative impacts to wildlife resources that would result from the presence of people, drones, or helicopters used for implementation of the proposed action. These proposed actions would be short lived and intermittent in nature. The impacts from the proposed action and the past, present, and foreseeable future actions can be effectively reduced to negligible levels using the avoidance and minimization measures outlined in Tables 4 and 5, Appendix D, and the implementation of existing SOPs as described for listed species. Although the project would cause negligible, periodic and short-term adverse impacts (e.g. increased air and foot traffic), success of the project would reduce the prevalence of nonnative *Culex* mosquitoes in the Kaua'i wilderness environment. Suppression of nonnative mosquito populations in turn, indirectly impacts the rate of avian malaria. The indirect impact would result in long-term beneficial indirect impacts to general wildlife or wildlife habitat. Successful implementation of the proposed action would result in cumulative impacts that are overwhelmingly beneficial for wildlife resources that occur within the proposed project area.

4.3 Vegetation Resources

4.3.1 Affected Environment

Approximately half the project area (30,275 acres/12,251 hectares) contains montane native wet forest and shrubland that primarily comprises a canopy of ʻōhiʻa (*Metrosideros polymorpha*) and to a lesser extent koa (*Acacia koa*) that occurs between 730 and 5,220 ft elevation (222 – 1,591 m). These areas of forest typically contain a dense understory of native trees and shrubs such as

kōlea lau nui (*Myrsine lessertiana*), ʻōhiʻa hā (*Syzygium sandwicensis*), and ʻōlapa (*Cheirodendron* spp.); sedges such as *Gahnia vitiensis* subsp. *kauaiensis* and ʻuki (*Machaerina angustifolia*); and ferns, principally uluhe (*Dicranopteris linearis*) (Gon et al. 2006, DLNR 2011). Close to a third of the project area (16,258 acres/6,580 hectares), primarily at lower elevations (sea level to 4,700 ft; 0 – 1,432 m), contains nonnative forest and shrubland (10 – 5,080 ft; 3 – 1,548 m). The remaining vegetation and landcover types include smaller areas of native dry forest and shrubland (560 – 4,310 m; 170 – 1,313 m) (2,316 acres/937 hectares), native vegetation on wet and dry cliffs (670 – 5,190 ft; 204 – 1,581 m) (6,916 acres/2,798 hectares), nonnative grassland (70 – 4,120 ft; 21 – 1,255 m) (860 acres/348 hectares), and unvegetated areas (30 – 5,080 ft; 9 – 1,548 m) (2,252 acres/911 hectares).

4.3.2 Potential Impacts from No-Action Alternative

Under the no-action alternative, there would be no new impacts to vegetation within the project area and conditions would continue to be the same or very similar to their current state. However, if avian malaria and avian pox continue to cause the decline of Hawaiian honeycreeper species that serve as pollinators and seed dispersers of certain native plants, there could be longer term population declines for native plant species due to lowered reproduction and seed dispersal. Despite this general assumption, predicting which species are most at threat from mutualistic breakdowns is complicated by our limited understanding of pollination and seed dispersal networks in Hawaiʻi (Barton et al. 2021). The ongoing management and recreational activities that impact or protect native vegetation within the natural area reserves that comprise the proposed project area are summarized in Section 4.3.4.

4.3.3 Potential Impacts from Proposed Action

The impacts of the proposed action would be the same as those outlined in section 4.3.2. for the no-action alternative with the addition of the beneficial effects of reducing populations of southern house mosquito through the release of incompatible male mosquitoes within the proposed project area. The impacts of the proposed action are summarized below.

The release and monitoring of incompatible male mosquitoes through the proposed action would result in an increase in human, vehicle, and helicopter traffic within the proposed project area. This increased traffic could potentially transport invasive microorganisms (e.g., spores and soil containing bacterial cells), plant propagules (seeds and vegetative sections), and eggs or live individuals of animals either into or between sites in the project area. The potential impacts of spreading invasive species to the project area are varied, ranging from nominal effects such as the dispersal of ruderal weeds along the margins of existing trails, to consequential impacts such as the accidental spread of the fungal pathogens that cause rapid ʻōhiʻā death. Increased foot, vehicle, and aircraft traffic would also result in damage to native vegetation within and on the immediate margins of hiking trails, fence lines, four-wheel-drive roads, campsites, and helicopter LZs due to trampling and in the case of helicopter LZs, downdraft from the helicopter rotors when flying at very low altitudes. This may lead to the localized damage or death of native plants within and on the margins of this transport infrastructure. Potential effects from introducing or spreading invasive species will be avoided by implementation of Biosecurity Protocols (See appendix D).

Incompatible male mosquitoes may be released directly or in small biodegradable packages designed to open on contact when reaching the canopy or forest floor. Packages would be composed of weed-free, environmentally friendly material derived from plants. The material used would have been heat treated during the manufacturing process, which reduces the likelihood of introduction of any foreign contaminants or invasive species, like other plant-based media products commonly used in forestry/reforestation projects. Although many thousands of release packages would be dropped across the project area throughout the duration of the project, the small packages would be spread diffusely and the biodegradable material would decompose quickly given the typical rainfall patterns in the project area, making the chance of observing multiple packages unlikely. Based on the degradable nature of the delivery packages and diffuse nature, the impacts on plant habitat are negligible.

Should the proposed action result in tangible reductions in southern house mosquitos and avian malaria/avian pox, we expect a beneficial impact from increasing native bird populations and the partial restoration of mutualisms (pollination and seed dispersal) for native plants. Potential increases in populations of ‘anianiau, ‘apapane, and Kaua‘i ‘amakihi, for example, could benefit the reproduction of ‘ōhi‘a and smaller-flowered species of native plants. An increase in native bird populations of species such as Kaua‘i ‘amakihi would likewise benefit the dispersal of native plant seeds as native bird species overwhelmingly forage on these plants compared to nonnatives (Wu et al. 2014, Kaushik et al. 2018). An increase in pollination and seed dispersal of native plant species could potentially increase the resiliency of ecosystems to encroachment from invasive species as well as the persistence of those native plant species that are being pollinated or dispersed.

4.3.3.1 PEDESTRIAN RELEASE AND MONITORING

As stated in Section 4.1.3.1, the proposed action would result in increased foot traffic within existing trail systems, fencelines, campsites, and helicopter LZs. There is potential under the proposed action for minimal adverse impacts to vegetation from localized plant removal or disturbance along trails, fencelines, and at landing zones and camps by ground crews. These impacts would be temporary in nature and largely occur in previously disturbed locations. In addition, these activities have been approved through previous environmental compliance of the State. To minimize any vegetation or ground disturbance, monitoring efforts and the dispersal of incompatible mosquitoes via ground-based pedestrian releases would be conducted on existing resource management trails and fence lines to avoid disturbance of soils and plant communities. Additionally, best management practices (Appendix D) would be implemented to reduce or remove the threat of introducing invasive plants within the project area; however, a risk of introduction still exists. Crews would be trained to follow BMPs to minimize this risk (Table 4, Appendix D). The potential impacts to and avoidance and minimization measures for native vegetation from this increased pedestrian traffic are the same as described in Section 4.1.3.1.

4.3.3.2 HELICOPTER AND FIXED-WING AIRCRAFT AERIAL RELEASE

As stated in Section 4.1.3.2, helicopters and fixed-wing aircraft are proposed for use to disperse incompatible male mosquitoes throughout parts of the project area that are inaccessible by other means. Helicopters would also be used to ferry project personnel throughout the remote parts of the project area and would require the use of LZs for landing and taking off. The potential impacts and mitigation measures for native vegetation from the use of helicopters during the

proposed project area are the same as described in Section 4.1.3.2. No impacts to native vegetation are likely to result from aerial releases of incompatible male mosquitoes using fixed-wing planes as these aircraft would take off and land outside of the project area. The impacts of these aircraft on the wider analysis area (wider island) are addressed in Section 4.1.3.2.

4.3.3.3 DRONE RELEASE

As outlined in Section 4.1.3.3, drones would be used to release incompatible male mosquitoes throughout the project area. This would require the use of existing 4WD roads, pedestrian trails, and LZs. The potential impacts and mitigation measures for native vegetation from the use of drones to disperse incompatible male mosquitoes during the proposed project are the same as described for listed plant species in Section 4.1.3.3.

4.3.4 Cumulative Impacts

As outlined in Section 4.1.4, the proposed action would result in limited cumulative impacts to native vegetation that would be short lived and intermittent in nature. There is potential under the proposed action, existing actions, and foreseeable future actions for minimal adverse impacts to vegetation from localized plant removal or disturbance along trails, fencelines, and at landing zones and camps by ground crews. These impacts would be temporary in nature and largely occur in previously disturbed locations. In addition, these activities have been approved through previous environmental compliance of the State. To help minimize any vegetation or ground disturbance, monitoring efforts and the dispersal of incompatible male mosquitoes via ground-based pedestrian releases would be conducted on existing resource management trails and fence lines to avoid disturbance of soils and plant communities. Additionally, best management practices (Appendix D) would be implemented to reduce or remove the threat of introducing invasive plants within the project area; however, a risk of introduction still exists. Crews would be trained to follow BMPs to minimize this risk (Table 4 and Appendix D). The impacts from the proposed action and the foreseeable actions can be effectively reduced to negligible using the avoidance and minimization measures outlined in Tables 4 and 5, and Appendix D. Projects that may occur in the project area in the future would also be expected to follow Federal and state avoidance and minimizations during impolementation. The implementation of these measures would result in cumulative impacts that are overwhelmingly beneficial for native vegetation within the proposed project area.

4.4 Cultural Resources

This section describes the potential impacts of the proposed action on cultural resources (archaeological remains, places of cultural significance, and other traditional cultural resources), as well as contemporary cultural practices and beliefs).

As part of the environmental assessment process, a cultural impact assessment (CIA) was conducted to assess the potential impacts of the proposed action on traditional cultural resources, practices, and beliefs, as well as on any current cultural practices being undertaken within the project area. This CIA (Traub et al. 2023, Appendix B and H of this EA), conducted by SWCA Environmental Consultants, was prepared in accordance with the methodology outlined in the Office of Planning and Sustainable Development's *Guidelines for Assessing Cultural Impacts*.

The information presented below provides a summary of the findings of the CIA (Appendix B), where this information is presented in greater detail with references.

4.4.1 Affected Environment

4.4.1.1 ARCHAEOLOGICAL RESOURCES

Although most of the project area has not been the subject of a formal archaeological survey, some locations within the area potentially impacted by incompatible male mosquito releases are known to contain Native Hawaiian cultural sites. During the pre-contact and early post-contact periods, habitation and intensive cultivation were concentrated in valleys and along the coast, while the high elevation forests and wetlands that comprise the majority of the terrain within the project area were not heavily utilized by Native Hawaiians. Many of the activities that took place in the uplands left little to no trace on the archaeological record. People did travel through the uplands to hunt birds, visit sacred sites, harvest trees for lumber, or gather other natural resources. These visitors to the area constructed temporary shelters and places of worship and created some of the trails that are still in use today (Yent 2004).

Nearly all previously recorded archaeological sites occur within Kalalau Valley in the northwestern section of the project area. Native Hawaiian communities in Kalalau built homes, practiced intensive irrigated agriculture, and constructed several *heiau* (temples) along the coastal trail (Major and Carpenter 1999). Some of the heiau, habitational structures, large agricultural terraces, and irrigation features in Kalalau Valley are located very near or even on trails used by modern hikers and hunters.

4.4.1.2 CULTURAL RESOURCES

The project area is rich in cultural resources that include places of traditional cultural significance as well as traditionally gathered natural resources such as medicinal and ceremonial plants, and trees such as ʻōhiʻa lehua and koa used in house and canoe construction. Several of these resources are collected and used by contemporary cultural practitioners. Not least among the culturally significant natural resources present within the project area are the native forest birds that the current project is intended to protect.

Native forest bird species play a unique and significant role in traditional and contemporary Hawaiian cultural customs, practices, and beliefs. References to forest birds are woven into the *mele* (chants and songs) and *moʻolelo* (stories and traditions) of the islands. They are regarded as kinolau (physical manifestations of the gods) and ʻaumakua (family ancestral deities). Their feathers were used to decorate the ʻahuʻula (capes), mahiole (helmets), kāhili (standards) and lei hulu (feather garlands) of the Hawaiian *aliʻi* (chiefs and chiefesses) (Rangi Hīroa 1957: 215-217).

Frederick B. Wichman's *Kauaʻi Ancient Place-Names and Their Stories*, one of the most comprehensive Kauaʻi place name resources describes a place named Halemanu near the project area where Native Hawaiian birdcatchers had a permanent camp.

> A few miles above Puʻukāpele is Hale-manu, "bird house," where bird catchers lived while they hunted Kauaʻi's unique bird family, the brilliantly colored honeycreepers that lived in the ʻōhiʻa lehua forests. Especially prized were the

> yellow-green ʻamakihi and ʻanianiau, the bright yellow ʻakialoa and nukupuʻu, the orange-red ʻiʻiwi or olokele, and the deep crimson ʻapapane (Wichman 1998: 15-16).

Today, native forest birds are viewed as a link connecting contemporary Hawaiians with the natural environment of their islands. *Hula* (traditional dance) practitioner and *haku mele* (composer) Ms. Sally Jo Keahi Manea recently composed a mele in honor of Kauaʻi's native birds. The mele that speaks of the ʻākohekohe, kiwikiu, ʻakikiki and ʻakekeʻe, describing their habitat, the colors of their feathers, and the characteristic peculiar to each bird (Appendix B). As the composition of this mele illustrates, Kauaʻi's native forest birds remain a source of inspiration to contemporary cultural practitioners.

4.4.2 Potential Impacts from No-Action Alternative

If no-action is taken, the warming climate will likely result in the continued migration of southern house mosquito populations and avian disease upslope into the higher elevations of the project area. It is predicted that avian malaria and avian pox will eventually result in the extinction of both the ʻakekeʻe and ʻakikiki, the loss of ʻiʻiwi populations on Kauaʻi, and the reduction of other native honeycreeper species (Paxton et al. 2022, Fortini et al. 2015). Given the cultural significance of these bird species, reduction of their populations and/or extinction would represent a tangible loss to Hawaiian culture.

In addition, native forest birds form part of the larger native ecosystem and play an active role in preserving that ecosystem. Native honeycreeper species serve as pollinators and seed dispersers for certain native plants. Their decline or loss could contribute to longer term population declines of native plant species, adversely impacting the contemporary cultural practices that make use of and depend on those species.

4.4.3 Potential Impacts from the Proposed Action

The potential physical impacts that the proposed action would have on the landscape, both archaeological and cultural, would be minimal and no greater than the current level of use by the public and by DOFAW and its management partners in maintaining the State Parks, Forest Reserves, and Natural Area Reserves located within the project area.

Incompatible male mosquito releases, monitoring, and other project related activities would be limited to existing routes of travel (fence line corridors, trails, and roads), established helicopter landing zones, and field camps already utilized for other management activities. No new roads, trails, landing zones, or camps would be created to support this project. Most of the known archaeological sites and culturally significant places within the project area are located far from the trails and areas where the project activities would take place. Some of the heiau, habitational structures, large agricultural terraces, and irrigation features in Kalalau Valley are located near trails used by modern hikers and hunters. These trails, however, would not be used for the current project-related access and therefore the sites in Kalalau would not be impacted by the project. No archaeological or cultural sites have been recorded near planned project access routes, landing zones, or field camps. As has previously been mentioned, archaeological surface structures are relatively rare in the forested uplands where most incompatible male mosquito

releases would occur. For these reasons, it is expected that the project would have no adverse impact on archaeological sites or culturally significant places.

Given that not all of the project area has been archaeologically surveyed, it is possible that previously unrecorded sites could be present in the vicinity of the access routes where project activities would take place. To avoid and minimize effects, project personnel would stay on designated roads and trails. Project related activities would be limited to existing routes of travel (fence line corridors, trails, and roads), established helicopter landing zones, and field camps already utilized for other resources management activities. No new roads, trails, landing zones, or camps would be created to support this project (see the cultural resources section of Table 4).

The findings of the CIA (Appendix B) indicate that the proposed action is unlikely to adversely impact cultural resources, practices, and beliefs. While cultural practitioners may make use of roads or trails within the project area to gather forest plants, hunt, or to carry out other cultural practices, incompatible male mosquito releases and monitoring activities are unlikely to interfere with their access.

One of the primary impacts of the proposed action on cultural resources is the anticipated positive outcome that reduced mosquito populations would have toward protecting and preserving native forest bird populations. Their existence and presence within the forest environments they inhabit are important for maintaining cultural continuity between traditional and contemporary cultural customs, practices, and beliefs.

4.4.3.1 PEDESTRIAN RELEASE AND MONITORING

Overall, no impacts to archeological resources are anticipated to result from the proposed action. Much of the project area has not been surveyed, but no new ground disturbance would result from the proposed action. Pedestrian mosquito release would be limited to existing routes of travel (fence line corridors, trails, and roads) and field camps already utilized for other natural resource management activities. This would avoid potential effects to historic properties, such as unrecorded archaeological sites and minimize impacts to culturally significant locations. The use of ground transportation would be minimized to the greatest extent possible to reduce noise disturbances to cultural practitioners and recreationists. The impact to established trails, some of which form part of the Nā Ala Hele trail network (Figure 3) and may be of traditional age, would not be substantially greater than that associated with current use.

Although no changes in public use or access are anticipated to be required for project operations, DOFAW would continue to provide notice of any changes in use or access to DOFAW-managed areas, including areas frequented by cultural practitioners, through social media announcements or updates on the DOFAW website. DOFAW also maintains a hunter email list that could be used to notify hunters about any changes to access or use of public hunting areas. If changes in public access do arise, DOFAW would consult with the ʻAha Moku representative for the area to ensure that dispersal and monitoring efforts are coordinated with cultural practitioners who may be using those areas to gather forest plants, hunt, or carry out other cultural practices.

4.4.3.2 HELICOPTER AND FIXED-WING AIRCRAFT AERIAL RELEASE

Some auditory impacts would be associated with all aerial operations, and helicopter and fixed-wing aircraft operations would constitute the greatest auditory disturbance. While helicopter and fixed-wing use could potentially act as a distraction to subsistence hunters and/or cultural practitioners carrying out cultural activities within the project area, these distractions would be minor and temporary. Project related aerial activities and the noise generated by them is not anticipated to be significantly greater than the current existing levels. The auditory impacts associated with the proposed project would be within the approximate background noise range of those generated from commercial helicopter tourism and would not be anticipated to result in significant noise impacts. It should also be noted that none of the interviewed participants noted noise as an impediment to cultural practice. The use of helicopter and fixed-wing aircraft would be minimized to the greatest extent possible to reduce noise disturbances to cultural practitioners.

Helicopter operations would utilize existing, previously disturbed landing zones. These existing areas (trails, fence lines, and landing zones or camps) have been cleared through previous State environmental compliance. Cultural impacts from use of helicopters and established LZ's is considered discountable.

4.4.3.3 DRONE RELEASE

Drones would be launched from existing facilities and access points where infrastructure is preexisting and/or where resources management operations already occur. This would minimize the potential impact to previously unrecorded archaeological sites and culturally significant locations.

Auditory impacts associated with drone releases could potentially affect subsistence hunters and/or cultural practitioners carrying out cultural activities within the project area, though these distractions would be minor and temporary. Noise produced by drone operations would be at substantively lower levels than helicopter and fixed-wing auditory impacts. The sound produced by a consumer-grade battery-powered rotary or fixed-wing drone at ground level is similar to loud highway noise (Schäffer et al. 2021). Most consumer-grade drones are far quieter than helicopters with some being up to 40 A-weighted decibels (dBA) quieter than a manned helicopter at roughly 328 feet AGL (Airborne Drones 2020). Drones would likely spend 15 seconds or less hovering over each mosquito release location, and it is possible that drones would be able to release the mosquitoes without pausing. The use of drones would be minimized to the greatest extent possible to reduce noise disturbances to cultural practitioners. Again, it should also be noted that none of the interviewed participants noted noise as an impediment to cultural practice. The acoustic impacts to ethnographic resources and traditional cultural practices would likely be temporary at any given location, though releases would likely occur over the long term. In addition, reduction of avian malaria as proposed would conserve numerous rare birds important to Native Hawaiian culture providing a beneficial impact.

4.4.4 Cumulative Impacts

Considering past, present, and foreseeable future activities, the no-action alternative would have the same impacts as noted in Section 4.4.2 regarding the potential decline and possible

disappearance of native forest bird species and the resulting loss of their presence as a living component of Hawaiian culture.

Trends and impacts from planned foreseeable actions would be expected to remain the same as, or similar to what is currently occurring. Ongoing or reasonably foreseeable activities identified in Appendix E are expected to have a minimal and temporary adverse impact on cultural places, traditions, practices, and beliefs. The proposed action does not measurably increase the frequency or intensity of other ongoing or future activities in the project area. Known ongoing and future activites follow DLNR SOPs, and avoidance and minimizations in Tables 4 and 5 and Appendix D. Based on this, the cummulative impacts of the proposed action in addition with known past, ongoing, and future activities are not expected to appreciably increase adverse impacts in the project area. The overall cumulative impact of successful implementation of the proposed action would be expected to be largely beneficial on Hawaiian cultural practices and resources in the form of helping Hawaiian forest bird recovery.

The proposed use of incompatible male mosquitoes to suppress wild mosquito populations and reduce the incidence of avian malaria and avian pox transmission to native forest bird species is but one component of a much larger effort to mālama (take care of) the native environment of the project area (see Appendix E). The intent of this and other current and proposed stewardship efforts is to preserve and protect this unique natural and cultural landscape. The threatened and endangered native forest bird populations are a culturally significant element of this landscape, and their continued survival would serve to perpetuate the rich cultural heritage associated with them.

4.5 Public Health and Safety

4.5.1 Affected Environment

Mosquito-transmitted diseases can lead to serious illness in individuals and therefore pose a threat to public health and safety. The Hawai‘i Interagency Biosecurity Plan (Hawai‘i Invasive Species Council, 2016) identifies mosquitoes as high-risk taxa and calls for expanded control of disease-carrying mosquitoes as a priority and objective for the protection of human health, as well as increased education and public awareness of mosquito-borne diseases. The only mosquito-borne diseases that have been reported in Hawai‘i to-date are dengue, Zika, and chikungunya, and none of these viruses are endemic to Hawai‘i but were introduced by travelers who were exposed outside of the state (DOH 2022a, 2022b, 2022c). Dengue, Zika, and chikungunya are transmitted by the day-biting yellow fever mosquito and Asian tiger mosquito and are not transmitted by the southern house mosquito, which is the target species of the proposed action (DOH 2022d).

Diseases transmitted to humans by the southern house mosquito include West Nile virus, St. Louis encephalitis, and lymphatic filariasis (University of Florida 2019). Of these, West Nile virus is the most widespread mosquito-transmitted disease in the continental US but has not yet been detected in Hawai‘i; neither has St. Louis encephalitis nor lymphatic filariasis (CDC 2022b, 2022c, DOH 2022e). Hawai‘i’s status as a travel destination, however, puts it at a high-risk for the introduction of mosquito-transmitted diseases; this, combined with the wide distribution of southern house mosquitoes on all Hawai‘i’s main islands, indicates that the state is at particular

high risk for the introduction of West Nile virus. For these reasons, health and wildlife agencies in Hawaiʻi are actively working to prevent the introduction and spread of West Nile virus to the state (DOH 2022e). West Nile virus causes symptoms for about 1 in 5 people infected, and about 1 in 150 infected people develop severe symptoms that can be fatal (CDC 2022b). The CDC's guidance document, *West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control,* emphasizes the importance of implementing proactive measures that maintain vector populations at low levels to minimize the risk of transmission to humans (CDC 2013).

Human populations that utilize the public portions of the project area and that may be subject to health and safety effects of mosquito-transmitted diseases include recreationists in parks and preserves, cultural practitioners, and land management staff. The portion of the project area that is private land is remote and undeveloped and therefore is not expected to incur much human use. There is no evidence that the release of incompatible male mosquitoes on Kauaʻi would have human health impacts. Existing efforts to manage mosquito populations within the project area are implemented by state agencies and conservation groups who are primarily focused on monitoring and mitigating mosquito-related risks to wildlife and habitat. Mosquito monitoring plots and traps are currently implemented by KFBRP, in the Alakaʻi Wilderness Preserve, and ungulate management activities (i.e., exclusion fences, hunting, and trapping) that reduce mosquito larval habitat are currently implemented by DOFAW and TNC throughout the project area (see Appendix E).

4.5.2 Potential Impacts from No-Action Alternative

Under the no-action alternative, existing public health and safety concerns associated with mosquito-transmitted diseases would remain as described under the affected environment, and the state of Hawaiʻi would remain at high-risk for the introduction and spread of new diseases (e.g., West Nile virus) that are not already present in Hawaiʻi but, if introduced, could be transmitted by the widespread southern house mosquito. Although existing ungulate management strategies that limit the amount of available mosquito breeding habitats would continue to be implemented, these strategies have not been effective in substantially suppressing or eliminating nonnative mosquito populations, as evidenced by their recent expansion into higher elevation habitat. Continued implementation of existing management strategies would therefore have a negligible effect on public health and safety concerns associated with mosquito-transmitted diseases.

4.5.3 Potential Impacts from Proposed Action

The proposed action aims to reduce populations of southern house mosquitoes in the project area. This action could benefit recreationists, cultural practitioners, and land management staff who utilize the project area by reducing abundance of southern house mosquitoes, which is a nuisance species. There would likely be short term increase in number of mosquitoes in localized release areas after each release event, the release of *Wolbachia*-infected incompatible male mosquitoes would have no adverse effects on public health and safety as male mosquitoes do not bite and therefore, cannot transmit diseases through biting. A reduction in southern house mosquito numbers will have no effect on populations of other nuisance mosquito species.

The magnitude of future public health and safety benefits from the proposed action would depend on the success of IIT treatments at reducing mosquito populations, which cannot be known until post-release monitoring is conducted. However, results of previous field-based trials of IIT (see Section 2.4) indicate that the treatments can be highly effective at reducing mosquito populations (up to 95% reductions). The level of mosquito population declines achieved by the proposed action would have a commensurate and beneficial effect on public health and safety by reducing the likelihood human arboviruses could be spread by southern house mosquitoes.

Given the short lifespan of mosquitoes, the beneficial effects on public health and safety from declining mosquito populations could be realized relatively quickly after incompatible male mosquito releases begin (e.g., within months). Success of the proposed release of IIT mosquitoes would be determined through post-release monitoring. Short and potentitially long-term public health benefits would be expected should the releases be effective.

Public perceptions surrounding mosquitoes and mosquito-borne diseases may lead to public concerns about the proposed action's effect on health and safety, which would warrant the need for project-specific public education and outreach. Members of the public may, for example, be unaware of the differences between mosquito species and sexes, leading them to believe that the release of mosquitoes could put them at an increased risk of being bitten. To facilitate better public understanding of the proposed action's potential benefits to public health and safety, DLNR would provide support for education and outreach efforts such as public outreach campaigns, informational flyers at trailheads, or the use of social media to educate the public about the project and associated health and safety benefits (see Table 4). These efforts would be consistent with and would reinforce the state's overarching Interagency Biosecurity Plan, which identifies public education about mosquito-borne diseases and other pest related issues as a critical issue for the state. Public meetings would additionally be held for the project on Kaua'i during the public comment period of this EA where the public would be provided informational materials and an opportunity to ask questions and voice concerns.

4.5.3.1 PEDESTRIAN RELEASE AND MONITORING

Pedestrian release methods would not result in any additional public health and safety effects beyond what is described in section 4.1.3.1. Monitoring activities (i.e., data collection and analysis) would not directly affect public health and safety but would indirectly affect public health and safety by influencing the success and duration of IIT treatments. Monitoring activities would be implemented with the goal of maximizing the efficacy of IIT treatments, which in turn could help justify the long-term use of these treatments, thereby increasing the duration and magnitude of associated benefits to public health and safety from declining mosquito populations.

4.5.3.2 HELICOPTER AND FIXED-WING AIRCRAFT AERIAL RELEASE

The use of helicopters for incompatible male mosquito releases is not expected to result in any additional public health and safety effects beyond what is described in section 4.1.3.2. The use of helicopters would follow all FAA rules and guidelines, which would ensure all aviation hazards are properly avoided. As discussed in Sections 4.1.3.2 and 4.1.3.3, wildlife strikes with aircraft may occur and could result in human fatalities or injuries in extreme cases (FAA 2021). Most wildlife strikes, however, do not result in human injury or fatality and the number of damaging

strikes has been decreasing since the 1990's, likely due to the increasing awareness in the aviation community and increased implementation avoidance and minimization measures to reduce the risks of wildlife strikes at airports. Of the total 232,320 wildlife strikes reported to FAA from 1990-2019, 16 (0.007%) resulted in human fatalities and 251 (0.1%) resulted in human injuries (FAA 2021).

4.5.3.3 DRONE RELEASE

The use of drones for incompatible male mosquito releases is not expected to result in any additional public health and safety effects beyond what is described in section 4.1.3.3. All FAA and DLNR safety-related guidelines for drones would be followed.

4.5.4 Cumulative Impacts

Ongoing mosquito monitoring and ungulate management activities (Appendix E) would continue to occur in the future at current or slightly increased levels. As described under Section 4.5.2, existing ungulate management strategies have not been effective in substantially suppressing or eliminating nonnative mosquito populations. These activities would therefore likely continue to have a negligible effect on public health and safety concerns associated with mosquito-transmitted diseases. However, if increased levels of ungulate management are more successful at reducing mosquito populations in the future, this would result in a beneficial effect to public health and safety by reducing the risk of southern house mosquitoes associated diseases being introduced and spread in the project area. None of the other ongoing or reasonably foreseeable activities identified in Appendix E are expected to impact public health and safety. When combined with the effects of the proposed action, the overall cumulative effect on public health and safety would be beneficial.

4.6 Recreation and Wilderness

4.6.1 Affected Environment

Several state-managed recreational areas occur within the project area, including 12,663 acres (21%) of Forest Reserves, 9,940 acres (17%) of Forest Reserve/Wilderness Reserve, 4,261 acres (7%) of Natural Area Reserves, 4,619 acres (8%) of State Wilderness Parks, and 3,438 acres (6%) of State Parks (see Table 1). Recreational uses that occur within each of these designations are summarized in Table 5 and further described below. Uses associated with cultural practitioners (e.g., plant gathering and hunting) are addressed in Section 4.4 of this EA as well as the project's CIA (Appendix B). Aerial helicopter tours are also a common occurrence in the area, with at least 10 or more air tour businesses located on Kaua'i that offer daily tours.

Table 6. Recreational Uses within Project Area

Recreational Area	Recreational Uses	Permit/ Fee Requirements	Management Priorities/Objectives
Hāʻena State Park	Beach use and hiking. Camping not allowed.	Requires advance parking and entry reservation for non-residents.	Cultural, historic, natural and scenic resources, recreational and education opportunities.
Haleleʻa Forest Reserve	Hunting and hiking. Camping not allowed.	Permits required for hunting and commercial uses.	Management of Okolehau Trail, monitoring invasive plants/animals, enhancement of native rare plant resources, maintenance of *Pritchardia* exclosure(s), and management of pig hunters.
Hono O Nā Pali Natural Area Reserve	Hiking, bird watching, hunting, volunteer service trips and guided hikes. Commercial uses allowed with SUP. Camping not allowed.	Permits required for hunting, commercial uses, or groups of 10 or more. Parking fee for non-residents.	Habitat protection, weed control and habitat restoration, rare species monitoring and collecting, education and outreach.
Kōkeʻe State Park	Hiking, camping, hunting, picnicking, wildlife viewing, fishing,	Entrance and parking fees for non-residents. Permit required for camping.	Recreational activities and natural resources.
Kuia Natural Area Reserve	Hiking and hunting. Camping not allowed.	Permits required for hunting, commercial uses, or groups of 10 or more. Parking fee for non-residents.	Habitat protection through game management and weed control
Līhuʻe-Kōloa Forest Reserve	Hunting, hiking, horseback riding, fishing, four-wheel driving, and commercial ecotourism. Camping not allowed.	Permits required for hunting and commercial uses.	Maintain the area for multiple uses, including watershed protection, recreation, maintenance of the Keāhua Arboretum, and possible timber and/or biomass plant production.

Recreational Area	Recreational Uses	Permit/ Fee Requirements	Management Priorities/Objectives
Nā Pali Coast State Wilderness Park	Hunting, hiking, camping, boating, wildlife viewing.	Requires advance parking and entry reservation or camping permit.	Outdoor recreation and heritage opportunities.
Nā Pali-Kona Forest Reserve	Hunting, hiking, horseback riding, fishing, biking, camping, picnicking	Permits required for camping, hunting, and commercial uses.	Watershed values, native ecosystems, Threatened, Endangered, and rare species management, resource protection, invasive species control, game management, commercial activity, and public activity.
Nā Pali-Kona Forest Reserve/Alakaʻi Wilderness Preserve	Hiking, camping, hunting	Permits required for camping, hunting, and commercial uses.	Protection of high-quality native ecosystems and rare and endangered endemic plants and animals; outdoor recreation is heavily restricted.
Puʻu Ka Pele Forest Reserve	Hunting, hiking, camping, picnicking, bird watching, fishing, horseback riding, biking	Permits required for camping, hunting, and commercial uses.	Native species conservation, recreational hunting, forestry, and other recreational activities

Sources: DLNR 2018, 2022a, 2022b, 2022c; DOFAW 2009a, 2009b, 2011a, 2013, 2022a, 2022b, 2022c

4.6.1.1 FOREST PRESERVES/WILDERNESS PRESERVE

DOFAW manages forest preserves for multiple uses, including recreational and hunting opportunities, aesthetic benefits, watershed restoration, wildlife habitat protection and management, cultural resources, and fire protection among many other things (DOFAW 2022d). Forest preserves within the project area include Haleleʻa Forest Reserve, Līhuʻe-Kōloa Forest Reserve, Nā Pali-Kona Forest Reserve, and Puʻu Ka Pele Forest Reserve. Recreational uses that occur within these forest reserves include hunting, hiking, camping, picnicking, horseback riding, fishing, bird watching, four-wheel driving, and commercial ecotourism. Hunting and hiking are allowed within all forest preserves in the project area; other uses are only allowed in certain forest preserves as shown in Table 5.

The Alakaʻi Wilderness Preserve is situated within the boundaries of the Nā Pali-Kona Forest Reserve and is managed as a sub-unit of the forest preserve; these two areas collectively make up 33% of the project area. Most of the recreational use in the Nā Pali-Kona Forest Reserve occurs outside of the wilderness area due to a greater number of roads and trails making it more accessible to the public. Recreational use of the wilderness preserve occurs to a lesser degree due

to limited access and more restrictive policies in place to protect its high-quality native habitat and associated rare and endangered endemic species.

4.6.1.2 NATURAL AREA RESERVES

DOFAW manages natural area reserves primarily for the protection of unique native ecosystems, geologic features, and rare and endemic species. Public access and recreational uses are heavily regulated to protect sensitive resources. Commercial recreational uses may be allowed subject to Special Use Permit (SUP) approval (DOFAW 1997).

4.6.1.3 STATE PARKS/WILDERNESS PARKS

Hawaiʻi State Parks and Wilderness Preserves are managed for outdoor recreation and heritage opportunities. State Parks are easily accessible and generally include more visitor amenities than at Forest Reserves or Natural Area Reserves (e.g., restrooms, picnic tables, water fountains, trash cans). Visitor use (including both day use and overnight use) is managed through a system of fees and permits.

4.6.1.4 RELEVANT ASPECTS OF VISITOR USE AND EXPERIENCE

Except for air tours, all other land-based recreational uses in the project area tend to be concentrated near established roads, trails, public campsites, day use areas, and other established facilities, all of which are distributed throughout the public portions of the project area. Hiking outside of designated trials is generally discouraged in all recreational use areas due to the potential for natural hazards.

All of the recreational use areas identified within project's footprint are within unique native ecosystems that provide visitors with an experience of wild and scenic natural beauty; the levels of remoteness, however, vary throughout the project area, with more accessible areas in Kōkeʻe State Park and less accessible areas at higher elevations in the Alakaʻi Wilderness Preserve. Commercial helicopter tour flights and helicopters used by natural resource managers, frequently fly over the entire project area daily. Visitors seeking solitude may experience slightly increased noise levels associated with aerial release. To the greatest extent possible, pedestrian releases will occur in areas that are heavily used by visitors, to reduce the potential for disturbance to visitors.

Given the high-quality habitat conditions in the project area (see Section 4.1.1), bird watching is an activity provided by all recreational use areas. In addition, biting mosquitoes are generally considered a nuisance by visitors. Night-biting species such as the southern house mosquito are primarily a nuisance for overnight campers who are present in the night and early morning hours. Hunters with dogs who camp overnight are also uniquely vulnerable to southern house mosquitoes since they can transmit heartworm (*Dirofilaria immitis*) to dogs. Reducing the abundance of southern house mosquitoes would be a benefit to recreational users of these areas.

4.6.2 Potential Impacts from No-Action Alternative

Under the no-action alternative, recreational uses that occur within the project area would continue as described in the affected envirnment section 4.6.1, subject to future changes resulting

from management actions and the influence of other socioeconomic factors (e.g., tourism industry).

4.6.3 Potential Impacts from Proposed Action

The proposed action would have both beneficial and adverse effects on wilderness and recreation. The project would adversely affect the visitor experience for land-based recreationists (e.g., campers, hikers, hunters) through increased human activity and noise (e.g., from people, vehicles, drones, and aircraft). The sections below discuss how these adverse effects on various user groups would vary by release strategy.

Incompatible male mosquitoes may be released directly or in small biodegradable packages designed to open on contact with the canopy or forest floor. Packages would be composed of weed-free, environmentally friendly material derived from plants. Although many thousands of release packages would be dropped across the project area throughout the duration of the project, the small packages would be spread diffusely, and the biodegradable material would decompose quickly given the typical rainfall patterns in the project area, making the chance of observing multiple packets unlikely. Based on the degradable nature of the delivery packages and diffuse nature of release locations, the impacts on recreationalists and the wilderness would be negligible.

The release of the male mosquitoes would not be expected to cause additional bites or nusiance to recreationalists and users of the wilderness resources. Unlike female mosquitoes that consume blood, male mosquitoes consume nectar and thus, would not be attracted to humans or pets. Localized concentrations of male mosquitoes could be expected to occur in the immediate vicinity (1 to 2 feet) of the release package as the mosquitoes emerge, but the mosquitoes would be expected to disperse within minutes.

The trails, campsites, and landing zones are typically managed by established and ongoing maintenance plans and follow State and USFWS avoidance and minimization measures (Table 4 and 5, Appendix D). Minimal additional vegetation clearing along established trails and LZ's would be expected under the proposed action. Any additional trimming of vegetation that would be needed as a result of the proposed action would follow the same State and USFWS avoidance and minimization measures used by the established maintenance crews (Table 4 and 5, Appendix D). Based on this, the proposed action would have a minimal effect on the trails, campsites, and LZs.

No changes in public use or access to state-managed recreational areas are anticipated to be required for project operations.

Beneficial effects to land-based recreationists would include reduced female mosquito populations and associated nuisances for overnight users and hunters with dogs, as well as the potential for increased populations of native forest bird species to provide improved bird watching opportunities. This project would not have an impact on the day biting *Aedes* mosquitoes, which also pose a nuisance to visitors.

4.6.3.1 PEDESTRIAN RELEASE AND MONITORING

Pedestrian releases would be implemented by up to three technicians and would involve the use of 4WD trucks and all-terrain vehicles. These activities would result in temporary and localized increases in human activity and noise, which may be noticeable to visitors in the immediate area. These effects would be most noticeable for visitors in more remote areas where visitation and human sources of noise are less common and unexpected. The noise effects of pedestrian releases would be less severe than those associated with aerial releases.

All adverse effects to recreationists from increased human activity and noise would be localized, temporary, and intermittent in nature since releases would be implemented in different locations throughout the project area on a weekly, bi-weekly, or monthly basis. Although adverse effects from pedestrian releases would therefore likely be noticeable to recreationists in the immediate area where releases occur, they are not expected to result in any long-term, meaningful declines to the overall visitor experience, especially when considering the countervailing beneficial effects of mosquito reductions and rebounding native bird populations.

Monitoring activities would have similar adverse effects on the visitor experience for land-based recreationists as described for pedestrian releases (see Section 4.1.3.1) since monitoring would involve the same types of vehicles, a similar number of technicians, and would occur at similar frequency and in the same locations as release sites. Implementation of monitoring, however, would also benefit recreationists by ensuring the maximum effectiveness of the ITT treatments and associated mosquito declines and rebounding native bird populations.

4.6.3.2 HELICOPTER AND FIXED-WING AIRCRAFT AERIAL RELEASE

Helicopter releases would adversely affect the visitor experience for recreationists through increased noise. The noise effects resulting from helicopter releases would be higher than with pedestrian releases. Although pedestrian releases may involve the use of helicopters for access, helicopter releases would take longer, making the duration of noise effects longer. Although the use of helicopters would also increase the overall number of aircraft operating in the project area, commercial air tour agencies are not authorized to fly their helicopters at the low altitudes necessary for release of incompatible male mosquitoes by the project. Tour operators would therefore fly well above the height or altitude necessary for project operations. Helicopter pilots, including those that would be involved in releases, also routinely communicate their locations and altitudes on a shared radio frequency for the purpose of safety. There would be no adverse effects to commercial helicopter air tour flight routes. Helicopter release methods would only be used to the extent necessary to enable access to remote locations and would not be implemented until the release mechanism technology has been fully developed and tested. Prior to aerial releases, DOFAW would notify commercial helicopter operators of program activities and recommended avoidance areas to avoid user conflicts and safety hazards.

4.6.3.3 DRONE RELEASE

Drone releases would adversely affect the visitor experience for recreationists through increased noise, although at significantly lower levels than helicopter use. The sound produced by a consumer-grade battery-powered rotary or fixed-wing drone at ground level is similar to loud highway noise (Schäffer et al. 2021). Most consumer-grade drones are far quieter than

helicopters with some being up to 40 A-weighted decibels (dBA) quieter than a manned helicopter at roughly 328 feet AGL (Airborne Drones 2020). The use of the drones themselves would not create any conflicts with air tours as they would operate below the minimum allowed altitude for helicopters (500 feet AGL [14 CFR Part 91, subpart B, Section 91.119]). The use of drones would not be implemented until the release mechanism technology has been fully developed and tested. Prior to aerial releases, DOFAW would notify commercial helicopter operators of program activities (including drone use) and recommended avoidance areas to avoid user conflicts and safety hazards. All FAA rules and DLNR Best Management Practices for drones would be followed.

4.6.4 Cumulative Impacts

Existing recreational uses in the project area would continue to occur in the future, and there are no reasonably foreseeable changes to the types of use or levels of use that are allowed to occur within the project area (see Appendix E). Ongoing and reasonably foreseeable conservation activities (i.e., ecological research, monitoring, and management) would continue to have both beneficial and adverse effects for recreational users. The project would adversely affect the visitor experience for land-based recreationists (e.g., campers, hikers, hunters) through increased human activity and noise (e.g., from people, vehicles, drones, and aircraft). Adverse effects would result from localized increases in noise and human activity when those activities are implemented in proximity to public spaces. Camping associated with project activities has the potential to have minor and infrequent overlap with public camping reservations at Waiʻalae cabin. Timing and frequency is not yet finalized and may change depending on level of mosquito control and monitoring needed. Estimated use of parking spaces at Kōkeʻe State Park would be restricted to a few spots in low-use areas and would be infrequent (KFBRP). Because of the low use, the impacts to the public are expected to be negligible. The proposed action could cause intermittent, but temporary increases in overall number of aircraft operating in the project area. Commercial air tour agencies, however, are not authorized to fly their aircraft at the low altitudes necessary for release of incompatible male mosquitoes in the project area. Rather, tour operators would fly well above the height or altitude necessary for project operations. Helicopter pilots, including those that would be involved in releases, also routinely communicate their locations and altitudes on a shared radio frequency for safety. There would be no adverse effects to commercial helicopter air tour flight routes expected to occur. There would be the possibility of visual effects for air tours if the air tour helicopter was to be present during mosquito releases. Depending on the occupants of the air tour, this may be perceived as adverse or fascinating.

Beneficial effects to existing and future recreationalists and wilderness users would result from the long-term contribution of the mosquito suppression. The suppression would be expected to improve the wilderness experience of users through the reduction of southern house mosquito bites, increased native avian wildlife and improved pollinator services. The proposed action is not expected to have adverse effects on ongoing or future hunting or resource collection activities within the project area.

4.7 Air Quality, Greenhouse Gas Emissions and Climate Change

The contemporary understanding and agreement among the scientific community is that anthropogenic sources of greenhouse gasses have been the primary cause of global temperature

increases since the mid-20th century (IPCC 2023). Regional effects of climate change are evident in the Hawaiian archipelago, and after a minor lull in the rate of climactic change in the early 2000s, a rapid warming trend appears to have resumed in 2014 (McKenzie et al. 2019). Some climate change models suggest that the mean temperatures in Hawaiʻi may increase by 3°–4°C by 2100 (Hayhoe et al. 2018). The effects of climate change have been found to result in increased stress to natural systems through altered temperatures and rainfall patterns (Alexander et al. 2016). Increases in mean temperatures, for example, have facilitated the spread of mosquitoes and avian malaria into habitats where cool temperatures very recently limit mosquito presence and transmission of malaria to highly susceptible endemic forest birds (Atkinson et al. 2014).

4.7.1 Affected Environment

The project area and its lower elevation buffer zones include the highest elevation areas of Kauaʻi comprised of State Parks, Natural Area Reserves, Wilderness Preserves and some private lands. The project area is relatively removed from many sources of air pollution other than intermittent vehicular travel, aerial tours, and resource management operations. Hawaiʻi has an established statewide monitoring network to measure ambient air concentrations of pollutants, which ensures that national air quality standards are met. Monitoring stations are maintained and data are collected by the Air Quality Monitoring Section of the State Laboratories Division; the State maintained 20 air monitoring stations on four islands in 2019. Although Kauaʻi has one monitoring station, it is primarily used to measure the air quality impacts from cruise ships (State of Hawaiʻi Annual Air Quality 2019 Data). Air quality in the project area is typically very good, and Kauaʻi meets National Ambient Air Quality Standards (EPA 2021). The National Ambient Air Quality Standards (NAAQS) can determine whether a region is in an air quality attainment or nonattainment area. An area is considered to be in attainment if it meets the Federal standard for all criteria pollutants. Subsequently, an area is in nonattainment if it does not meet (or contributes to ambient air quality in a nearby area that does not meet) the standard. When this occurs, states must submit implementation plans to the EPA discussing programs to improve air quality within that region. The project area is currently in an area of attainment for all NAAQS.

4.7.2 Potential Impacts of the No-Action Alternative

Under the no-action alternative, no additional contribution to greenhouse gas emissions would occur beyond what is already occurring in the project area and from future foreseeable actions (Appendix E).

4.7.3 Potential Impacts from Proposed Action

Incompatible male mosquito transport to Kauaʻi from the incompatible male mosquito production facility would utilize exisiting commercial air transport services and would not be expected to increase or otherwise contribute to greenhouse gas emissions. There are several release methods included as part of the proposed action that would produce greenhouse gas emissions. These actions include motor vehicle transport of personnel for release and monitoring activities, helicopter transport of personnel for pedestrian release to remote sites, and helicopter or fixed wing release of incompatible male mosquitoes. Greenhouse gas emissions associated with each of these modes of transport would be intermittent and temporary in nature in the

project area. Releases by fixed wing aircraft, if deployed as an application method has the potential to be the most efficient release option for the project area, resulting in diminished fossil fuel consumption and a sizable, reduced amount of time needed for applications. However, important factors such as incompatible male mosquito viability using this release method are still under development and testing.

Helicopter release would be used when other options such as pedestrian or drone release are not available to meet release needs or these alternate release methods could not be used to access the release sites. The flight time of the helicopter conducting releases would not be expected to exceed three flights during a day. Mosquito release flights would be limited to daytime hours and helicopters or fixed-wing aircraft. The proposed action would initially rely on pedestrian and helicopter or fixed-wing aircraft release, but over time would be expected to pivot to the use of drones as the primary incompatible male mosquito release method based on monitoring. Drones, which are battery powered, do not directly burn fossil fuel and do not generate fuel emissions. Helicopters, however, would still be needed to transport monitoring and support staff to some remote locations that are inaccessible by vehicle, and for occasional incompatible male mosquito release. Effects resulting from this relatively limited number of flights would be negligible compared to ongoing daily commercial (air tour) flights on Kaua‘i, and well below Federal reporting requirements for greenhouse gases (25,000 metric tons of CO2 emitted annually, 74 FR 56260).

4.7.4 Cummulative impacts

The project area has ongoing and foreseeable managment actions that produce greenhouse gases. In addition, air tours frequently fly over the area, though their frequency is variable because of weather, FAA regulations, demand, and other factors that may limit or affect flight operations. Although some management actions would result in emissions of criteria pollutants pursuant to the Clean Air Act, the greenhouse gas contributions resulting from the use of helicopters, fixed wing, and other motorized vehicles, would be extremely low and would lead to impacts on air quality and greenhouse gas emissions below nominal levels. Consistent with the interim National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change issued January 9, 2023 (88 FR 1196), the USFWS was guided by the rule of reason in developing this analysis commensurate with the (low) quantity of projected greenhouse gas emissions associated with the proposed action. Conducting an in-depth, quantitative analysis of emissions was not considered proportionate to the insignificant quantity of emissions that the proposed action would be expected to contribute. The additional contribution to the cummulative greenhouse gass emmission to the existing and freseeable future projects in the area would be expected to be negligible.

Though climate change and associated adverse impacts have and will continue to affect specific resources on Kaua‘i and within the project area (Alexander et a. 2016, Pauchard et al. 2016), greenhouse gases from helicopter, fixed wing aircraft and motor vehicle emissions associated with the proposed action are not expected to have a measurable effect on global climate change or local climatic conditions. Although, for example, the release of incompatible male mosquitoes would result in some fossil fuel consumption, the associated greenhouse gas emissions would be negligible because of the comparatively limited number of flights anticipated, compared to ongoing daily commercial (air tours) flights on Kaua‘i. Based on the considerations discussed

above, air quality, greenhouse gas emissions, and climate change were dismissed from detailed analysis as an impact topic.

4.8 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Executive Order 12898 and supplemental Executive Order 14096 are Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." A minority population exists within an affected area when either the minority population exceeds 50%, or the minority population is meaningfully greater than the minority population of the general population (CEQ 1997).

According to EJScreen, EPA's Environmental Justice Screening and Mapping Tool, census block groups within and around the project area on Kauaʻi are comprised of populations where at least 50% of the population is considered a minority. Therefore, environmental justice communities exist in the study area.

4.8.1 Potential impacts from No-Action Alternative

Under the no-action alternative, residents that use or reside within the project area and its buffer zone would continue to experience a decrease in native bird species and presence of southern house mosquitoes, and ongoing and future activities resulting from management actions and air tour management actions.

4.8.2 Potential impacts from Proposed Alternative

The proposed action involves the use of pedestrians, drones, helicopters, and fixed-wing aircraft to release incompatible mosquitoes for the purpose of suppressing nonnative mosquitoes and the spread of avian malaria. The mosquitoes that would be released provide no threat to the public as they would be male mosquitoes, which do not bite and do not transmit disease to humans.

While the suppression of avian malaria should result in a positive overall impact on the project area ecosystem on Kauaʻi, mosquito release methods would involve the use of aircraft, which could adversely impact the public who are utilizing public and private lands during project implementation. These potential impacts would mostly be due to the daytime noise or visual disturbance from aircraft. Aerial operations associated with ongoing maintenance and management already occur on state and private lands on Kauaʻi. Areas that have high recreational use and are accessible by vehicles would use pedestrian release methods to deploy mosquitoes, which would reduce the potential for noise and visual disturbance from aircraft. Increase in noise and visual impacts would primarily affect only those members of the public that are actively utilizing the project area or those residing near the project area that may hear or see the intermittent implementation of the proposed action. Helicopter use and drone use

associated with the proposed release actions would occur during daytime hours and would not occur at night.

The intent and expected outcome of this project is to avoid the extinction of Hawaiian forest birds, which is identified as an important ecological and cultural resource by the Native Hawaiian community. Native Hawaiian identify forest birds as ʻohana (family), kūpuna (ancestors), and ʻaumākua (familial gods), and their unique habitats are revered as sacred places for the cultural ecological services they provide. The preservation of these species has been identified as a priority by Native Hawaiian community leaders (Paxton et al. 2022).

5 CONSISTENCY WITH EXISTING LAND USE, PLANS, AND POLICIES

5.1 National Environmental Policy Act

The NEPA process requires evaluation of Federal of federally funded actions including assessing alternatives (e.g., proposed and no-action alternatives). NEPA also requires the disclosure to the public of impacts on the human environment as a result of the alternatives considered. This process is documented in the environmental analysis presented in an EA or EIS. This EA has been prepared in compliance with NEPA, current CEQ (40 CFR 1500-1508) and DOI NEPA Regulations (43 CFR Part 46), and USFWS directive manual 550 FW 1-3 and 505 FW 1-5. Pursuant to NEPA and associated implementing regulations and USFWS policy, this EA presents the analysis of the proposed project and alternatives including the no-action alternative. This EA evaluates impacts anticipated from all alternatives to inform decision makers and the public using an interdisciplinary approach to address all aspects of the human environment relevant to the potential impacts of the proposed project. The direct, indirect, and cumulative impacts of the proposed project are analyzed and presented within the document.

5.2 Section 106 of the National Historic Preservation Act

Compliance with Section 106 of the National Historic Preservation Act is conducted in consultation with the Hawaiʻi State Historic Preservation Division (SHPD), Native Hawaiian Organizations, and individuals with familial/traditional ties to Kauaʻi and the project area. Pursuant to 36 CFR § 800.2(c)(4), USFWS has authorized DOFAW to initiate and conduct Section 106 consultation with the State Historic Preservation Officer (SHPO) and others but remains legally responsible for all findings and determinations (Appendix G). As part of this procedure, DOFAW will initiate the Section 106 process, identify historic properties and produce an assessment of potential adverse effect (36 CFR §§ 800.3 through 800.5) to the SHPD.

Registered historic properties that occur in the project area range from traditional Native Hawaiian habitation sites to Civilian Conservation Corps-era rustic cabins (Table 7). As outlined in Section 4.4, although most of the project area has not been archaeologically surveyed, habitation and intensive cultivation were concentrated in valleys and along the coast during the pre-contact and early post-contact periods. The high elevation forests that comprise the majority of the project area were not intensively utilized by Native Hawaiians. Many of the activities that took place in the uplands were temporary, ephemeral, and left little to no trace on the

archaeological record. Nearly all documented archaeological sites within the project area are located in Kalalau Valley. Two registered historic properties are located in Kōkeʻe State Park within the project area: Camp Sloggett, located southwest of HI 550 and the Civilian Conservation Corps Camp along HI 550.

Table 7. Registered Historic Properties in the Project Area.

Site Name	SIHP Number	Restricted Access
Nā Pali Coast Archaeological District	50-30-02-03200	Yes
Waimea Valley Complex	50-30-06-00035	No
Camp Sloggett, Kōkeʻe	50-30-06-09395	No
Civilian Conservation Corps Camp, Kōkeʻe	50-30-06-09392	No

The potential physical impacts that the proposed project would have on these sites, both archaeologically and culturally, would be no greater than that caused by the current level of use by the public and by DOFAW and its project partners in maintaining the State Parks, Forest Reserves, and Natural Area Reserves within the project area. All activities associated with the project would be located well away from known cultural sites and no ground-disturbing activities would occur. It is therefore anticipated that no cultural and historic sites will be physically impacted by the project. Given that not all of the project area has been archaeologically surveyed, it is possible that previously unrecorded sites could be present in the vicinity of the access routes where project activities would take place. Potential impacts to cultural and historic sites would be effectively avoided and minimized through the implementation of the measures outlined in Table 4 and Appendix B.

5.3 Endangered Species Act

The Endangered Species Act (ESA) provides broad protection for plants, fish, and wildlife that have been listed as threatened or endangered in the United States or elsewhere and conserves ecosystems on which these species depend (16 United States Code 1531–1544). The USFWS has participated in the development of this EA and provided input on the development of alternatives, impacts to threatened and endangered species, and mitigation measures to minimize species impacts. Formal intra-Service ESA section 7 consultation would occur once a formal application for funding for the selected alternative is submitted to the USFWS. The proposed action has the potential to stabilize and assist in the recovery of listed and non-listed Hawaiian honeycreeper species. The proposed action would also potentially benefit the recovery of listed native plant species that depend on these avian species for pollination and seed dispersal. Although the proposed action would potentially have an adverse impact on listed native plant and animal species, these impacts would be effectively avoided and minimized through the implementation of the measures outlined in Tables 4 and 5 and Appendix D.

5.4 Migratory Bird Treaty Act

The MBTA prohibits the take of migratory birds. A list of birds protected under MBTA regulations is provided in 50 CFR 10.13. Unless permitted by regulations, it is unlawful under the MBTA to pursue, hunt, take, capture, or kill; attempt to take, capture, or kill; possess, offer to or sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product. The USFWS does not currently have a comprehensive program under the MBTA to permit the take of migratory birds by otherwise lawful activities. Conservation measures proposed by DLNR to avoid or minimize impacts to MBTA species are included in Appendix D. The proposed action could potentially stabilize populations of six Hawaiian honeycreeper species that are listed under the MBTA. The proposed action may benefit native seabirds (e.g., koa'e kea, white-tailed tropicbird [*Phaethon lepturus*]) and other impacted native bird species that are included within the MBTA by reducing adverse interactions with southern house mosquitoes. Although the proposed action will potentially adversely impact MBTA species, significant adverse impacts will be avoided and mimimized through the implementation of the measures outlined in Tables 4 and 5 and Appendix D.

5.5 State Regulations

5.5.1 Hawai‘i Coastal Zone Management Program (HRS 205A)

The Hawai‘i Coastal Zone Management (CZM) Program (HRS Chapter 205A) was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972. Hawai‘i’s CZM area encompasses the entire state, including all marine waters seaward to the extent of the state’s police power and management authority, including the 12-mile U.S. territorial sea and all archipelagic waters. The purpose of the SMA permit is to ensure that uses, activities, and operations within the SMA are carried out in compliance with the state’s CZM law (HRS 205A). SMA permits regulate permissible land uses that are already allowed by land use policies, taking into account zoning designations, county general plans, and community plans. Although the project is located within the Special Management Area (SMA), no development or ground disturbance will occur.

5.5.2 Hawai‘i Revised Statutes, Chapter 343

The State of Hawai‘i EIS law, HRS Chapter 343, was developed “to establish a system of environmental review that would ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations” (HRS 343-1). This chapter requires the development of an EA or EIS that discloses the effects of a proposed action, including the cumulative and overall effects, relative to an established set of 13 significance criteria, as defined in 11 HAR 200-12. HRS 343 also mandates that state agencies consider the potential effects of a proposed action on cultural practices as part of the environmental review process. Act 50 of the Session Laws of Hawai‘i (A Bill for an Act Relating to EISs) clarifies that “the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawai‘i’s culture, and traditional and customary rights” and stresses the need to include consideration of cultural resources, customs, practices, and beliefs as part of the EA and EIS process. As part of the project’s approval

process, this Final EA has been prepared in accordance with HRS Chapter 343, as required under Revised Ordinances of Honolulu (ROH) Chapter 25.

6 ANTICIPATED DETERMINATION FOR HRS CHAPTER 343 COMPLIANCE

6.1 Significance Criteria and Analysis

A FONSI is anticipated for this project, based on the following analysis:

1. *No irrevocable commitment to loss or destruction of any natural or cultural resource would result.* The project is not expected to irrevocably commit to the loss or destruction of any natural or cultural resources. SOPs would be implemented to avoid or minimize potential impacts to natural or cultural resources.
2. *The proposed action would not curtail the range of beneficial uses of the environment.*
3. *The proposed action would not conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 343, Hawai'i Revised Statutes.* The project would be in conformance with the State's long-term environmental policies and goals expressed under HRS 343.
4. *The proposed action would not substantially affect the economic or social welfare of the community or State.* The project is not anticipated to cause substantial, adverse effects to the economic or social welfare of the community or State.
5. *The proposed action would not affect public health.*
6. *No substantial secondary impacts, such as population changes or effects on public facilities, are expected.* The project is not expected to result in substantial secondary impacts to population or public facilities.
7. *No substantial degradation of environmental quality is expected due to the proposed action.* The project is not anticipated to cause substantial degradation of environmental quality.
8. *No cumulative effect on the environment or commitment to larger actions would be involved. T*he project is not anticipated to have adverse cumulative environmental effects and it is not linked to any larger action.
9. *No rare, threatened, or endangered species or their habitats would be adversely affected.* The project has the potential to reverse the population declines and likely global extinction of two endangered and one threatened Hawaiian honeycreeper species. The recovery of these bird species would potentially benefit the reproduction and recovery of mutualist-dependent listed native plant species. Adverse effects of the proposed action would be effectively mitigated through the implementation of mitigation measures.
10. *The proposed action would not detrimentally affect air or water quality, or ambient noise levels.* The project is not anticipated to result in significant adverse impacts to air or water quality. However, there would be a temporary, short-term adverse impact for recreational users within the accessible areas of the project area due to the intermittent and short-term

increase in noise from helicopters and fixed-wing aircraft. These adverse impacts would be minimized to the greatest extent possible by limiting the use of helicopters and fixed-wing aircraft in favor of less intrusive drones within accessible sections of the project area. The impacts of noise from aircraft on native wildlife would be managed through the implementation of the mitigation measures in Tables 3 and 4.

11. *The proposed action would not detrimentally affect environmentally sensitive areas such as floodplains, tsunami zones, beaches, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters, or coastal waters.* The project is not anticipated to adversely affect environmentally sensitive areas such as floodplains, tsunami zones, beaches, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters, or coastal waters.
12. *The proposed action would not substantially affect scenic vistas and view planes identified in county or state plans or studies.* The project would not adversely impact scenic vistas and view planes.
13. *There would be no requirement for substantial energy consumption.* The project would not require substantial energy consumption.

6.2 Anticipated Determination

Based on a review of the significance criteria in HRS Chapter 343, and HAR Section 11-200.1-13, it is anticipated that the project would not result in significant adverse effects on the natural or human environment.

7 CONSULTATION

On October 21, 2022, the DLNR and USFWS issued a preparatory notice requesting consultation for the draft EA. The notice, which included a detailed description of proposed project activities and maps of the project area, was emailed to 91 recipients and sent as hard copy letters to 22 individuals or offices. Represented in this request for consultation were at least 33 State or Kaua'i governmental offices,14 Federal governmental offices representing the USFWS, Department of Defense, U.S. Department of Agriculture and USGS, 49 non-governmental/non-profit organizations that included 14 cultural, 29 environmental, six civic entities, and 11 for profit organizations or companies. A copy of the preparatory notice is included in Appendix H.

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Appendix A:

Issues, Potential Impact Topics, and Alternatives Considered but Dismissed from Detailed Analysis

Table A-1. Affected Environment Resources that are Considered Unlikely to be Impacted by the No-Action Alternative and Proposed Action.

Impact Causing Element	Resources Potentially Impacted	Assessment of Likely Impacts During Project
Geological disturbance and soil erosion	Existing roads and trails	Implementation of the project would result in nominal increases in vehicle and pedestrian traffic within existing transport infrastructure. The impacts of this increased traffic on soil erosion within this transport infrastructure will be minimized due to incompatible male mosquito release and monitoring being undertaken in appropriate weather to minimize damage to trails. Soil erosion resulting from vehicle and pedestrian movement is likely to be very localized and negligibly greater than the existing conditions with onging and future use. No additional geological or soil disturbance would be expected across the broader proposed project area.
Presence of Wolbachia-infected mosquitos	Southern house mosquito; other invasive mosquito species	If successful, populations of invasive southern house mosquito would be reduced to low levels within the proposed project area. This would result in a net benefit for native flora and fauna within the affected area. The risk of novel strains of Wolbachia being transmitted to other invasive mosquito species via hybridization or horizontal gene flow was evaluated but deemed to be of negligible risk.
Surface and ground water	Water quality and quantity	No impacts on water quality are anticipated from the proposed action.

Impact Causing Element	Resources Potentially Impacted	Assessment of Likely Impacts During Project
Disturbance or degradation of aquatic habitats (wetlands, marshes, streams, rivers, fishponds, and anchialine ponds)	Water quality and quantity, aquatic flora and fauna in and on the margins of aquatic habitats	Disturbance of freshwater features is anticipated to be limited to monitoring southern house mosquito populations within these habitats. This monitoring is presently being undertaken within the proposed project area and is expected to have no impacts on water quality, quantity, or the habitat that these features provide for flora and fauna. Pedestrian release of incompatible male mosquitoes would have negligible impacts on aquatic environments because crossing of streams would be limited to designated crossings on the established trails within the projec area.
Coastal features (beaches, estuaries, coastal waters)	Coastal geology and sediments, water quality, coastal flora and fauna habitat, recreational sites (e.g., surfing sites, boating, diving)	It is unlikely that project personnel would access coastal sections of the proposed project area during the project. Similarly, no project equipment would be placed near or within this zone.
Lightscapes	Project area and surrounding line of site locations	No impacts to lightscapes are anticipated to result from the proposed action. All work would be conducted during daylight hours. This issue was considered and dismissed from further analysis.
Land Use	Project area	No impacts to land use are anticipated to result from the proposed action. All current land uses would continue as is under the proposed action. This issue was considered and dismissed from further analysis.
Viewsheds	Natural features visible within line-of-sight	Helicopters, fixed-wing aircraft, and drones would be visible intermittently during from elevated vantage points throughout the proposed project area. However, the visual intrusion of these aircraft would be limited in extent (seconds to minutes) and will have no permanent impact on the viewsheds.

Impact Causing Element	Resources Potentially Impacted	Assessment of Likely Impacts During Project
Soundscapes	Disturbance of the natural acoustic environment from human-generated sounds	Helicopters, fixed-wing aircraft, drones, motor vehicles, and personnel will be present intermittently within the proposed project area. However, the audible presence of project associated aircraft, vehicles, and personnel would occur only intermittently and for short time periods. By minimizing the use of aircraft and vehicles, this increase is unlikely to meaningfully contribute to the overall soundscape beyond existing levels.
Wilderness (including visitor experiences)	Visual and audible disturbance of wilderness experience for humans recreating within proposed project area	See Viewsheds and Soundscapes in this Table and Wilderness section in this appendix.

ALTERNATIVES CONSIDERED BUT DISMISSED

Application of conventional pesticides/adulticides

Of the six conventional pesticide spray formulations currently registered in Hawaiʻi and labeled for control of mosquitoes in non-agricultural areas, none are labeled for use against mosquitoes in conservation areas, forests, bogs or waterways. More notably, the use of conventional pesticide products containing active ingredients that kill arthropods are unacceptable for use in natural areas due to the presence of native insect species. There are over 1,400 described arthropod species that are endemic to the island of Kauaʻi. The natural areas that serve as the last refuges for native forest birds also support a diversity of the remaining endemic arthropods, including federally listed endangered and threatened species. For example, *Drosophila musaphilia* is endemic to Kauaʻi and its known range and critical habitat is in Kōkeʻe within the proposed application area. Furthermore, the repeated application of pesticides within the proposed project area could potentially contaminate soil and water due to pesticide runoff or drift, as well as the potential development of pesticide resistance within target and non-target insects.

Application of conventional larvicides

Similar to conventional spray formulations, conventional larvicides containing active ingredients with modes of action known to broadly impact arthropods; these are also unacceptable for application in natural areas. Rare native arthropod species occur within the proposed application area, and larvicides could threaten species outside of the project area if run-off or pesticide drift occurs. The remote high elevation habitat in which endangered forest birds persist is additionally inaccessible and challenging to traverse, therefore surveying for cryptic larval habitat and applying larvicides to achieve comprehensive control is logistically unfeasible. Even if pursued, this method is also unlikely to be successful given that the proposed project area receives extensive rainfall, which would dilute and disperse chemicals outside of intended target areas.

Application of bacterial larvicides

There are at least 11 products registered in Hawai'i and labeled for control of mosquitoes in the larval stage that use the bacteria *Bacillus thuringiensis israelensis* (Bti) as the active ingredient. While many of these products can be used in natural areas, including bogs and waterways, there are significant constraints on locating larval habitat and applying the larvicide in remote, inaccessible areas. Bti is not effective in controlling late instar mosquito larvae, which could still emerge as adult mosquitoes. This approach is also quickly rendered ineffectual in high rainfall environments where Bti is likely to be quickly diluted after application.

Cultural controls

Management in natural areas can help to decrease the presence of larval habitat, but it cannot completely eliminate it. To prevent the degradation of native forests and the creation of larval habitat by introduced hoofed animals, activities such as fencing and ungulate control are essential. These measures, however, do not address the breeding of larvae in areas with natural standing water, such as tree cavities, bogs, and streamside pools.

There are also actions that can be taken to reduce the availability of larval habitat created by humans. These actions include filling potholes on roads and removing man-made materials that may hold water. Regardless, these measures are not effective in achieving area-wide control of mosquitoes.

Biological control

Biological control of mosquitoes has been undertaken using *Toxorhynchites* mosquitoes, which are natural predators of mosquito larvae in aquatic habitat (Steffan 1968). While they are generalist predators, *Toxorhynchites* have been documented to prefer mosquito larvae. Two *Toxorhynchites* species (*T. brevipalpis* and *T. amboinensis*) were released to control mosquitoes and have established self-sustaining populations in Hawai'i (in 1950 and 1953, respectively) (Steffan 1968). While the two species may contribute to localized control, they appear incapable of providing effective area-wide suppression of southern house mosquito populations (Nakagawa 1963).

Application of males sterilized by irradiation

The application of incompatible males for fruit fly control and eradication programs has been highly successful worldwide. The process of releasing male mosquitoes sterilized by irradiation would be logistically similar to the application of incompatible male southern house mosquitoes (*Culex quinquefasciatus*). Previous studies, however, indicate that irradiation levels required to sterilize male mosquitoes reduce their competitiveness in locating and mating with female mosquitoes, when compared to wildtype males (Bellini et al. 2013, Yamada et al. 2014).

Self-limiting genetically modified mosquitoes

Self-limiting, genetically modified (GM) mosquitoes are being used in other places around the world (Florida, California, Brazil, Panama) to achieve mosquito control, with the goal of reducing arboviral disease transmission for public health and safety (Waltz 2016, EPA 2021). The release of GM mosquitoes requires similar logistics to the use of incompatible male mosquitoes or irradiated sterile male mosquitoes. Such technology, however, has not yet been developed for southern house mosquito and concerns have been expressed by communities in Hawai‘i relating to the safety of genetically engineered or modified organisms (GMOs), and GM mosquitoes in particular.

Other Mosquito Control Methods

In 2017 a group of biologists, entomologists, biotechnology experts, and public health specialists met over three days to discuss the possible solutions to the problem of mosquito-borne diseases in Hawai‘i (https://reviverestore.org/the-plan-to-restore-a-mosquito-free-hawaii/). The group identified the sterile insect technique (SIT; i.e., sterilizing mosquitoes with radiation), IIT using the *Wolbachia* bacteria, and self-limiting insect approaches using next generation gene tools (i.e., “gene drive”) as possible options. At the time, SIT research had not yielded promising results for area-wide mosquito control programs. Concerns with gene drive technology, similar to those identified for self-limiting genetically modified mosquitoes above, were also acknowledged. Furthermore, there was no existing gene drive approach developed for mosquito control nor was there an accompanying regulatory pathway for such a tool to be registered and utilized. *Cordyceps* or other fungus species were not identified as tools for suppressing mosquito populations, and there is no fungus that is effective at suppressing populations of the southern house mosquito. New technology as it becomes available will be explored as potential options in the future.

Reforestation and Habitat Restoration

Reforestation and habitat restoration have occurred in the past and are ongoing actions in and around the project area and are expected to continue. While these efforts contribute significantly to the long-term restoration of suitable habitat throughout endangered forest bird critical habitat on Kaua‘i, these efforts alone will not prevent the extinction of the species.

Loss of suitable habitat has been extensive in the Hawaiian Islands and is a significant threat to forest birds generally. Introduced and established mosquitoes, however, are also a threat because forest birds on Kauaʻi are highly susceptible to mosquito-borne diseases and are not expected to persist in areas where mosquitoes are present. Restoration of suitable habitat through reforestation of areas in which mosquitoes are present is therefore not expected to be an effective alternative strategy to prevent the extinction of forest bird species. Restoration of suitable habitat in higher elevation areas where mosquitoes are expected to become prevalent as global temperatures rise, is an important part of recovery efforts. However, restoration alone does not constitute an effective alternative to mosquito control at this time because, 1) the acreage of potential suitable habitat at those higher elevations is vanishingly small, and 2) restoration of suitable habitat in those areas takes decades and cannot be completed before the projected extinction timeline of the affected species. Lastly, reforestation and habitat restoration would not remove the southern house mosquito from the project area and therefore not abate the spread of avian malaria.

As previously mentioned, the proposed action would be part of a suite of management actions designed, at least in part, for the preservation of native forest birds. The U.S. Fish and Wildlife Service (USFWS) detailed a long-term conservation and recovery plan for several taxa of endangered Hawaiian forest birds, including the remaining populations of ʻakikiki and ʻakekeʻe on Kauaʻi (USFWS 2006). The plan prioritized measures to improve and restore degraded habitat through invasive species control and reforestation. Population viability models, however, predicted time to extinction of both the ʻakikiki and ʻakekeʻe as soon as 2023 (Paxton et al. 2022), which further demonstrates the urgency for implementing mosquito suppression techniques in both current and previously occupied ranges where habitat restoration and invasive species control are ongoing.

Restoration of Natural Water Flow

Although it is true that human infrastructure in streams in Hawaiʻi can create additional larval habitat for the southern house mosquito, the abundance of mosquitoes in high elevation habitat on Kauaʻi is not caused by stream diversions or other human-caused water flow disturbances. Mosquitoes breed in various natural water sources including, but not limited to, tree cavities, pig wallows, natural depressions, and streamside pools. Restoration of natural water flow throughout relevant habitat on Kauaʻi would therefore not decrease or eliminate the presences of southern house mosquitoes on the island, nor decrease the spread of avian malaria in forest bird habitat.

OTHER POTENTIAL ENVIRONMENTAL IMPACTS

Unintended Release of Female Mosquitoes

Although the inadvertent release of female incompatible mosquitoes (i.e., “female contamination”) would negatively impact the project’s tool effectiveness to suppress southern house mosquito populations on Kauaʻi, this presents no more risk to humans or animals than the mosquitoes that currently occur on the island. Such inadvertent releases of females likewise would not increase the population of mosquitoes on Kauaʻi.

Owing to the importance of only releasing male incompatible mosquitoes, sorting out and removing females is vital. In similar IIT programs, sex sorting was accomplished several ways and with varying rates of success. A primary method to separate and remove females uses sieves, or another similar physical separation method, taking advantage of the fact the female pupae are larger than those of males (Kittayapong et al. 2018, Crawford et al. 2020, Zeng et al. 2022). This method alone is estimated to remove >95% of all females, and various additional methods have been used to eliminate the remaining females or render them sterile (e.g., exposure to radiation). The proposed action will employ sorting methods consistent with Crawford et al. 2020, which estimates the risk of releasing a female to be 1 out of 900 million released mosquitoes (Crawford et al. 2020). This highly technical process relies on physical separation of pupae followed by imaging and sorting of emerged adults via artificial intelligence (AI) programs that remove any remaining females (Crawford et al. 2020). An iterative process of vetting AI scanned images is then used to further reduce the risk of female presence in any given batch of mosquitoes bound for release. Following the methods described by Crawford et al. (2020), Beebe et al. (2021) did not detect any released females (or larvae containing control *Wolbachia*) during their project in Australia. Following a different method, Zeng et al. (2022) estimated a female contamination rate of <1% and saw no local establishment of *Wolbachia*-infected mosquitoes in their study site in Hunan, China. The Crawford et al. (2020) sex sorting employed in this project would result in a female contamination rate that is several orders of magnitude smaller than reported in Zeng et al. (2022).

As discussed above, southern house mosquitoes release as part of this project would be transinfected with the wAlb *Wolbachia* strain, while wild mosquitoes in Hawai'i are naturally infected by the wPip *Wolbachia* strain (Atkinson et al. 2016). Should a wAlb female be released, she would be compatible with the released wAlb male mosquitoes and could produce viable offspring. This, however, is detrimental to the project's suppression goals and every effort would be made to reduce or eliminate female contamination of released male mosquitoes. For local establishment of a wAlb population of southern house mosquitoes to occur, females would first need to be released and survive long enough to reproduce (i.e., mate, find a blood meal, and lay eggs). If overflooding rates of released males are correctly calculated, it is possible that a released female could find a compatible male with which to mate. Although southern house mosquitoes are bidirectionally incompatible between wAlb and wPip strains, both pairings of wAlb males and wPip females and pairings of wPip males and wAlb females are incompatible. Should a released female mate with a wild type wPip male, no offspring would therefore be produced. If a released female successfully produces offspring with a released male, all resulting offspring would be infected with the wAlb *Wolbachia* strain. These offspring, however, would need to mate with other wAlb southern house mosquitoes to continue the reproductive cycle, as would all successive generations. Meanwhile, any mating events with wPip wild type mosquitoes would suppress any developing wAlb population. Successful establishment of a wAlb population would therefore be the product of a series of extremely unlikely events. Should local establishment by chance be detected, halting releases of wAlb males will allow the local wild type wPip mosquitoes to reinvade a portion of treatment area and eliminate the wAlb population. Deliberately releasing wild type wPip male mosquitoes could similarly accomplish the same objective.

Horizontal Transfer of *Wolbachia*

As previously discussed, *Wolbachia* (wPipV) is already present in the southern house mosquito and *Wolbachia* (wAlbA and wAlbB) strains are already found in the Asian tiger mosquito (*Aedes albopictus*) in Hawaiʻi. It is highly improbable that incompatible male mosquitoes, which cannot reproduce and would perish in the environment in under a week after release, are more likely to undergo horizontal transmission of *Wolbachia* than the existing populations of southern house mosquitoes that have been reproducing across the islands for the last 125–200 years. Compounding this improbability, *Wolbachia* is already common among native Hawaiian insects (Bennett et al. 2012).

Wolbachia is an endosymbiotic organism (i.e., it exists within the cells of another organism) that is maternally inherited or is passed down from a mother to her offspring. This process of passing *Wolbachia* from mother to offspring is referred to as "vertical transfer" (Weeks et al. 2002). Alternatively, "horizontal transfer" would be the transmission of *Wolbachia* from one organism to another via a non-maternal route (Ding et al. 2020). The mechanism for such a transfer in *Wolbachia* is not known, would only occur following a series of extremely unlikely events, and would require *Wolbachia* bacteria to live outside of their host cells for a period of time (Ding et al. 2020). In a laboratory setting, maintaining living *Wolbachia* outside of host cells requires precise conditions to preserve these bacteria in a cell-free medium for even short periods of time (Rasgon et al 2006); numerous environmental factors would severely limit the lifespan of *Wolbachia* outside of their host cells (e.g., pH, UV radiation) in a natural setting. This technique is in fact required for the process of creating the incompatible mosquitoes to be used in this project. Tolley et al. (2019) asserted or implied that the ability to preserve *Wolbachia* outside of cells in a laboratory setting (Rasgon et al. 2006) represents evidence that *Wolbachia* can live extracellularly in nature. There is, however, no known evidence or example in the literature of free-living (extracellular) *Wolbachia*. The mechanism for horizontal transmission of *Wolbachia* remains unknown, but the hypotheses for how this has occurred in the past have little relevance to the system in the proposed project. Tolley et al. (2019) has suggested that horizontal transfer in ants could have occurred through social interactions or predation, but again there remains no direct evidence of this and this hypothesis is purely speculative.

Regarding the second point, both the Asian tiger mosquito and the yellow fever mosquito (*A. aegypti*) live in the same environments in many parts of the world, including on Hawaiʻi Island. While the Asian tiger mosquito is nearly always naturally infected with *Wolbachia* (the same strain that would be used in the proposed project), the yellow fever mosquito is naturally uninfected by *Wolbachia* (Klassen et al. 2009) and there is no evidence of horizontal transfer of the bacteria between these two species. There is likewise no evidence that the strain of *Wolbachia* found in southern house mosquitoes has been transmitted to the Asian tiger mosquito (or any other mosquito), or vice versa, in Hawaiʻi (or anywhere else) despite co-occurrence for >130 years (Atkinson et al. 2016). There is additionally no evidence of transfer of *Wolbachia* from mosquitoes to other arthropods, including native Hawaiian insects (Bennett et al. 2012). The low rate of horizontal transfer among related species, such as Asian tiger and yellow fever mosquitoes, suggests that the rate of transfer among unrelated arthropods would be lower still.

Horizontal Gene Transfer

While horizontal transfer of Wolbachia would involve the non-heritable movement of the Wolbachia bacterium between insect species, "horizontal gene transfer" would be the theoretical movement of genetic material (DNA) from the Wolbachia bacterium into the genome of the southern house mosquito (Klassen et al. 2009). Horizontal gene transfer is a natural process that has occurred innumerable times throughout evolutionary history. Scientists have found segments of DNA within numerous eukaryotic (e.g., animal) organisms that can be traced back to a prokaryotic (i.e., bacterial) organism, often in parasite-host interactions (Klassen et al. 2009, Dunning Hotopp 2011). This may in fact be an important evolutionary process that is just now being realized. The process of horizontal gene transfer itself, however, is not a concern. More pertinent is whether such a transfer includes transcriptional phenotypic traits that could be acted on by selective pressures that allows for beneficial traits to be developed. A segment of DNA does not necessarily contain all the required information to be transcribed or read and conferred into new traits or functions of the individual organism. Much of a genome in fact contains sequences of non-coding DNA, often referred to as "junk DNA." The likelihood that such an event could somehow alter the genome of the mosquito in a meaningful way is therefore exceptionally low. Further, the horizontal transfer of genes between Wolbachia and a mosquito would by no means constitute the creation of a new species of mosquito.

It has been suggested that Klassen et al. (2009) had purported to show evidence of horizontal gene transfer between *Wolbachia* (wPip) and the yellow fever mosquito. These authors found several sequences of DNA within the typically *Wolbachia*-free yellow fever mosquito's genome that had previously been identified from the *Wolbachia* genome. Klassen et al. (2009) do acknowledge, however, that while the most likely direction of transfer was from the *Wolbachia* to the mosquito, it could not be determined for certain the transfer did not occur in the opposite direction. Importantly, these examples of gene transfer occurred as a result of a natural evolutionary event(s), not as a result of any human-caused process (such as in the proposed project); the timescale required for these transfer events is therefore unknown. Given that the wPip strain of *Wolbachia* has co-evolved with the southern house mosquito for likely millions of years, it is considerably more likely that horizontal gene transfer may have occurred naturally between these species than between the transinfected wAlb and the southern house mosquito.

Lastly, concerns such as horizontal gene transfer are predicated on the establishment of a reproducing population of southern house mosquitoes infected with wAlb strain of *Wolbachia.* The very purpose of the proposed project is to suppress the population of southern house mosquitoes within the project area on Kauaʻi, not to augment them. Local establishment of wAlb southern house mosquitoes would work against that goal and extreme care would be taken to avoid that scenario.

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Appendix B

Cultural Impact Assessment

Cultural Impact Assessment of Using *Wolbachia*-based Incompatible Insect Technique for the Suppression of Southern House Mosquito Populations on Kaua‘i

MAY 2023

DRAFT

PREPARED FOR

State of Hawai‘i Department of Land and Natural Resources Division of Forestry and Wildlife

PREPARED BY

SWCA Environmental Consultants

CULTURAL IMPACT ASSESSMENT OF USING *WOLBACHIA*-BASED INCOMPATIBLE INSECT TECHNIQUE FOR THE SUPPRESSION OF SOUTHERN HOUSE MOSQUITO POPULATIONS ON KAUA‘I

Prepared for

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SWCA Project No. 00067334-000-HON

May 2023

EXECUTIVE SUMMARY

At the request of the State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), SWCA Environmental Consultants (SWCA) has prepared the following Cultural Impact Assessment (CIA) to assess the potential cultural impacts of the use of *Wolbachia*-based Incompatible Insect Technique to reduce mosquito populations within approximately 59,204 acres (23,959 hectares) of forest reserves, state parks, and private lands in the Kōke'e and Alaka'i Wilderness areas of Kaua'i. The goal of the Kaua'i mosquito suppression project is to protect native forest birds in critical higher-elevation habitats by disrupting the breeding of southern house mosquitoes (*Culex quinquefasciatus*) within the project area. The CIA was prepared to assist DOFAW in complying with its responsibilities under State of Hawai'i Revised Statute Chapter 343, which requires state agencies to take into account the potential effects of a proposed project on traditional cultural resources, practices, and beliefs as part of the environmental assessment process.

In preparing this CIA, SWCA followed the *Guidelines for Assessing Cultural Impacts* provided by the Hawai'i State Office of Environmental Quality Control (now the Office of Planning and Sustainable Development). Archival research was undertaken into the cultural history of the project area and into the previous archaeological studies conducted in the vicinity in an attempt to determine the traditional cultural use and significance of the project area. This research was followed by community consultation and informant interviews undertaken to identify any cultural resources, practices, and beliefs, both traditional or contemporary, associated with the project area.

One of the principal impacts of the proposed project on cultural resources is the anticipated reduction of mosquito populations. As *Culex quinquefasciatus* mosquitoes are carriers of avian malaria and avian pox, their suppression would reduce the threat of these diseases and contribute to the long-term protection and preservation of surviving native forest bird populations. As these birds play a significant role in Hawaiian culture, their existence and presence within the forest environments they inhabit are important to maintaining cultural continuity between traditional and contemporary cultural customs, practices, and beliefs.

The ethnohistorical literature associated with native birds, *kia manu* (birdcatchers), and the project area is extensive. Numerous oral traditions describe kia manu who lived and gathered feathers within the project area. Additionally, traditional place names within and near the project area are rich in references to native birds. Native bird species factor prominently in traditional Hawaiian cultural practices, customs, and beliefs.

As part of the CIA process, five individuals knowledgeable concerning the project area and the cultural significance of native birds were interviewed. All of the interviewees shared a great concern for the declining native bird populations and stressed the importance of native birds to Hawaiian culture; past, present, and future. Each spoke to the cultural significance of the project area and the numerous cultural resources, *wahi pana* (storied places), and culturally significant biological communities found within it. All of the interviewees supported the project and expressed their hope that it would succeed and accomplish what it is intended to do. One interviewee was cautiously wary of the project because of the failures of past biological interventions throughout the history of the Hawaiian Islands. Interview participants recommended close monitoring of both mosquito populations and of native forest bird populations.

The findings of the CIA indicate that the proposed project is unlikely to adversely impact cultural resources, practices, and beliefs. Instead, the proposed project is expected to enhance traditional cultural resources and beliefs as well as contemporary cultural practices.

Efforts, such as the proposed use of *Wolbachia*-based Incompatible Insect Technique (IIT), that are designed to reduce the incidence of avian malaria and avian pox transmission among native forest bird species would result in positive outcomes for the species themselves and the cultural heritage associated with them. The potential long-term beneficial impacts to the conservation of native forest birds would enhance cultural resources, practices, and beliefs.

Under the no-action alternative, avian malarian and avian pox will continue to impact native bird species, likely resulting in more extinctions and the loss of these significant cultural resources. Under the proposed action, the suppression of southern house mosquitos would result in increases in populations of native forest birds within the project area which would in turn enhance the cultural heritage represented by these native forest birds.

Reference Citation:
Traub, Wainani, Hattie Gerrish, and Rowland Reeve. 2023. Cultural Impact Assessment of Using *Wolbachia*-based Incompatible Insect Technique for the Suppression of Southern House Mosquito Populations on Kaua‘i. Report prepared for the State of Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife by SWCA Environmental Consultants, Hawai‘i.

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1 INTRODUCTION

On behalf of the State of Hawaiʻi, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), SWCA Environmental Consultants (SWCA) has prepared the following Cultural Impact Assessment (CIA) to assess the potential cultural impacts of the proposed use of *Wolbachia*-based Incompatible Insect Technique (IIT) in the suppression of mosquito populations and the protection of critical high-elevation native forest bird habitat within approximately 59,204 acres of forest reserves, state parks, and private lands in the Kōkeʻe and Alakaʻi Wilderness areas of Kauaʻi (Figure 1).

The proposed project area encompasses a large portion of Kauaʻi's surviving native rainforest, a landscape imbued with cultural significance. The several wahi pana (storied places) found within these areas are integrated cultural and natural landscapes strongly associated with Hawaiian cultural traditions, practices, and beliefs. As the project is designed to protect surviving native bird populations, this CIA is particularly concerned with recording the past and present historical and cultural significance of native forest birds and the environment they inhabit.

1.1 Project Area

The proposed project area covers a substantial portion of northwestern Kauaʻi, stretching from the coast up into the mountains. It encompasses the *ahupuaʻa* (traditional land divisions) of Waimea, Wainiha, Makaweli, Hanakāpīʻai, Hanakoa, Pōhakuao, Kalalau, and Honopū (Figure 2). The project area also includes some high elevation areas of Lumahaʻi, Hanalei, Wailua, Hanamāʻulu, and Hanapēpē Ahupuaʻa. These ahupuaʻa are situated within the *moku* (districts) of Kona, Nāpali, Haleleʻa, and to a lesser extent, Puna. This area encompasses the Kōkeʻe State Park, Hono o Nā Pali Natural Area Reserve, Kuʻia Natural Area Reserve, Nā Pali Coast State Wilderness Park, Nā Pali-Kona Forest Reserve, the Alakaʻi Wilderness Preserve, and private lands (Figure 3).

The boundaries of the project area were established through coordination between the U.S. Fish and Wildlife Service (USFWS), the Kauaʻi Forest Bird Recovery Program (KFBRP), and the DLNR. The area covered accounts for mosquito dispersal as well as target areas outside of the existing safe forest bird habitat to prevent mosquitoes from moving into the core habitat from lower elevations where mosquito densities are significantly higher.

1.2 Project Background

The native forest birds of Kauaʻi face several threats to their survival. Already, 10 of the 16 native honeycreepers of Kauaʻi have gone extinct, and 3 of the remaining 6 species are endangered or threatened. Although several factors contribute to the continuing decline in native bird populations, the main threats to Hawaiian forest birds are avian malaria (*Plasmodium relictum*) and avian pox (*Avipoxviru*s spp.); diseases principally spread by the nonnative southern house mosquito (*Culex quinquefasciatus*). Despite the danger that these diseases pose to native forest birds, there has not, until recently, been a viable method to control mosquito populations within natural areas in Hawaiʻi.

The Incompatible Insect Technique (IIT) has been successfully usedin numerous cities in the U.S. and throughout the world to control mosquitoes that carry human diseases. The technique utilizes lab-raised male mosquitoes that carry a select strain of *Wolbachia*, a bacteria that naturally occurs in at least 65% of insect species, and that is naturally found in native and introduced arthropods in Hawaiʻi. When *Wolbachia*-carrying male mosquitoes, which do not bite or carry diseases, are released into a target

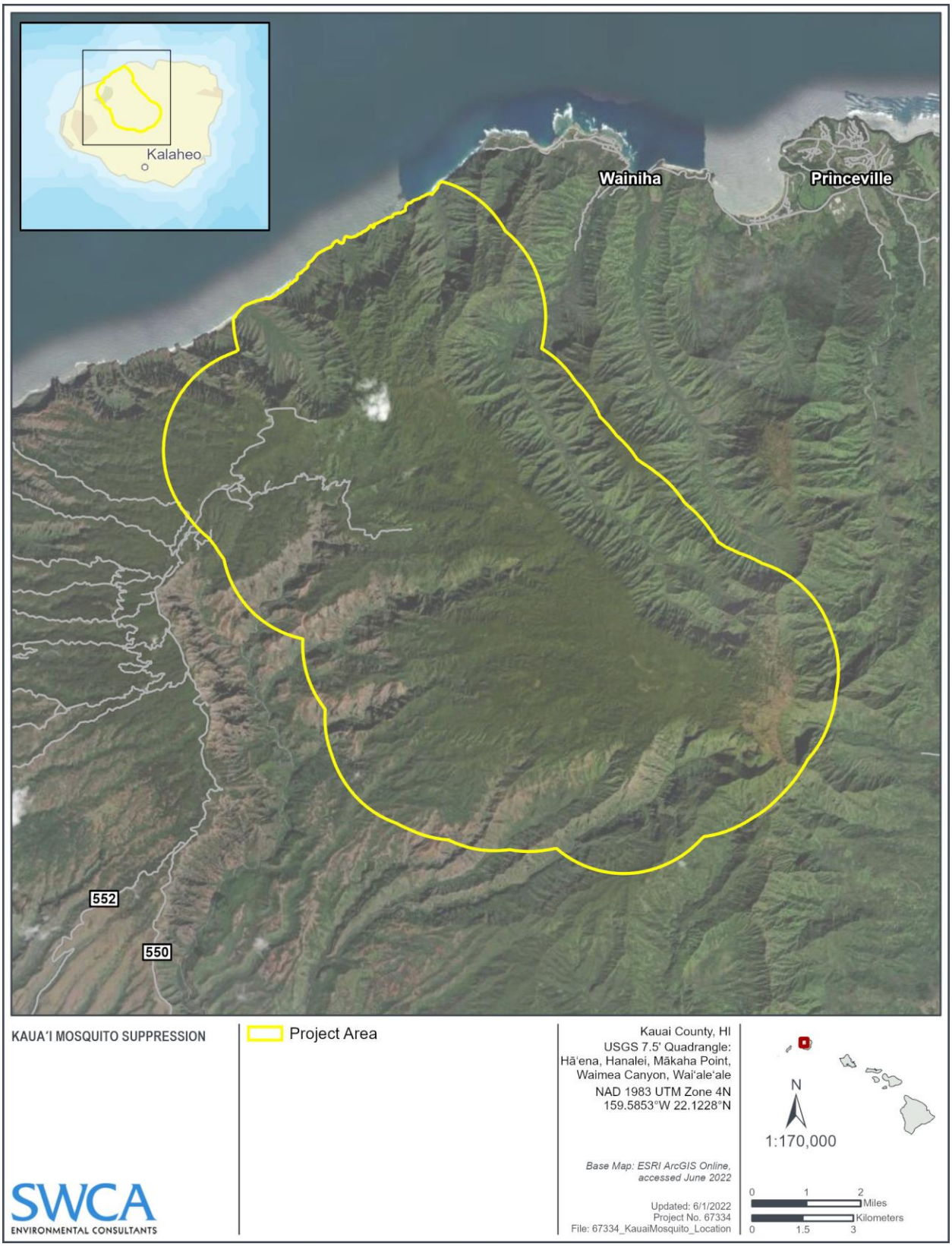

Figure 1. The boundaries of the proposed project area.

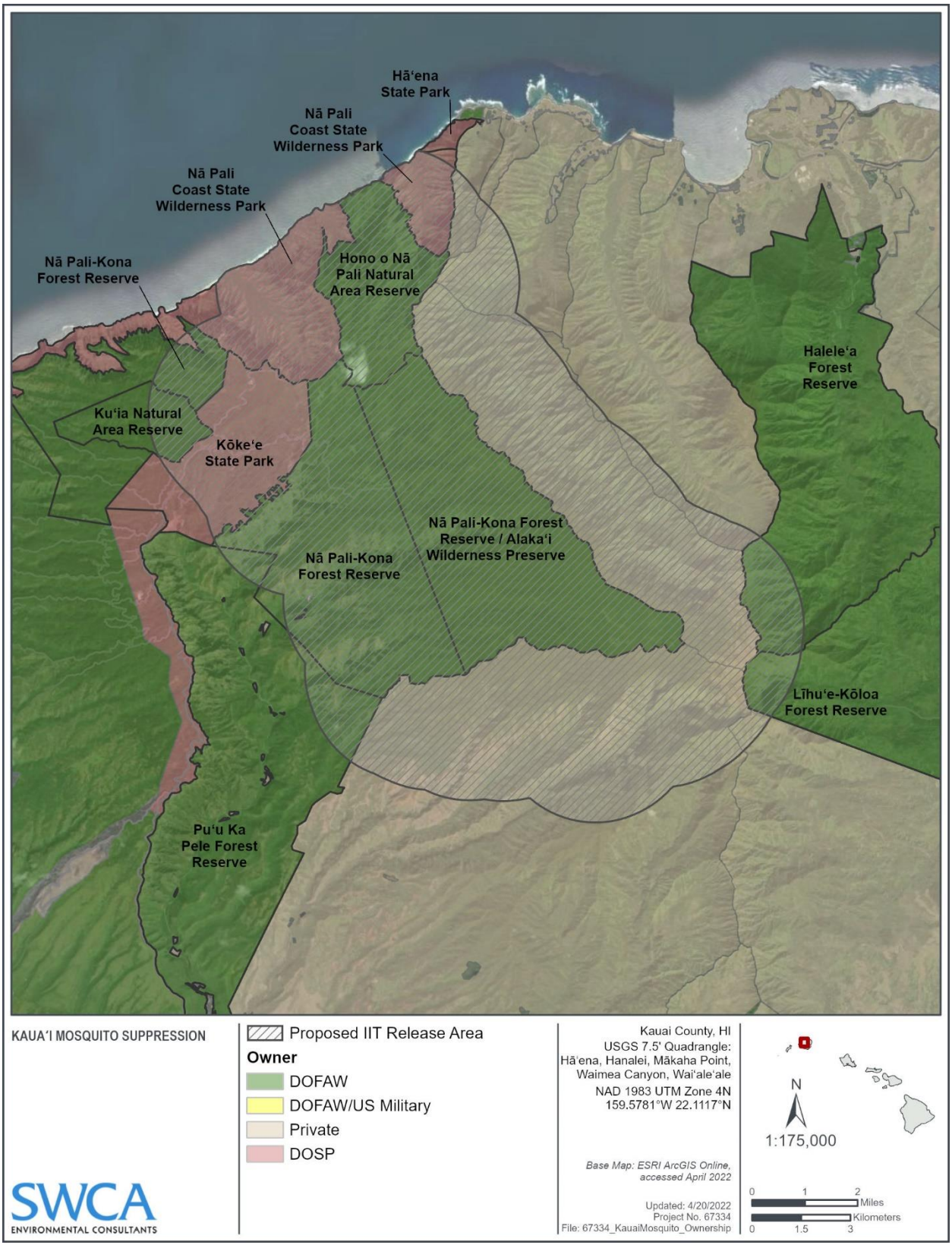

Figure 2. State Parks, Forest Reserves, and Natural Area Reserves within and overlapping the project area.

habitat and mate with female mosquitoes, the *Wolbachia* bacteria prevents the healthy development of resulting eggs, and they do not hatch. This causes a general decline in the mosquito population within the target area.

The development of IIT to combat mosquito-borne diseases that affect humans presents a unique opportunity to further develop the technique to control mosquitoes that spread avian diseases to native forest bird species in Hawaiʻi. The mosquito species targeted in this process are also a vector of human diseases, such as West Nile Virus and lymphatic filariasis, and can transmit heartworm to pets. It is notable that this technique does not use any genetically modified organisms or involve genetic engineering of bacteria or mosquitoes.

1.3 Project Description

The DLNR and its project partners are proposing the sequential release of lab-raised male southern house mosquitoes that carry a strain of *Wolbachia* that is incompatible with the strain that is present within the wild female southern house mosquito population. The mosquitoes would be released from the ground and air within 23,959 ha/59,204 acres of the highest elevation areas of Kauaʻi (Figure 1). The Kōkeʻe State Park, Nā Pali-Kona Forest Reserve, and the Alakaʻi Wilderness Preserve overlap with the extant native forest bird habitat, including critical habitat for ʻakekee and ʻakikiki, on the island (Paxton et al. 2016; species accounts provided below) (Figure 3). Ongoing monitoring of mosquito populations and native forest birds would be undertaken prior to and during the project.

1.3.1 Mosquito Release

The lab-raised incompatible male mosquitoes are planned to be released from both the ground, along established roads trails, and fence line corridors, and the air, from helicopters, fixed-wing aircraft, or unmanned aerial vehicles (UAS "drones"). For more a more detailed description of mosquito release methods, see section 3.2.6 of the EA.

For ground release, only existing routes of travel would be used, and no new roads, trails, or helicopter landing zones would be created to support this project; only existing facilities and access points would be used. Release areas would be prioritized based on ease of access, availability of support resources, presence of southern house mosquitoes, and proximity to core endangered forest bird populations. Project management units would be demarcated by access roads and trails, and vegetation types. In terms of ease of access, some higher priority areas would include accessible fence lines, roads, trails, and field camps used for other resource management activities. Field camps accessible by road may be of higher priority than those accessible by helicopter. Available times to occupy camps would be coordinated through the appropriate management agency.

For the pedestrian release method, incompatible male mosquito releases would occur along existing roads via four-wheel-drive (4WD) vehicles or via pedestrian hiking trails and fence line corridors. The appropriate DLNR permit process would be followed, where necessary. Most trails, access roads, and LZs would not require vegetation maintenance in addition to what is already maintained to support the KFBRP and other ongoing DLNR programs. Vegetation clearing around infrastructure, camps, trails, fence lines, and LZs is a standard management practice approved under DLNR Chapter 343 exemptions filed with the Hawaiʻi Office of Planning and Sustainable Development[1]. No new roads or trails would be created for this project.

[1] See: http://oeqc2.doh.hawaii.gov/Agency_Exemption_Lists/State-Department-of-Land-and-Natural-Resources-Exemption-List-2020-03-03.pdf

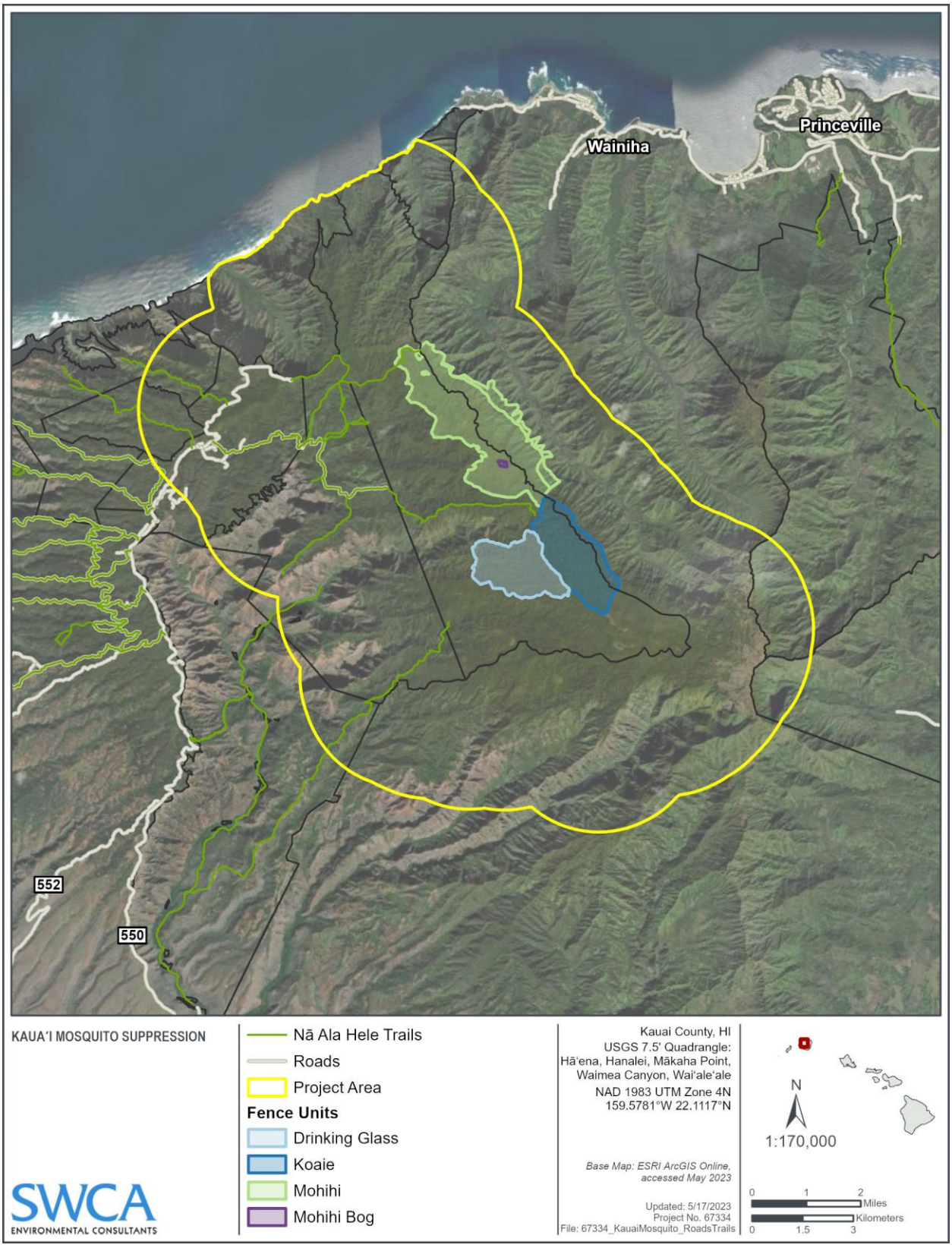

Figure 3. Roads and trails within the boundaries of the project area.

All helicopter operations would be conducted by contracting a private helicopter company and would utilize existing LZs, some of which would require small amounts of vegetation maintenance of these areas, as for other resource management purposes. Existing remote campsites (described in Section 3.2.4.1) would be utilized for field crews and also require routine maintenance or vegetation clearance, as for other resource management purposes.

For each release event, which is anticipated to last one day, efforts would be made to minimize traffic (the number of technicians and vehicles or helicopter flights) required to travel to the release sites and field camps. An established camp would be used if an overnight stay is required.

1.4 Regulatory Framework

To comply with its obligations under the National Environmental Policy Act (NEPA) and Hawai'i Revised Statutes (HRS) Chapter 343, the DLNR, DOFAW is preparing an environmental assessment (EA) to address the proposed release of incompatible male mosquitoes with *Wolbachia*. The environmental assessment, of which this CIA is a part, provides background information concerning IIT and outlines the proposed action, potential impacts, and strategies to avoid, minimize or mitigate the effects of the proposed release of incompatible male mosquitoes within the project area.

This CIA has been prepared to assist the DLNR in complying with its regulatory responsibilities under the State of Hawai'i Revised Statute (HRS) Chapter 343 Environmental Impact Statements law, and was developed in accordance with the State of Hawai'i Office of Environmental Quality Control (OEQC) (now the Office of Planning and Sustainable Development) *Guidelines for Assessing Cultural Impacts* as adopted by the Environmental Council, State of Hawai'i, on November 19, 1997.

1.4.1 Hawai'i State Statutes, Regulations, and Guidelines

Articles IX and XII of the Hawai'i State Constitution, as well as other state laws, and court decisions, impose on government agencies a duty to promote and protect the cultural beliefs, practices, and resources of native Hawaiians, as well as other ethnic groups. One means of ensuring these protections is through the preparation of Cultural Impact Assessments.

Under the State of Hawai'i environmental review process, as stipulated under State of Hawai'i Revised Statute (HRS) Chapter 343 (Environmental Impact Statements—Implemented through Hawai'i Administrative Rules (H.A.R.) § 11-200), requires state agencies to take into account the potential effects of a proposed project on traditional cultural resources, practices and beliefs as part of the environmental assessment process. This involves the preparation of a CIA to be included within the Environmental Assessment for a project under review.

The Hawai'i State Constitution, Article XII, Section 7 affirms that the state "shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes." Each state agency has the responsibility to ensure the effective stewardship of any cultural resources that may be affected by their actions. HRS § 343 mandates that environmental review be integrated into state and county planning processes, and that state agencies consider the potential effects of a proposed action on cultural practices as part of the environmental review process. Act 50 of the Session Laws of Hawai'i (A Bill for an Act Relating to Environmental Impact Statements) clarifies that "the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawai'i's culture, and traditional and customary rights" and stresses the need to include consideration of cultural resources, customs, practices, and beliefs as part of the environmental assessment (EA) and environmental impact statement (EIS) process.

To address concerns regarding the potential impacts of state projects on cultural resources, customs, practices, and beliefs, the Hawai'i State Office of Environmental Quality Control (now the Office of Planning and Sustainable Development) established *Guidelines for Assessing Cultural Impacts* (Hawai'i State Office of Environmental Quality Control and Environmental Council 1997) that were adopted by the State of Hawai'i Environmental Council in November 1997. These guidelines recommend that preparers of CIAs adopt the following protocols for analyzing potential cultural impacts as part of the EA process.

Identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices, and beliefs found within the broad geographical area (e.g., district or *ahupua'a* [traditional land division]).

Identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action.

Receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area.

Conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research.

Identify and describe the cultural resources, practices, and beliefs located within the potentially affected area.

Assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures on the cultural resources, practices, and beliefs identified.

The State of Hawai'i Environmental Council recommends that an assessment of cultural impacts should address, but not necessarily be limited to, the following:

A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations that might have affected the quality of the information obtained.

A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted and any constraints or limitations that might have affected the quality of the information obtained.

Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations, or biases.

A discussion concerning the cultural resources, practices, and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.

An explanation of confidential information that has been withheld from public disclosure in the assessment.

A discussion concerning any conflicting information in regard to identified cultural resources, practices, and beliefs.

An analysis of the potential effect of any proposed physical alteration on cultural resources, practices, or beliefs; the potential of the proposed action to isolate cultural resources, practices, or beliefs from their setting; and the potential of the proposed action to introduce elements that may alter the setting in which cultural practices take place.

A bibliography of references and attached records of interviews that were allowed to be disclosed.

This CIA report addresses each of the elements of the State of Hawai'i Environmental Council's Guidelines.

1.5 Report Organization

The following report has been structured to fulfill the statutory requirements discussed above. The **Introduction** section includes background information on the project, its location, purpose, and area of potential effects, as well as a discussion of the relevant government statutes and regulations related to the project. The **Environmental Setting** section provides information on the natural environment of the project area. The **Methods** section describes the methodology followed in undertaking archival research and conducting community consultation and informant interviews. The **Cultural and Historic Background** section presents the results of archival research into the available cultural and historical documents relating to the project area and to the traditional activities known to take place there. This cultural and land use history extends from the pre-Contact period up through the recent post-Contact period. The **Cultural Resources, Practices, and Beliefs** section provides a summary of the cultural resources, customs, practices and beliefs found to be associated with the project area. The **Previous Archaeological Studies** section details the results of archaeological studies in the project area. The **Previous Cultural Studies** section details the results of cultural studies undertaken within and surrounding the project area. The **Community Consultation** section includes a discussion of the efforts made to contact organizations and individuals knowledgeable about the project area as well as the results of community outreach and informant interviews. The **Summary and Recommendations** section presents an overview of efforts, findings, and recommendations from this study. The **Glossary of Hawaiian Words Used in the Text** section provides a list of Hawaiian words used and their definitions, while the **References Cited** section lists the references cited in the report.

The data appendices that support the report include:

Appendix A. Request for Information Letter
Appendix B. Table of Individuals and Organizations Contacted
Appendix C. Interview Consent Forms
Appendix D. Interview Transcripts

2 ENVIRONMENTAL SETTING

The island of Kauaʻi is the most biologically diverse of the main Hawaiian islands due to its age, isolation, and unique topography (Mitchell et al. 2005). The project area encompasses a significant amount of the islands' landmass and includes some of the greatest proportion of intact native ecosystems on the island. The natural vegetation in the Kōkeʻe State park area consists of mesic forest dominated by *ʻōhiʻa lehua* (*Metrosideros polymorpha*) and *koa* (*Acacia koa*). The Alakaʻi Wilderness Preserve is the largest upland bog in Hawaiʻi and the second largest wetland. The Hono o Nā Pali Natural Area Reserve includes perennial streams, riparian and ridgeline habitat, and lowland and montane forests. The Kuʻia Natural Area Reserve includes lowland and montane vegetation.

2.1 Traditional Environmental Zones

The traditional inhabitants of Kauaʻi recognized and gave names to the various natural habitats that existed within their island home. These traditionally recognized environmental zones stretched from the *kahakai* (the shoreline) to the *wao kele* (the remote and rainy forested uplands). While the entire project area covers a number of these traditional zones, proposed project activities would be focused within the higher elevation inland regions that are the home to the Islandʻs native forest birds. These lands are located within the *wao*, or realms, of traditionally uninhabited wilderness.

Native Hawaiians recognize and named many divisions within the *wao*: *wao lāʻau* (lowland forest), *wao kele*, or *wao maʻu kele* (rain forest), etc. The areas highest in elevation are regarded as the *wao akua*, or the realm of the gods, understood to be places of profound spiritual and cultural significance. The wao kele and the wao akua, the zones of undisturbed forest, served as aquifers and resource banks for native biodiversity. These remote forest zones, which were beyond the area of pre-Contact human resource management and extraction, were dominated by indigenous plant communities. These were areas of the forest where "the monarchs of the forest grow" (Malo 1951:17). Below the wao kele and the wao akua was the *wao nāhele*, a stretch of relatively undisturbed forest that was a prime habitat for native birds. During the pre-Contact period, this upland forest zone was accessed by *kia manu* (birdcatchers) seeking to capture forest birds for their colorful feathers, which were used to decorate chiefly cloaks (*ahuʻula*), helmets (*mahiole*), and standards (*kāhili*). These upland forest zones were originally dominated by native *koa* (*Acacia koa*) and *ʻōhiʻa lehua* (*Metrosideros polymorpha*), with an understory of indigenous forest plants.

Below these undisturbed forests is the wao lāʻau. This was the zone where timber and other forest products were traditionally gathered. Massive koa logs were felled to serve as the hulls of canoes and ʻōhiʻa timbers were cut down to be used as house posts. These and other native hardwoods were used for a range of purposes from digging sticks and other daily tools to carved temple images. Trees, vines, and shrubs, both natives and Polynesian introductions, were harvested for use as firewood, cordage, and weaving materials, medicines, and dyes, as well as ceremonial and personal adornment. The wao lāʻau was a managed forest ecosystem supplying important forest resources to the inhabitant of the ahupuaʻa. Some of these resources, particularly dye and medicinal plants, are still harvested and used today by contemporary cultural practitioners.

Still further downslope was the wao kānaka. This area at the lower edge of the forest was most heavily encroached on by human activity. Within it were scattered house sites and fields where upland kalo (taro, *Colocasia esculenta*) or maiʻa (banana, *Musa* x *paradisiaca*) were grown. This zone was used as needed to augment availability of food resources grown in the inhabited valleys and coastal areas.

2.2 Ua (Rains)

In Native Hawaiian oral traditions, winds and especially rains were acutely observed and oftentimes assigned names. Oral traditions such as *oli* (chants), *mele* (songs) and *moʻolelo* (stories and traditions) preserve the memory of these names as well as the characteristics and traits that a wind or rain possessed. Traditional rain and wind names are evidence of the intimate connections Native Hawaiians have to the forces of nature and the value attached to these forces. Some of the rain names associated with the project area are discussed below.

2.2.1 Noelehua

The *Noelehua* rain is associated with Waiʻaleʻale, Kauaʻi. "Noe lehua" translates to "lehua mist." "*Ka ua Noelehua o Waiʻaleʻale,"* is a traditional saying meaning, "the Noelehua rain of Waiʻaleʻale." Mary Kawena Pukui says that the Noelehua is "the rain of Waiʻaleʻale that moistens the lehua blossoms there" (as cited in Akana and Gonzalez 2015:211).

The Noelehua and Nāulu rains are mentioned in the following excerpt of a *mele inoa*, or name chant, for Albert Ka Haku O Hawaiʻi by his uncle, Kamehameha V.

Kapu ka luna o Waiʻaleʻale i ka ua Noelehua
Lehua, ʻo ka lehua maka noe
Ua nonohe wale i Hauaʻiliki
I ʻiliki ʻia e ka Noe luna o Alakaʻi
Kaʻi ʻāuna lākou a Kawaikini a Kawaikōī
I Kahelekua, i hele hiō i ke ala kīpapa a Ola
E ola i ka wai ua a ka Nāulu

Translation:

The upland of Waiʻaleʻale is sacred with the Noelehua rain
Lehua, the lehua maka noe shrub
Very attractive at Hauaʻiliki
Poured down upon by the Noe atop Alakaʻi
They moved like a flock to Kawaikini, to Kawaikōī
At Kahelekua, going along the sloped, paved path of Ola
Live by the waters of the Nāulu rain
(Akana and Gonzalez 2015:211)

2.2.2 Nāulu

The Nāulu rain is associated with several places including the Kona Moku of Kauaʻi. The Nāulu rain is described as a sudden shower. It is also the name of a shower cloud and a wind (Akana and Gonzalez 2015:187).

Mention of the Nāulu rains can be found in a chant originally composed for his royal highness Lunalilo and inherited by king Kalākaua. This portion of the mele was composed by Nāmāhana (Hawaiian source: *Na Mele Aimoku*, Kalākaua 1886:151, English translation by Akana and Gonzalez 2015).

Hana ua wai Nāulu ʻo Kona
Hana ua wai Nāulu ʻo Mānā
I hoʻonani ʻia e piha Keālia wai
Wai Kahelu, ua piha Kalanamaihiki

Na ka wai ua Kaunalewa
Maikaʻi iho i ka wai Lolomauna

Translation:

Kona produces the Nāulu rainwater
Mānā produces the Nāulu rainwater
That enhances and fills the spring of Keālia
The waters of Kahelu, Kalanamaihiki is filled
By the rainwater of Kaunalewa
Beautified by the water of Lolomauna
(Akana and Gonzalez 2015:199)

2.2.3 Makakoʻi

The rain specific to the Haleleʻa District was the Makakoʻi rain (Akana and Gonzalez 2015:170). *"Ka ua Makakoʻi o Haleleʻa"* is a traditional saying meaning, "the Adz-edged rain of Haleleʻa." Pukui describes the Makakoʻi rain as, "a rain so cold that it feels like the sharp edge of an adz on the skin." (Pukui 1983:172).

3 METHODS

The cultural assessment for the Kauaʻi Mosquito Suppression Project was developed through a combination of archival research and community consultation following the *Guidelines for Assessing Cultural Impacts* laid out by the Hawaiʻi State Office of Environmental Quality Control (now the Office of Planning and Sustainable Development) and Environmental Council. The study was undertaken under the overall supervision of Principal Investigator Rowland Reeve, M.A. Background research was conducted by Wainani Traub, M.S., and Hattie Gerrish, B.A. Community consultation and informant interviews were conducted by Wainani Traub.

3.1 A Brief Historic Context for Traditional Hawaiian Cultural Knowledge

In any sensitive discussion of Native Hawaiian culture, one must understand the role of colonization in eroding traditional cultural knowledge systems. Native Hawaiian culture —past and present— exists in close partnership with its natural environment. Changes in the traditional land tenure system and the adoption of western concepts of land ownership in the nineteenth century had significant direct and indirect impacts on traditional cultural practices and beliefs tied to *ʻāina* (land). The privatization of land resulted in the loss and destruction of many significant cultural resources and denied Native Hawaiian cultural practitioners access to lands previously used for traditional cultural purposes. As an example of this, one of the informants interviewed for this cultural assessment recalls when he and other hunting families had hunting rights on private lands taken away leaving only the public lands available for hunting (Bill DeCosta 2022 see appendix D).

The loss of traditional Hawaiian cultural knowledge during the nineteenth and early twentieth centuries was further compounded by the devastating decline in the native population resulting from the introduction of foreign diseases to which the Hawaiian people had no developed immunity. Changes in traditional life ways resulting from the migration of younger people from the country districts to growing economic centers such as the port of Honolulu, as well as the shift from subsistence agriculture to the commercial cultivation of crops such as pineapple and sugar, contributed to a loss of cultural memory.

With the passing of the last custodians of specialized cultural knowledge, that knowledge was lost forever.

Not until 1978 was the Hawaiʻi constitution amended to protect and preserve the traditional customary rights of Native Hawaiians, and not until 1995 did the Hawaiʻi Supreme Court confirm Native Hawaiian rights to access undeveloped and under-developed private lands (State of Hawaii Environmental Council 1997:1). These actions came much too late to prevent irretrievable loss of traditional cultural knowledge.

With this in mind, it is important to note that an absence of evidence is not evidence of absence. The authors of this cultural assessment recognize that the loss of Hawaiian traditional cultural knowledge likely applies to the current project area. It is probable that there are place names whose meaning has been lost or which themselves have been forgotten, and traditions no longer passed on. We also recognize that, while we have made a good faith effort to address the cultural resources, practices, and beliefs associated with the project area, it is possible that there may be place names missed, traditional history misinterpreted, or *kūpuna* (elder) voices not heard.

As this cultural assessment shows, however, despite the enduring legacies of colonialism, there are many individuals who possess cultural knowledge, and efforts to revitalize cultural resources, practices, and beliefs are growing. Considering a significant part of the project area are public lands, the Native Hawaiian community has had uninterrupted access to these lands which has enabled a continuity of cultural use of these lands.

3.2 Archival Research

3.2.1 Limitations

The *Guidelines for Assessing Cultural Impacts* indicate that a cultural assessment report should include a discussion of constraints and limitations relevant to the study. The research conducted for this report was constrained to some extent by the language proficiency of the SWCA cultural resources team. Although our primary ethnographer is a Hawaiian language speaker, their fluency in reading historic documents written in the Hawaiian language is more rudimentary, limiting our capacity to capture the nuances of Native Hawaiian perspectives held within the vast repository of existing Hawaiian language sources, particularly Hawaiian language newspapers of the nineteenth and twentieth centuries. The task of identifying newspaper articles of relevance to this cultural assessment and then translating the contents was beyond the current Hawaiian language capabilities of the SWCA cultural resources staff. The same holds true for any foreign language sources. All major immigrant groups to Hawaiʻi printed newspapers in their native language. We recognize the valuable potential insights that lie in these sources but were unable to fully access them.

The research conducted for this cultural assessment was completed outside of Kauaʻi and so does not include any records held in archives on Kauaʻi. Additionally, while several of the individuals interviewed were residents of Kauaʻi, none of the oral history interviews included in this assessment were held in person on Kauaʻi. The oral history interviews were constrained to a virtual format using video conferencing technology.

3.3 Community Consultation

SWCA undertook to identify and consult with individuals possessing knowledge of the project area and its cultural significance, including the cultural resources, customs, practices, and beliefs associated with the area as well as any current cultural practices that are being conducted within the project area. To

initiate this process, SWCA compiled a list of cultural consultation contacts that included government agencies, Native Hawaiian Organizations (NHOs), community groups, and individuals identified as having a potential interest in the project including individuals referred to in previous cultural studies conducted within the vicinity of the project area.

In compiling this list SWCA included all NHOs listed on the U.S. Department of Interior's *Native Hawaiian Organization Notification List* whose geographical purview is Kauaʻi Island and whose stated mission relates to environment and or culture. The list also included select NHOs with a statewide purview whose stated mission relates to environment and or culture. SWCA prepared a request for information letter, a copy of which was sent out to each of the contacts on the cultural consultation contact list. The request for information letter delineated the area of the project, described the project and its potential impacts, and requested assistance in:

- Identifying *kamaʻāina* (long term residents), *kūpuna* (elders), and other individuals who might be willing to share their cultural knowledge of the project area
- Providing information on the present and past land use of the project area
- Providing information on place names and cultural traditions associated with the project area
- Providing information on cultural sites which may be impacted by reconstruction work within the project area
- Providing knowledge of traditional gathering practices within the project area, both past and ongoing
- Indicating any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area

The text of the request for information letter is provided in Appendix A of this report. A copy of the cultural consultation contact list has been included as Appendix B of this report.

4 CULTURAL AND HISTORIC BACKGROUND

This section presents the past and present historical and cultural significance of the project area and the native Hawaiian forest birds that inhabit this environment. Particular attention is paid to the ways native forest birds appear in the ethnohistorical literature associated with the project area. Considering that the proposed project will not involve any ground disturbing activities, less emphasis has been placed on providing a detailed history of land use for the entire project area. The following historic and cultural background research is intended to be sufficient to the extent appropriate to assess the potential project impacts on cultural resources practices and beliefs.

4.1 Place Names and Land Use

The island of Kauaʻi, is the oldest of the larger main Hawaiian Islands. Historically, Kauaʻi was divided into several distinct political units, which in ancient times were subject to various chiefs—sometimes independently and at other times in unity with the other districts. These early moku included Nāpali, Haleleʻa, Koʻolau, Puna, and Kona (Buke Mahele, 1848). The current project area extends into all but one of Kauaʻi's five moku, covering portions of Kona, Nāpali, Haleleʻa, and to a lesser extent, Puna (Figure 2).

In traditional Hawaiian society, land was not owned. Instead, the *makaʻāinana* (commoners) worked individual plots of land, providing tribute in goods and services to the local *aliʻi* (chiefs), who held the land in trust for the *aliʻi ʻai moku* (the chief who eats the island/district), who in turn held the land in trust

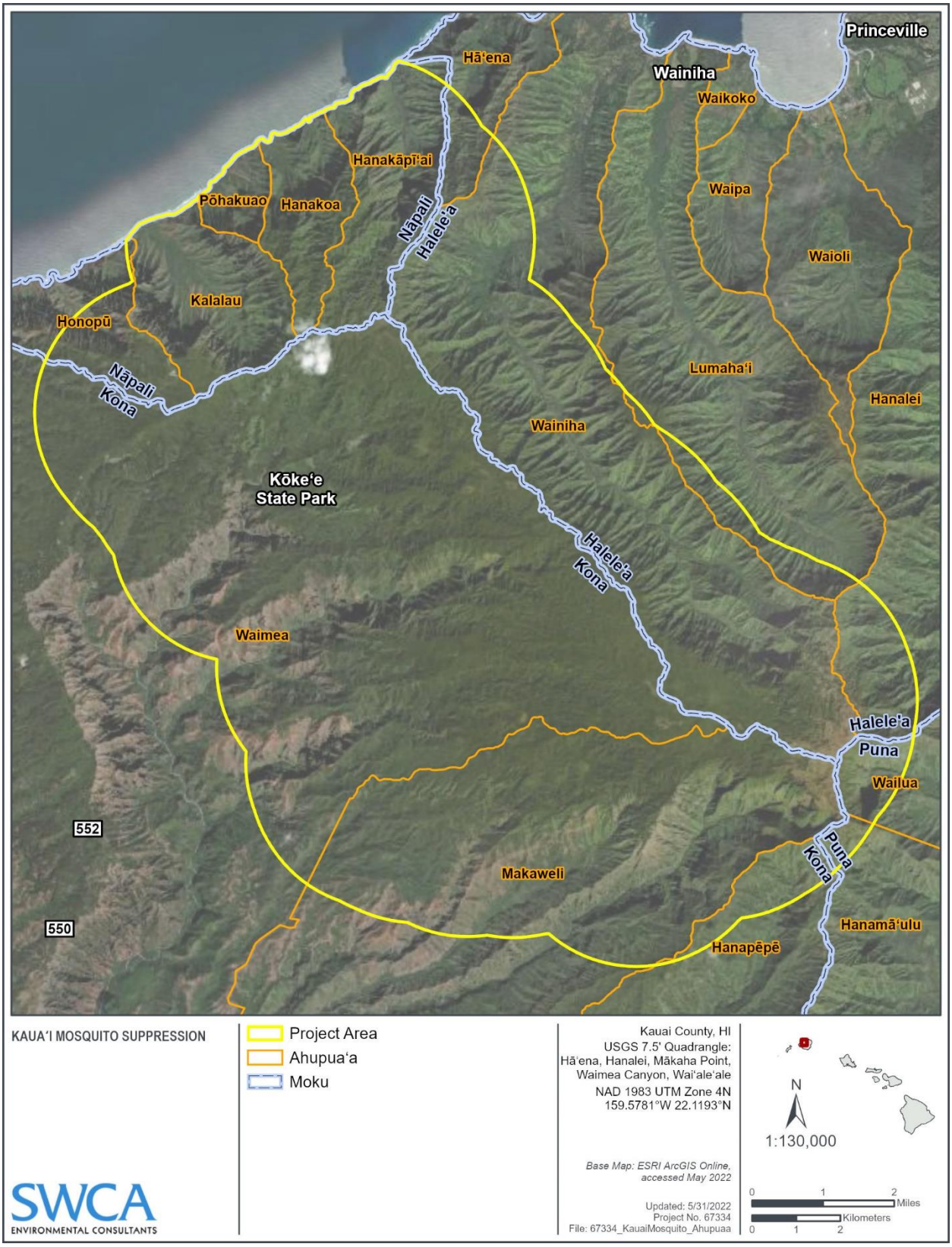

Figure 4. The ahupuaʻa and moku resting within the project area boundaries.

for the gods. The title of aliʻi ʻai moku ensured rights and responsibilities to the land but did not confer absolute ownership. The aliʻi ʻai moku kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs.

A moku contained smaller land divisions (ahupuaʻa), which customarily stretched inland from the ocean into the mountains. Extended household groups living within the ahupuaʻa were, therefore, able to harvest from both the land and the sea. Ideally, this situation allowed each ahupuaʻa to be somewhat self-sufficient, supplying needed resources from different environmental zones (Lyons 1875:111).

Much of the project area consists of high elevation and remote inland areas of Kauaʻi. These upland areas were primarily utilized as resource gathering zones, rather than as areas of permanent habitation or agriculture (Yent 2004:6). Some inland areas of Waimea, Makaweli, Olokele and Hanapēpē, however, possess evidence of well-terraced and cultivated areas (McGuire et al. 2000:12). Particular varieties of kalo known as *haʻo kea* and *nā kalo a ʻOla*, are associated with these inland areas (Handy and Handy 1972:397). Generally speaking, traditional habitation within the project area was concentrated to the Nā Pali coastline where there is extensive archaeological evidence of habitation sites and agricultural terracing.

The following subsections briefly discusses the history of the landscape and settlement of the lands that comprise the project area as well as some of the meanings behind prominent place names (Figure 5). Much of the information in the following subsections is taken from Frederick B. Wichman's *Kauaʻi Ancient Place-Names and Their Stories*, one of the most comprehensive Kauaʻi place name resources (Wichman 1998). The *Cultural Impact Assessment for Kōkeʻe and Waimea Canyon State Parks* (Chiogioji et al. 2004) includes an oral history interview with Wichman.

4.1.1 Place names associated with native birds

Traditional place names in and around the project area are rich in references to birds. These place names could indicate the presence of particular kinds of bird resources in the area (Gomes 2016:41-42). Root words such as *manu* (bird) and *hulu* or *huluhulu* (feathers) indicate associations to native birds (Table 1).

4.1.1.1 NĀPALI MOKU

The project area covers the majority of Nāpali Moku. It includes the entirety of Kalalau, Pōhakuao, and Hanakoa Ahupuaʻa; the majority of Hanakāpīʻai Ahupuaʻa; and the inland half of Honopū Ahupuaʻa. Nāpali is the smallest of the five moku of Kauaʻi. Nāpali, "the cliffs," is so named for its many tall cliffs and narrow valleys. The ahupuaʻa boundaries of this moku generally correspond with each of its valleys.

Nāpali is known for excellent deep-sea fishing areas along its coast. The upland forests of Nāpali were once full of the brightly colored native honeycreepers whose feathers were made into magnificent cloaks, capes, helmets, and wreaths. Kia manu hunted the forests of Nā Pali for three months out of the year trapping birds for their feathers (Wichman 1998:134).

4.1.1.2 HONOPŪ AHUPUAʻA, NĀPALI

Within Nāpali Moku is the ahupuaʻa of Honopū. Wichman describes the various techniques that kia manu employed in catching birds around Kainamanu peak in Honopū:

> The uplands of Honopū are dominated by Ka-ina-manu, "sound of birds in the distance," a 4,100-foot peak at the top of Kala-wao, "to proclaim through the wilderness," the western valley and stream. It joins Kapaka Stream to form the Honopū River. *Kia manu* (birdcatchers) smeared gum made from the resin of breadfruit trees onto branches of

Table 1. Place names within and near the project area with references to birds

Place Name	Translation	Description	Source
Halemanu	Bird house	*outside of project area (see Figure 5) Peak and stream in Waimea ahupua'a. Place where bird catchers had a permanent camp.	Pukui et al. 1974:38
Kahōluamanu	The sled of birds	The highest cliff of Waimea Valley.	Pukui et al. 1974:65
Kainamanu	The sound of birds in the distance	A peak at the top of Kalawao	Wichman 1998:150
Kaleinakolekoleā	Leap like a plover's	A dangerous high peak makai of the Kalou trail	Wichman 1998:144
Kamanu	The bird	A peak	Wichman 1997:114
Kanaloahuluhulu	huluhulu can be a *kaona* (hidden meaning) for bird feathers or the abundance of the forest	A meadow associated with the mo'olelo of Kanaloahuluhulu	NeSmith 2022; Wichman 1985:114-117
Kūkalaanāmanu		A place name referenced in a *mele mākaʻikaʻi* (song recalling a visit) for Queen Emma	As cited in Nogelmeier 2001:90-91
Nā Keiki o Nā ʻIʻiwi / Nā Keiki o Nāʻiwi	The children of Nāʻiwi or the children of the ʻIʻiwi	Ridge on the path to Kalalau marked by two stone pillars said to be the two children of Nāʻiwi who were turned to stone	Wichman 1998:146
Pueoinu	Drinking owl	A resting place along a trail in Pōhakuʻau Ahupuaʻa	Wichman 1998:141
Waiahulu Stream	Water of feathers	An ʻili and stream located within Waimea Ahupuaʻa	U.S. Geological Survey 1960

Figure 5. Traditional place names referenced in the text (U.S. Geological Survey 1960)

> flowering *ʻōhiʻa lehua* trees, a favorite source of nectar for the little birds. The bird would perch on the branch and become stuck. *Kia manu* also trapped birds by stretching nets between trees. A highly skilled catcher could hold a nectar-laden lobelia flower in his hands and catch the long-beaked bird in his fingers as it thrust into the tubular blossom. Birdcatchers operated only three months of the year, leaving the bird population time to rebuilt itself (Wichman 1998:150).

4.1.1.3 KALALAU AHUPUAʻA, NĀPALI

Kalalau is the largest of the Nāpali ahupuaʻa. There are two possible meanings given for Kalalau and both are associated with a moʻolelo. Kalalau meaning the "the wanderer" refers to the giant named Puni who was a friend to the Menehune and wandered over the island with them. Puni, who traveled faster than his Menehune friends, would pass the time waiting for his friends by shaping the cliffs at Kalalau into what looked like curtains of tapa (Wichman 1998:142). An alternate pronunciation is Kalālau meaning, "to seize." This interpretation of the place name is associated with the moʻolelo of Kukua-o-Kalālau a thief who seized taro fields, fish nets, youngsters, and anything else that did not belong to him (Wichman 1998:143). Remains of house sites, *heiau* (temples), and wetland taro patches attest to a once large and productive population within this ahupuaʻa. At least three trails led into the valley enabling the movement of people in and out of Kalalau.

4.1.2 Haleleʻa Moku

The project area covers the inland reaches of Haleleʻa Moku. It includes the majority of Wainiha ahupuaʻa, and overlaps the innermost reaches of Hanalei, Lumahaʻi, and Hāʻena ahupuaʻa. In Lumahaʻi, the project area overlaps the Mahinakehau ridge. Hale-leʻa literally translates to "house of happiness." This moku is cited in several moʻolelo and chants for its beauty. A fertile land, its many rivers irrigated extensive agricultural fields of kalo and the abundant rainfall supported forests of native trees such as *kou* (*Cordia subcordata*), *milo* (*Thespesia populnea*) and *hala* (*Pandanus tectorius*) (Wichman 1998:106)

Within this moku is the peak HaehaekamanuaKānealohikeʻalemaineikawai, which translates to, "tear the bird, Kānealohi, for the water is rippling." The story associated with this name is discussed in the ethnohistorical literature section further on in this report.

4.1.2.1 HANALEI AHUPUAʻA

Hanalei once consisted of four ahupuaʻa which suggests the abundance of this land in the traditional period. There are a few interpretations of the meaning of Hanalei, one of which is "crescent bay." According to Wichman, however, "wreath making" and "lei valley" are closer to the original intent. Wichman explains that, "the wreaths are the rainbows that appear in the upper valley from the constant rainshowers" (Wichman 1998:108). Several rain names are associated with this ahupuaʻa. The project area overlaps a small section of the innermost reaches of Hanalei.

4.1.3 Kona Moku

Kona is the largest of Kauaʻi's five moku. The majority of the project area falls within the inland areas of the Kona moku.

4.1.3.1 WAIMEA AHUPUAʻA

Waimea, which translates to "red water," was named for "the color of the dirt carried by the river in flood." (Wichman 1998:7). Waimea is the largest ahupuaʻa on the island of Kauaʻi and likely supported

the largest coastal settlement on the southwest side of Kauaʻi in pre-contact times. Some of the places within this ahupuaʻa, such as Nuʻalolo, may have at one time been separate ahupuaʻa.

Alakaʻi, located within the ahupuaʻa of Waimea in the moku of Kona, is a primary source of the island's freshwater. Its high elevation forests filter rainwater into subterranean aquifers that feed Kauaʻi's seven main rivers. These rivers flow into the lowlands and irrigate fields of kalo (Joesting 1984:5).

The ethnohistory of Waimea focuses on the engineering feats that made the agricultural abundance of the ahupuaʻa possible. Early Western explorers to Hawaiʻi noted Waimea was well cultivated with kalo fields. Waimea was an ideal place for foreign vessels to re-provision their ships as the ahupuaʻa was abundant in food resources and fresh water and the harbor was deep enough for ships to anchor safely. (McGuire 2000:10).

4.1.3.1.1 Halemanu

Within the ahupuaʻa of Waimea is located Halemanu, which is closely associated with bird hunting.

> A few miles above Puʻukāpele is Hale-manu, "bird house," where bird catchers lived while they hunted Kauaʻi's unique bird family, the brilliantly colored honeycreepers that lived in the ʻōhiʻa lehua forests. Especially prized were the yellow-green ʻamakihi and ʻanianiau, the bright yellow ʻakialoa and nukupuʻu, the orange-red ʻiʻiwi or olokele, and the deep crimson ʻapapane. (Wichman 1998: 15-16)

"Family lore stated that the Hawaiian bird catchers used a grass house at Halemanu while on their feather-gathering expeditions" (Duensing 2006:3).

In the forest above Halemanu is a small clearing known as Kaumuaiea. Here, in the forest of Miloliʻi on the ridge of Kaumuohua, was located the heiau of Kaumuaiea (also referred to as Kaunuaie or Kaunuohua). All that remains today are a few stones in a rough line, that do not form a platform or definite outline (Bennett 1931:104, Hammatt & Shideler 2008:12). The folklorist Thomas Thrum, writing in 1906, described this heiau as a small shrine and says that no platform remains to indicate its location (Thrum 1907:64). "Ka-unu-aiea is a small shrine in the dense koa forest of Milolii. It was only an "unu," or shrine, for the shifting population of the forest belt. There is no platform left to indicate its existence." (Thrum 1907:64).

> The top of Nāpali is marked by a row of hills stretching from Wainiha Valley to Puʻuokiha. From there to Halemanu, overlooking Waimea Canyon, is the ridge Ka-unu-o-Hua, "altar of Hua," which divides Nāpali from the swamps of ʻAipō and Alakaʻi. It takes its name from a small shrine in the ahupuaʻa of Miloliʻi near the beginning of the Kōkeʻe State Park. This shrine was built to commemorate the end of the war Ka-welewele-iwi, "stripping of flesh from bones," which was fought in the mid-fourteenth century (Wichman 1998:136).

4.1.3.2 MAKAWELI AHUPUAʻA

Makaweli translates to "fearful eyes." The *ʻōlelo noʻeau* (proverb or wise saying), "Hoʻolele ka uila o Makaweli" offers some insight into a possible meaning of the place name. Mary Kawena Pukui translates the ʻōlelo noʻeau as, "sending the lightning of Makaweli flying." Pukui explains that "maka-weli" is a play on words, literally translated it means "terrifying eyes," though it is also an expression referring to the sending of a god on an errand of destruction (Pukui 1983:117). At one time, Makaweli might have been known for this particular kind of sorcery or perhaps *akua lele* (flying gods) were commonly seen in this region. Specific information regarding this seems to have been lost over time (McGuire 2000:11).

Another more recent interpretation of Makaweli is, "red or burning eyes," referring to the fine red dirt of Makaweli that when blown by the wind irritates one's eyes (McGuire 2000:11).

4.1.4 Puna Moku

A small part of the project area is located within the moku of Puna. The project area overlaps Waiʻaleʻale summit in the moku of Puna in the ahupuaʻa of Wailua. At Waiʻaleʻale is the Kaʻawakō heiau or shrine.

4.2 Ethnohistorical Literature: Selected Moʻolelo

The Hawaiian word moʻolelo is a single concept that conveys multiple meanings, encompassing what in English would be considered history, traditional accounts, legend, and myth. While in the English language these terms are distinct from one another, moʻolelo are fluid products of a long history of oral tradition and are too culturally complex to be reduced to any single Western term (Brown 2016:8; Nogelmeier 2010:132).

A sample of moʻolelo associated with native birds, birdcatchers, and the project area have been included in this section. These moʻolelo construct a unique history and reveal the richness of the oral traditions that continue to hold significance to this region of Kauaʻi. Additionally, these moʻolelo are evidence of the traditional significance of native forest birds.

In these moʻolelo native forest birds often are associated with akua and aliʻi. Speaking on the occurrence of birds in Hawaiian mythology, Martha Beckwith explains that native forest brids, "appear in myth as kindred and servants of gods who are worshipped as family guardians, or the god himself may manifest himself on earth in bird form and be worshipped under the name of his particular manifestation" (Beckwith 1970:92). As Beckwith explains, Hawaiian gods may take the form of a bird. This detail reinforces the significance of birds in traditional Hawaiian society. The moʻolelo of "Lepe, the Bird Maiden" (Knudsen 1946:63-69) is about the discarded egg-child of Chief Keahua of Kauaʻi who is raised by her grandparents on Oʻahu. Lepe takes the form of both a beautiful colorful bird and a young lovely girl adorned with tapa and a wreath of green feathers.

In the following selection of moʻolelo, Maunahina in Wainiha Valley is mentioned as a home to birdcatchers. Lauhaka and Kāneʻalohi a nephew and uncle pair of birdcatchers and the birdcatcher brothers Waʻawaʻaikinaʻauao and Waʻawaʻaikinaʻaupō are all said to have lived at Maunahina in Wainiha Valley. One could speculate that perhaps Maunahina was once a place favored by birdcatchers to live and or to catch birds.

The island of Kauaʻi figures prominently in the oral traditions of the menehune. Menehune are depicted in moʻolelo as a group of mythical people, small in stature, prolific and skilled in engineering. A defininig characteristic of menehune is they complete impressive construction feats from start to finish in just one night. It has been proposed that the menehune were possibly a distinct group of early settlers to Hawaiʻi perhaps originaly from the Marquesas Islands (Joesting 1984: 19-21). The historian and folklorist Abraham Fornander notes that the term "manahune" was used in Tahiti as the name for the laboring class, what would be the equivalent of the traditional Hawaiian *makaʻāinana* or commoners (Fornander 1969:55). Some of the selected moʻolelo included in this section have menehune characters.

Many of these moʻolelo are condensed versions of moʻolelo compiled in Frederick B. Wichman's *Kauai Tales* and *More Kauaʻi Tales.* The moʻolelo compiled by Wichman come from several sources including the Hawaiian traditions documented by William Hyde Rice, Abraham Fornander, Hofgaard, and Nathaniel Emerson, while some were told to Wichman by Jacob Maka of Hāʻena (Wichman 1985:155).

The plethora of mo'olelo associated with the project area reinforce its significance as a *wahi pana* (storied place).

4.2.1 Māui

The following brief mo'olelo comes from *Legends of Ma-ui A Demi God of Polynesia and His Mother Hina* by William D. Westervelt. It tells of how the pan-Polynesian hero Maui first made birds visible.

> One of the old native Hawaiians says that in the long, long ago the birds were flying around the homes of the ancient people. The flutter of their wings could be heard and the leaves and branches moved when the motion of the wings ceased and the wanderers through the air found resting places. Then came sweet music from the trees and the people marvelled. Only one of all mankind could see the winged warblers. Maui, the demi-god, had clear vision. The swift flying birds covered with red or gold he saw. The throats tinted many colors and reflecting the sunlight with diamond sparks of varied hues he watched while they trembled with the melody of sweet bird songs. All others heard but did not see. They were blind and yet had open vision
>
> Sometimes the iiwi (a small red bird) fluttered in the air and uttered its shrill, happy song, and Maui saw and heard. But the bird at that time was without color in the eyes of the ancient people and only the clear voice was heard, while no speck of bird life flecked the clear sky overhead.
>
> At one time a god from one of the other islands came to visit Maui. Each boasted of and described the beauties and merits of his island. While they were conversing, Maui called for his friends the birds. They gathered around the house and fluttered among the leaves of the surrounding trees. Soon their sweet voices filled the air on all sides. All the people wondered and worshiped, thinking they heard the fairy or menehune people. It was said that Maui had painted the bodies of his invisible songsters and for a long time had kept the delight of their flashing colors to himself. But when the visitor had rejoiced in the mysterious harmonies, Maui decided to take away whatever veil shut out the sight of these things beautiful, that his bird friends might be known and honored ever after. So he made the birds reveal themselves perched in the trees or flying in the air. The clear eyes of the god first recognized the new revelation, then all the people became dumb before the sweet singers adorned in all their brilliant tropical plumage.
>
> The beautiful red birds, iiwi and akakani, and the birds of glorious yellow feathers, the oo and the mamo, were a joy to both eye and ear and found high places in Hawaiian legend and story, and all gave their most beautiful feathers for the cloaks and helmets of the chiefs. (Westervelt 1910:112-114)

A variation of this story can be found in Mary Kawena Pukui and Caroline Curtis' *Tales of the Menehune*. Like the Westervelt version, it shows how birds were held in high regard by Native Hawaiians

> Long ago birds were invisible. Men could hear the whir of their wings and listen to their songs, but the birds themselves no one could see —no one but Māui.

> One day a visitor came from another island and challenged Māui to a boasting contest. A crowd gathered and listened with delight as each man boasted of his island —its mountains, waterfalls, and forests.
>
> "I must win!" Thought Māui, and aloud he said, "I'll prove to you that we have something here that you have never dreamed of." Secretly he called the birds. They lighted all about on trees and bushes and filled the air with song.
>
> The boastful visitor was silent while the crowd listened in wonder. "Spirits!" they whispered.
>
> At last, using his mighty power, Māui caused them all to see the little feathered singers. The boastful man exclaimed, "O Māui, you have won! In my island there is no such wonder."
>
> Ever since that day birds may be seen as well as heard. (Pukui and Curtis 1985:33)

4.2.2 Ka Hoʻokolokolo o ʻElepaio

The *ʻelepaio* **(monarch flycatcher, genus *Chasiempis*)** has a reputation for being curious and mischievous. There are many variations of a well known moʻolelo about a curious ʻelepaio poking a hole into a man's water gourd causing all of the water within it to pour out. The man, angry and frustrated with ʻelepaio, throws a rock at ʻelepaio hurting his leg. ʻElepaio, oblivious to his own wrong-doings, calls on all the birds in the forest to sympathize with him and yet they all side with the man and tell ʻelepaio that he was wrong to peck a hole in the gourd. ʻElepaio realizes that he has only himself to blame for his injured leg and no one should pity him for his own wrong-doing (Wichman 1997:120-123).

From this story comes the *ʻōlelo noʻeau* or proverb, "hoʻokolokolo aku i ka nui manu," literally translated it means, "go inquire of the other birds" the intention being, to go and consult others (Pukui 1983:116).

4.2.3 Lauhaka and Kāneʻalohi

The bird catcher Lauhaka appears in several Kauaʻi moʻolelo and is sometimes named Lahi. In some moʻolelo he is described as a young man who would eat only birds, and traveled to the top of Kilohana (a lookout at the edge of the Alakaʻi Swamp) where the *ʻuaʻu* (also spelled ʻuwaʻu, Hawaiian petrel, *Pterodroma sandwichensis)* nested to satisfy his hunger (Rice 1923 as cited in Yent 2004:6).

The following is a condensed version of Wichman's retelling of Lauhaka. This moʻolelo contains several details of the methods used by kia manu to trap birds and the rituals associated with their profession (Wichman 1985:119-124).

Lauhaka was raised by his uncle Kāneʻalohi a bird catcher at Maunahina in Wainiha. The only thing Lauhaka possessed of his parents was a feathered helmet given to his mother by his father. Kāneʻalohi trained Lauhaka in bird catching and for many months of the year they lived in the *lehua* (*Metrosideros polymorpha*) forests of Kōkeʻe gathering bird feathers. Lauhaka was taught to make the proper offerings to Kūhuluhulumanu, god of the bird catchers. He learned to imitate the birds' calls to draw them to perch on branches smeared with the sticky sap of the kukui tree. With the bird's feet stuck to the branch, Lauhaka would carefully pluck a few colorful feathers and then release the bird. Lauhaka learned to be very patient and could remain motionless for many hours holding a tubular flower between his fingers waiting for a honeycreeper to dip its beak into the flower.

Lauhaka and Kāneʻalohi lived beside a pool at the top of the cliffs where the trail that led into Wainiha began and the trail of logs across Alakaʻi swamp ended. As soon as anyone stepped on the log path across the swamp Lauhaka and Kāneʻalohi would see ripples in the pool and know someone was approaching. Lauhaka and Kāneʻalohi ate the ʻuaʻu birds unaware that the Waimea chief Hakau expected tribute and taxes. Hakau was a harsh ruler who did not hesitate to kill anyone for any wrong-doing. On learning of the pair of birdcatchers who ate the prized ʻuaʻu birds without paying him tribute, Hakau sent his soldiers to retrieve Lauhaka and Kāneʻalohi, but this first attempt to capture them was unsuccessful. Lauhaka and Kāneʻalohi noticed the ripples in the pool and escaped before they could be captured. A few days later Hakau and a large group of soldiers attempted again to capture the bird catchers. Noticing the ripples in the pond, Lauhaka told his uncle to tear the ʻuaʻu bird he was roasting into pieces. This place is so named Haehae-ka-manu-a-kāneʻalohi-ke-ʻale-mai-nei-ka-wai (tear the bird of Kāneʻalohi for the water is rippling).

Without enough time to escape the army, Lauhaka put on his feather helmet and waited to be approached. Hakau recognized the helmet as belonging to him. Realizing that Lauhaka might be his son, Hakau told Lauhaka that he would build him a meeting house and when it was finished, he would send for him. Hakau was angry and humiliated that a backwoods birdcatcher had not only defeated him in battle but also claimed him as his father. He was not convinced that Lauhaka was his son and plotted to kill him. When the meeting house was finished, Hakau sent a message inviting Lauhaka and Kāneʻalohi to come down to join him within it. At Hakau's order, a deep hole with sharpened spears at the bottom had been dug into the center of the meeting house floor concealed under a *lau hala* (pandanus leaf) mat. Suspicious that no one was seated in the center of the meeting house. Lauhaka threw his spear into the center of the room and it tore through the mat revealing the pit full of spears. A fight broke out and Hakau fell into the trap he had intended for his son. When the people of Waimea were told of Lauhaka's parentage and of his father's treachery, they happily accepted Lauhaka as their new chief. Kāneʻalohi returned alone to the mountains. Some time later Lauhaka acknowledged that he did not feel fit to be a chief and returned to the mountains admitting that he is "a birdcatcher, nothing more" (Wichman 1985:120-124). Whichman may have incorporated elements of other moʻolelo into his retelling of Lauhaka. Some of the details regarding Lauhaka's parentage is similar to the moʻolelo of ʻUmi a Līloa.

The moʻolelo of Lauhaka gave rise to a poetical saying. Mary Kawena Pukui includes "Haehae ka manu, ke ʻale nei ka wai," in the text, of *ʻŌlelo Noʻeau: Hawaiian Proverbs and Poetical Sayings.*

> Haehae ka manu, ke ʻale nei ka wai.
>
> Tear up the birds, the water is surging.
>
> Let us hurry, as there is no time for niceties. Kaneʻalohi and his son lived near the lake of Halulu at Waiʻaleʻale, Kauaʻi. They were catchers of ʻuwaʻu birds. Someone falsely accused them of poaching on land belonging to the chief of Hanalei, who sent a large company of warriors to destroy them. The son noticed agitation in the water of Halulu and cried out a warning to his father, who tore the birds to hasten cooking. (Pukui 1983:50)

The same expression also appears in the name of the place where the events occurred.

> Near the lake is the peak Haehae-ka-manu-a-Kāneʻalohi-ke-ʻale-mai-nei-ka-wai, "tear the bird, Kāneʻalohi, for the water is rippling," on the edge of a high cliff just above the waterfall Halulu, "rumbling." Kāneʻalohi, a bird catcher, lived in this part of the mountains with his nephew Lauhaka. Their camp was on the cliff side of the Alakaʻi Swamp beside an open bit of water. The water of this pool rippled whenever anyone stepped into the swamp miles away. Inadvertently, they were breaking the new rules of Ka-lā-kāne-hina, the Waimea chief, who had forbidden the catching of ʻuaʻu birds, the dark-rumped petrel, which was good eating. Kalākānehina sent some warriors to kill the

> two bird catchers, but they were warned by the rippling water as they broiled a petrel over their fire. Lauhaka called out to his uncle to tear the bird apart so they could eat it before the warriors reached them— hence the name. (Wichman 1998:110)

4.2.4 *Waʻawaʻaikinaʻauao and Waʻawaʻaikinaʻaupō*

Many stories are told of a pair of bird catcher brothers named Waʻawaʻaikinaʻauao and Waʻawaʻaikinaʻaupō who lived with their *tūtū* (grandmother) at Maunahina in Wainiha Valley. Their tūtū was named Nāhulu and she is described as the most skillful feather lei maker in all Kauaʻi.

Waʻawaʻaikinaʻauao was clever and found it amusing to trick his gullible brother into doing difficult tasks. When their tūtū asked them to catch wild chickens, Waʻawaʻaikinaʻauao said he would keep the chickens with two holes in their beaks while Waʻawaʻaikinaʻaupō got to keep those with one hole and the brother with fewer chickens must pluck the feathers and grill the birds. Not knowing that all chickens have two holes in their beaks, Waʻawaʻaikinaʻaupō inevitably had to pluck and grill the birds. Tūtū Nāhulu explained to Waʻawaʻaikinaʻaupō that his brother had tricked him. To get back at his brother, Waʻawaʻaikinaʻaupō covered himself in feathers to look like Kūhuluhulumanu, the god of the bird catchers. When Waʻawaʻaikinaʻauao least suspected, Waʻawaʻaikinaʻaupō leaped out from hiding and terrifed his brother. That night, it was Waʻawaʻaikinaʻauao who had to cook dinner (Wichman 1997:114-117).

Another moʻolelo about these two brothers describes a banana contest and how the kindness of Waʻawaʻaikinaʻaupō gets rewarded.

Waʻawaʻaikinaʻauao went into the mountains to find the very best bunch of bananas to enter a contest. He only gathered what he thought to be the very best-looking bunches of the very best varieties of banana. Waʻawaʻaikinaʻaupō went along with his brother to help but he did not care about the contest. While out in the forest, Waʻawaʻaikinaʻaupō picked the *iholena* and *puapua nui* varieties of banana. These were among the few varieties of banana that women were allowed to consume. Waʻawaʻaikinaʻaupō picked them for his tūtū knowing that she should appreciate them. Waʻawaʻaikinaʻauao did not consider these varieties for the contest and continued to pick other bananas. The next morning, Waʻawaʻaikinaʻauao proudly displayed all of his bunches of bananas for the chief to inspect. To the surprise of Waʻawaʻaikinaʻauao and everyone else who entered the contest, the aliʻi conducting the contest was a woman. To her disappointment none of the bananas entered into the contest were of the varieties women could consume. Defeated, the *aliʻi wahine* turns to leave but is stopped by Tutu Nāhulu who shows her the two bunches Waʻawaʻaikinaʻaupō picked for her. The aliʻi was charmed by the kindness of Waʻawaʻaikinaʻaupō and rewarded Tūtū Nāhulu and her grandsons with free access to harvest bird feathers in all of Hāʻena and Nāpali. (Wichman 1997:126-131)

4.2.5 *Nā Keiki a Nā-ʻiwi*

In the wet upland forest of Kalalau lived Nāʻiwi with his two children Kuapōhaku and Hikimaunalei. Nāʻiwi was named after the ʻiʻiwi birds that surrounded their home. Nāʻiwi and his children were Mū people, related to the menehune, they were small and could only come out of their cave at night because sunlight turned them to stone. Kuapōhaku and Hikimaunalei longed to play with the children of Kalalau but never were able to because the children went to sleep at night and Kuapōhaku and Hikimaunalei could only come out at night. On a bright full moon night Kuapōhaku and Hikimaunalei heard the children of Kalalau play and they excitedly joined them. The children played all night and lost track of time. As Kuapōhaku and Hikimaunalei noticed the sun was about to rise over the mountains, they hurried home. However, it was too late. As the two children were climbing the cliffs to their home, the sun rose and they

were turned to stone. The two stones on the path to Kalalau are known as Nā Keiki a Nāʻiwi, the children of Nāʻiwi (Wichman 1985:126-132).

4.2.6 Kanaloahuluhulu

The following moʻolelo is an account of how the grassy meadow in which the present day Kōkeʻe State Park Headquarters is located came to be.

A big and hairy giant named Kanaloa was terrorizing lost travelers on the Kōkeʻe trail making it unsafe for anyone to cross. Determined to restore safety to the trail, the hero Kauahoa sought out Kanaloa. The giant lived in a grove of lehua trees in a small boggy place. It was there that Kauahoa confronted Kanaloa. He was only slightly taller than Kauahoa and was covered in a great mass of hair that grew everywhere on his body. Unintimidated by the giant, Kauahoa said to him "I shall call you Kanaloa-huluhulu, the very hairy one." Kauahoa continued to insult Kanaloa saying things like, "this trail was built for the use of everyone at all times. It belongs to no one person, not even an ugly, hairy fool like you." Kanaloa enraged by these comments, started to fight Kauahoa. In the chaos trees and plants were uprooted and trampled. Kauahoa swung his *pīkoi* (tripping club), which wrapped around Kanaloa's knees causing him to fall. Kauahoa then leaped on the giant's back and used his dagger to cut off the giant's head. Kauahoa took Kanaloa's head to Kilohana and tossed it over a cliff where the giant would not be able to find it to put his head and body back together. The headless Kanaloa tore up the lehua trees and stamped about trying to find his head and in doing so crushed all the remaining trees and shrubs in the bog. When the sun set, the body of Kanaloa lost its life and fell to the ground. Where the lehua grove had been was nothing but a dusty plain. To this day, the area is a grassy clearing without trees and is named Kanaloahuluhulu, after the hairy giant (Wichman 1985:114-117).

4.2.7 Kahōluamanu

Kahōluamanu is the highest cliff of Waimea Valley (Pukui et al. 1974:65). A moʻolelo is associated with this place name which can be roughly translated as the *hōlua* slide (sledding path) of Manu. This first version is summarized from *Tales of the Menehune* compiled by Mary Kawena Pukui and Caroline Curtis.

A boy named Manu became tired of sliding down the small and short slopes where he lived. They were too slow to excite him any longer. Manu climbed a steeper slope but saw that his parents had placed two rocks on the slide to prevent him from going down the dangerous slope. This did not stop Manu, he slid around the first rock and leaped over the second. Manu hurt himself jumping over the second rock, so he climbed to it and rolled it into the Waimea Stream and then did the same with the smaller rock. It is said that these two rocks remain where they fell into the Waimea Stream. Manu then went looking for a slope his parents did not know about so he could slide without worrying his parents. Manu found a cliff that satisfied his need for adventure. It was the steepest cliff of Waimea Valley. Sliding down this cliff Manu truly felt as though he were a bird. The cliff of the canyon wall is so named Holua Manu the slide of the bird (Pukui and Curtis 1985:70-71).

Wichman's *Kauaʻi Tales* contains another interpretation of the same moʻolelo. Some details between the two versions overlap and it is noteworthy that in both interpretations of this moʻolelo, birds are not a part of the moʻolelo. Manu is simply the name of the boy or young man. In Wichman's version, Manu is so named because he was "full of energy and flew from place to place" (Wichman 1985:62).

Manu lived with his parents where Ōpaewela valley joins ʻŌmaʻo valley. In this version of the moʻolelo Manu's parents possess the ability to lift and move rocks in the air and send freshets of water rushing down the stream at will. Manu's parents used their special powers in cruel ways. They found it amusing

to drop rocks on unsuspecting travelers and send freshets to tumble them off their feet into the stream. They would also subject Manu to these cruel acts. The couple were extremely lazy and never built themselves a taro patch. Instead, they ordered Manu to go out to gather food for them each day. Gathering food from wild sources and then preparing the food each day consumed all of Manu's time leaving no time to himself to pursue any of his desires like that of hōlua sledding. One evening as Manu was returning home from gathering wild taro he came on a new hōlua slide. As he stood admiring the slide a rider on a tiny *papa hōlua* (sled) came sliding down. The rider hit a pebble and flew off his *papa holua.* Manu caught the rider in mid-air, saving him from death. Manu put him down and the small man darted off into the bushes before Manu could say anything to him. The small man didn't bother to pick up his broken sled so Manu decided to take it home with him thinking that by repairing this one he could learn how to build himself a papa hōlua. Manu's parents thought it was selfish of him to spend his time repairing the papa hōlua when he could be gathering more food for them. Frustrated with his parents' laziness and dissatisfaction at all that he does for them, Manu pleaded with his parents to allow him just one day to himself to slide down the hōlua. Manu's parents agreed to allow Manu one day to himself if he could accomplish all the following things in three days time: fill a large *imu* (earth oven) with food, build a *loʻi* (irrigated field of wetland taro), and plant a patch of sugarcane and banana. Manu's parents said these things jokingly as they knew it was an impossible task.

Manu repaired the sled and left it at the top of the hōlua to be found by its rider. As Manu made his way back late in the afternoon the little bearded man appeared before him suddenly holding the repaired sled. The little man came to thank Manu for saving his life and for repairing his sled. To show his gratitude, he prepared a meal for them to share. Manu could not recall a time someone had ever prepared food for him. The little man asked Manu why he spent all his time searching for wild foods and why he did not go sledding. Manu expressed that he would like nothing more than to go sledding but first he needed to build a taro patch and garden so he would not need to travel so far to find food. The little man offered to take him sledding but Manu declined as he knew his parents were waiting for their dinner and would be angry with him if he were late. When Manu got home his parents were angry with him and sent him out again to find more *ʻōpae* (shrimp) for them to eat. As Manu went searching for ʻōpae in the stream his parents sent down a freshet which tumbled Manu in its rapids. The shouts of his parents' laughter echoed from the hills. Unbeknownst to Manu and his parents, others were watching them, and they were not amused.

When the family awoke the next morning, they were astonished to see all the outrageous requests that Manu's parents had asked for were completed. Beside their house was a taro patch connected to a ditch from the stream above. There was also a garden of sugar cane and banana and there were also many calabashes set on the lau hala mat filled with food still warm from the imu. The little man Manu saved was a menehune chief and he and his people worked through the night building all of this so that Manu could go hōlua sledding (Wichman 1985:62-70).

4.2.8 Puʻu Ka Pele

Excerpted below is the ghost story of Puʻu Ka Pele, as told to Eric Knudsen by an old Hawaiian man from Waimea. It is one of several tales compiled in *Teller of Hawaiian Tales* by Knudsen.

> Many hundreds of years ago, an old Hawaiian named Papu went from Pokii to Kalalau to visit friends, and after a long stay he made a large pack of dried fish and, climbing the cliffs, started home again to Pokii.
>
> A few days later some young men arriving in Kalalau inquired for Papu. "Why, he went some days ago," said his friend.
>
> Since the old man had not returned to his home, they suspected trouble and at once started back in search of him. Finally they found his body lying in the brush, his head

> crushed and his pack gone. Sadly they buried him where he had been killed, and returned to Pokii.
>
> Now every year the spirit of the old man comes back to the spot where he was murdered, and sits by the side of the road, with a pack of dried fish on his back, and in revenge he kills the first man who passes that night. (Knudsen 1946:24)

Knudsen goes on to give two accounts of encounters with the ghost of Pu'u Ka Pele, one of which is his own. In both accounts the smell of dried fish is a sign indicating Papu's presence. Knudsen ends with the advisory to not travel that trail at night.

4.2.9 Kaluaiko'olau and Pi'ilani

The story of Kaluaiko'olau (also known as Ko'olau) and his wife Pi'ilani is an example of a historic mo'olelo. It plays out in the isolation of Kalalau valley. In 1893 Ko'olau and his son Kaleimanu were discovered to have leprosy and directed to be confined and taken to the Kalawao leprosy settlement on the isolated Makanalua peninsula of Moloka'i. As quarantine was the only proven method of disease prevention at the time, isolating those afflicted with the disease was believed to be necessary to prevent the spread of leprosy. The leprosy settlement had been created in 1866 and operated under a policy of compulsory segregation. With no viable treatments and no known cure, many patients bound for Kalawao considered it a death sentence (Inglis 2013:71-72).

At the time that Ko'olau was diagnosed, the political climate of Hawai'i was undergoing significant changes. In 1893 the Hawaiian monarchy had been overthrown and a provisional government established. At the same time, the Board of Health had become more forceful in removing leprosy patients to Kalawao without allowing *mea kokua*, or helpers, typically a spouse or other family member to accompany them (Inglis 2013:71).

Ko'olau agreed to go to Kalawao only if his wife Pi'ilani could accompany him and his son Kaleimanu. When authorities denied his request, the family sought refuge in Kalalau valley intent on evading the authorities who would tear their family apart. Deputy Sheriff Louis Stolz, also known by the name "Lui," along with provisional government soldiers pursued Ko'olau with the instructions that "Koolau should be taken alive, if possible, but if it could not be done without shedding blood, to shoot him dead." In the end, Lui did not leave the valley alive (Inglis 2013:71-72). The family remained hidden in Kalalau for approximately three years. Kaleimanu died first of leprosy and then Kaluaiko'olau about a year later. Pi'ilani saw to the proper burial of both her son and husband and then emerged from the valley to return to her home in Kekaha (Inglis 2013:95-96).

4.3 Native Birds in Traditional Hawaiian Society

From a Native Hawaiian worldview, each native forest bird species is unique and precious. Not only do they play an essential role in maintaining the native ecosystem, they also factor prominently into several aspects of traditional Hawaiian customs, practices, and beliefs. In his *Mo'olelo Hawai'i*, the early Hawaiian historian David Malo describes in detail various of the native forest birds, the color of their feathers, and how they were caught (Malo 1951:38-39). The depth of understanding that the early Hawaiians had regarding forest birds can be seen in Malo's description of the *ula*; "The *ula* is a bird with black feathers, but its beak, eyes, and feet are red. It sits sidewise on its nest (he punana moe aoao kona). This bird is celebrated in song. While brooding over her eggs she covers them with her wings, but does not sit directly on them" (Malo 1951:39).

4.3.1 Canoe making

The behavior of birds were observed for practical reasons. In accounts of *kahuna kalai waʻa* (canoe builders), it is said that "when a tree had been selected for a canoe hull, the workmen first watched for the coming of the ʻelepaio, a useful bird, because when it alighted on a koa tree it searched for insects. If the bird soon flew away the Hawaiians assumed the tree was sound and not infected with damaging insects" (Joesting 1984:2). This knowledge is captured in the following *ʻōlelo noʻeau* or descriptive proverb.

> Ua ʻelepaio ʻia ka waʻa.
>
> The ʻelepaio has [marked] the canoe [log].
>
> There is an indication of failure. Canoe makers of old watched the movements of the *ʻelepaio* bird whenever a *koa* tree was hewed down to be made into a canoe. Should the bird peck at the wood, it was useless to work on that log, for it would not prove seaworthy. (Pukui 1983:306)

4.3.2 Kia Manu (Bird Catchers) and Featherwork

Traditional Hawaiian featherwork exemplifies the importance of native forest birds to traditional Hawaiian society. Kia manu captured small native forest birds primarily for their vibrant feathers, which were used for creating chiefly garments and accessories that were symbols of rank and prestige such as *ʻahuʻula* (capes and cloaks, Figure 6)), *mahiole* (helmets, Figure 7), *kāhili* (standards) and *lei hulu* (feather garlands) donned by Hawaiian nobility. Their brilliant feathers linked the aliʻi class with the upland realm of the gods, the wao akua.

An immense amount of effort went into making these symbols of chiefly status. Each feather had to be tied individually onto the woven fabric net that formed the base of the cloak. In discussing the

Figure 6. ʻAhu ʻula presented by Kamehameha IV to Surgeon Sloggett, HMS *Calypso*, 1858. Returned to Hawaiʻi by Lieut. General Sir Arthur Sloggett, British Army, to his nephew, Digby Sloggett, Līhuʻe, Kauaʻi, 1927 (Hawaiʻi State Archives)

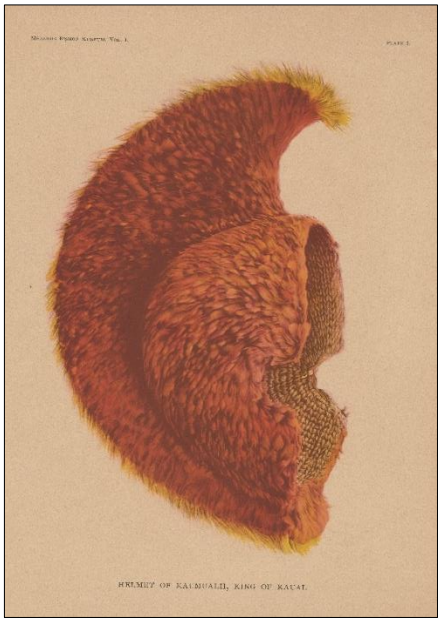

Figure 7. Feathered helmet of King Kaumualiʻi (Hawaiʻi State Archives)

Kia manu understood the behaviors and environments of the birds, and they used a variety of techniques to attract and capture them (Marzan and Gon 2015:26). Kia manu captured forest birds during the moulting season. One of the several methods used by the kia manu to trap birds involved applying a tacky lime made from breadfruit gum (*kepau*) or kukui tree gum (*pilali*) onto tree branches where the birds would land and be unable to fly away due to the sticky substance. This gentle method of trapping the bird allowed kia manu to pluck the desired feathers without harming the birds. Kia manu did not believe in killing birds that grew golden feathers. Trapping and plucking the golden feathers of the *ʻōʻō* (*Moho Acrulocerus nobilis*) and the *mamo* (*Drepanis pacifica*) was done without damage to the birds so they could be set free to grow more feathers. Some *ʻōʻō* were, however, killed for their black body feathers. In describing the ʻōʻō and mamo, David Malo states that:

> Their feathers are made up into the large royal *kahili*. Those in the axillae and about the tail are very choice, of a golden color, and are used in making the feather cloaks called ahu-ula which are worn by (the *alii* as well as by) warriors as insignia in time of battle (and on state occasions of ceremony or display -Translator). They were also used in the making of *lei* (necklaces and wreaths) for the adornment of the female chiefs and women of rank, and for the decoration of the Makahiki idol. These birds have many uses, and they are captured by means of bird lime and the pole. (Malo 1951:39)

The *ʻiʻiwi* (*Vestiaria coccinea*) and the *ʻapapane* (*Himatione sanguinea*), too extensively covered with red feathers to survive plucking, were killed, skinned, and eaten (Rangi Hīroa 1957:4). The feathers of larger fowl were used in the making of *kāhili* (standards).

While not always documented, most likely some sort of bird hunting was practiced in virtually every ahupuaʻa (Gomes 2016:39). Even in the mid-to-late 1800s there were still many different traditional forms of bird hunting that were practiced by Hawaiians (Gomes 2016:34). The differences in technique varied according to the kind of bird being hunted (Marzan and Gon 2015:26, Emerson 1895).

The available ethnohistorical literature on kia manu describes their profession as a lonely one. During the months spent in the upland forests gathering feathers, they had only themselves and maybe one or two

companion bird catchers for company (Wichman 1985:126). Spending a significant amount of time in the uplands, they possessed detailed knowledge of upland boundaries and were among those most familiar with upland areas.

4.3.3 Bird Hunting for Subsistence

Traditional Hawaiian bird hunting was not undertaken solely to acquire feathers for aliʻi regalia. For the *makaʻāinana*, the common people, larger birds such as the ʻuaʻu and *nēnē* (Hawaiian goose, *Nosochen sandwicensis*) were utilized as a source of wild meat (Gomes 2016:33-35). The feathers were harvested and the birds were usually eaten. Harvested feathers were rarely trimmed, although large flight feathers would be split in two to create a greater quantity of usable material. ʻUaʻu chicks are commonly said to have been a delicacy reserved for aliʻi in ancient times (as cited in Gomes 2016:48). The moʻolelo of Lauhaka and Kāneʻalohi supports this fact as they were persecuted for eating ʻuaʻu.

An analysis of land boundary commission testimonies found that on Hawaiʻi island "there is a correlation between ahupuaa with large land holdings and bird catching for meat" (Gomes 2016:40), suggesting that the importance of bird hunting as a traditional source of wild meat may have influenced the shape and size of some ahupuaʻa. The "correlation between the size and shape of an ahupuaʻa and the importance of wild birds as a major food source" (Gomes 2016:49) suggests that makaainana belonging to large ahupuaʻa probably relied heavily on wild bird meat as a food source (Gomes 2016:40-41).

4.3.4 Spiritual Significance of Native Birds

Native forest birds are woven into the creation stories of the islands. The Kumulipo, one of the great cosmological and genealogical chants that tell of the forming of the islands and its creatures speaks of the birth of the ʻapapane, the ʻōʻō, the mamo and other forest birds (Beckwith 1972:72 and 195). They appear in numerous traditional songs, sayings, and stories as representations of natural, spiritual, and human phenomena. Native forest birds are regarded as conduits for *akua*, the divine, functioning as the *kinolau*, or physical manifestations of deities. Among some families, they are *ʻaumakua* or family gods.

4.4 Mid-1800s Declining Native Bird Populations

Native Hawaiians of the nineteenth century noticed declining bird populations and were very concerned for the survival of native bird species. In a letter to *Ke Au Okoa* printed June 29, 1871 T. N. Penukahi asks the editor and readers to consider the plight of native birds.

> To the Au Okoa, greetings:
>
> I have a present to lay on your level space, if the captain and editor permits me to and you will carry it to the shores of islands so that my fellow readers of the newspaper will see the title, "The natives of the [land of the] Tuahine Rains are lost." They have not been seen for more than ten years.
>
> My friends must be wondering who these lost natives are and think perhaps that they are our old men. No, not they. Some have gone on the usual way of all earthly beings and we knew of their going. These natives that I am talking about, we know not where they are gone. It is this, the native of our upland, the iiwi, the o-u, the akakane, the amakihi, the oolomao, the elepaio, these are the natives that are lost. Some of you may ask, "what is the reason for their being lost?" I will tell you, it is because of the increase of the bad birds from foreign lands on our plains, mountains, mountain tops, vallies, cliffs, forest, taro patch borders, shores and streams…

> (T. N. Penukahi *Ke Au Okoa* June 29, 1871. Translation assumed to be Mary Kawena Pukui, Hawaiian Ethnological Notes (HEN) Newspapers)

Penukahi was likely writing from Oʻahu as the Tuahine rain is associated with Mānoa, Oʻahu (Akana and Gonzalez 2015:252).

Penukahi goes on to share childhood memories of interacting with native birds.

> …They were small birds with beautiful voices and feathers. We enjoyed watching them when we were children. When a gale blew here, the birds of the mountains came out and gathered before the doors of the houses. It was fun to see the leaves of the ilima move when we were little and these were our playmates when we were small children. Before, when the other birds had not come, there were many iiwi, amakihi, akakane, o-u, oolokela, and elepaio right around here, on the cannas, on the hau trees, on the small noni trees and farther up there were flocks of them among the blossoms of the mountain apples, on the low lehua trees and on the tall ohia trees. They were the interesting things of the upland but now, they are lost. Perhaps they are driven away by these bad birds.
>
> (T. N. Penukahi *Ke Au Okoa* June 29, 1871. Translation assumed to be Mary Kawena Pukui, Hawaiian Ethnological Notes (HEN) Newspapers)

Penukahi anthropomorphizes native birds by referring to them as, "the natives of the uplands" and relating that they were childhood playmates. The individuals intervieweed for this cultural assessment speak about native forest birds in a similar manner, regarding them as equal members of our island communities, deserving of every right to live as humans do.

While Penukahi attributes the disappearance of native birds to the introduction of "the bad birds from foreign lands", these introduced avian species were not the only contributors to the decline in native bird populations. The introduction of invasive species like mongoose and cats decimated numerous native bird species (Caldeira et al 2015:254). The mosquito, another post-Contact introduction, has brough foreign diseases like avian malaria and avian pox that have further reduced the number of native forest birds.

4.5 Queen Emma visits Alakaʻi in 1871

One of the significant historical accounts of travel into the Alakaʻi swamp is associated with Queen Emma Kaleleonālani's visit to the area in 1871. This important event is remembered and celebrated today by the people of Kauaʻi in the way of the hula festival, *Eō e Emalani i Alakaʻi*. The hula festival is discussed further in the Cultural Resources, Practices, and Beliefs section of this CIA.

Queen Emma was fond of travel and adventure. She traveled to Kauaʻi often to visit with family, to see her property there, and to fulfill her chiefly responsibilities to her people (Nogelmeier 2001:65). A few years after the devastating loss of her husband Alexander Liholiho Kamehameha IV and their son Prince Albert, the Queen traveled to Kauaʻi to regain her health and spirit of adventure. The Queen wanted to see the famous Alakaʻi swamp and Waiʻaleʻale for herself. She would have heard about these places from Prince Lot Kapuāiwa through his hunting stories (Nogelmeier 2001:65).

The Queen's journey into Alakaʻi is celebrated and remembered in part because it was such a daring trip especially for a queen to embark on. Many people tried to dissuade her from going because of all the dangers it posed (Nogelmeier 2001:65). At the time very few people were familiar with the old and overgrown trail. Vladimir Knudsen recommended Kaluahi, an elderly Hawaiian man to guide the Queen and her company. Though it had been several years since he walked the trail, Kaluahi agreed to guide the group. In all, approximately 100 people formed the Queen's procession. They included men, women,

children, dancers, musicians, and retainers. The procession started their journey on horseback (Joesting 203-204). At the edge of the valley of Kauaikinana the trail stopped, and they had to leave the horses and proceed on foot. Here, Queen Emma paused to admire the view toward the Alakaʻi and called on her dancers and musicians to perform. Following the performance, they descended the *pali* (cliff) and continued toward the Alakaʻi (Joesting 1984: 204).

On the queen's return to Waimea, a grand feast was organized in her honor on January 29, 1871. Mele and oli celebrating her journey to Kōkeʻe and Alakaʻi were recited, including one which Queen Emma recalled in a letter:

> Lilikalani told the story to the country folk of the pleasure of being together in the uplands and how they had to bear the cold, something to brag about for all the people who were on the trip to the mountains with their beloved queen (Forbes 1970:7)

Mele composed for this event preserve the memory of the landscape as it was at that time. For instance, certain pōhaku are mentioned that were once along the trail and have since been moved as a result of road construction during World War II (Hammatt 2008:57).

4.5.1 Mele Mākaʻikaʻi

The two mele presented here are among several *mele mākaʻikaʻi* or travel chants composed in honor of Queen Emma's adventure into Alakaʻi. These mele document the memorable moments of the journey. Some lines describe the cold of the mountains and how the travel party stayed warm by fire. The kindness of Queen Emma is conveyed in the lines, "I ka heahea ʻana mai, "Ma hea mai ʻoukou lā?," "Ma ʻaneʻi, ma ka mehana" which describes Queen Emma inviting her fellow travelers to come closer to warm themselves by the fire. Many lines speak to the difficulty of traveling through the rugged terrain and how the travel party held hands while crossing narrow ridges. The landscape views would have been rewarding moments of the journey, these moments are captured in the several mentions of place names. One line reads *E lālama e ka nui manu*, the birds flitted about. This line of the mele can be interpreted in the literal sense, however, the birds are also a reference to Emma's fellow travelers (Nogelmeier 2001:91).

Untitled

He nenelu ke ala e hiki aku ai lā	Marshy is the pathway on which to arrive
He ʻūlika launa ʻole maila	Unmatched in its claylike stickiness
Hoʻāʻo i nā lepo pīlali lā	Attempt the soils, sticky like breadfruit gum
Kohu lepo hoʻi o Kawainui lā	Like the mud of Kawainui swamp
Kūkalaakamanu aku ia lā	But indeed it is Kūkalaakamanu
He ihona aku o Kawaikōī lā	A descent of the rushing waters
Koʻi kua ʻino i ka loa lā	An adze that cuts the expanse of the land
ʻAikena, ua māʻopaʻopa lā	Overwhelmed, tired and aching
He hanahanai Halepaʻakai lā	Halepaʻakai rises like the brow of a hill
Ke unihi mai ʻAipōnui lā	And great ʻAipō seems to draw near
Ka nahele hoʻi o ʻAipōnui lā	The forest itself of great ʻAipō
Kaleleonālani he inoa lā.	For Kaleleonālani, a name song

(Source: MS SC Roberts 3.5, p. 86. Contributed by Hanohano Makea, Hanapēpē. Translation by Puakea Nogelmeier. As cited in Nogelmeier 2001:84)

Untitled

A Kilohana ʻo Kalani	The heavenly one was at Kilohana
Nānā iā Hanalei	Looked down on Hanalei

I ke one o Mahamoku	On the sands of Mahamoku
Me ka wai o Lumahaʻi	And the waters of Lumahaʻi
A nā lae hale o Naue	To the hala-covered sea cape of Naue
Ālai ʻia e ka noe	Was screened from view by the fog
Maunahina ka i luna	Maunahina stood above
I ke ala kuikui lima	The trail where all held hands
Puni ʻia i ke ʻala	Surrounded by the fragrance
Ke ʻala o ka waokele	The fragrance of the damp forest
Ui aʻe nei ʻEmalani	ʻEmalani turned to say
"E huli hoʻi kākou lā"	"Let us now go back"
I ke ala wai ʻōhiʻa	By the mountain-apple trail
Ala Kīpapaaola	And the paved path of Ola
Keawakoʻo ka i lalo	Keawakoʻo lies below
Naele o Alakaʻi	The wilderness of Alakaʻi
Leʻa kūlou ʻo ʻEmalani	Emmalani bowed herself down
I ke anu o ʻAipō	In the cold of ʻAipō
Pūʻili lālā i ke ahi lā ē	Twigs were gathered for a fire
A i kapa no ia uka lā	To warm her in that upland
Ka leo ka mea aloha	How we loved that dear voice
I ka heahea ʻana mai	As she called out to us
"Ma hea mai ʻoukou lā?"	"Where, indeed, are you all?"
"Ma ʻaneʻi, ma ka mehana"	"Come here where it is warm"
I ka piʻina o nei ikiiki	Difficult was the ascent
O Kūkalaanāmanu	Up Kūkalaanāmanu
Hoʻomaha aku ʻo Kalani	The heavenly one rested
I ka lehua makanoe	Among the stunted lehua
Lehua lei ʻāpiki lā	The wondrous lehua made into leis
Paukū me ka paʻiniu	Interwoven with paʻiniu
E lālama e ka nui manu	The birds flitted about
I ka ʻohi hua mokihana	To gather mokihana berries
I lei no ka wahine lā	To make a lei for the woman
No ʻEmalani nō he inoa lā.	Emalani is her name.

(Source: MS SC Roberts 5.4, p. 113b. Several other sources. Translation assumed to be Mary Kawena Pukui. (As cited in Nogelmeier 2001:90-91)

4.6 History of Recreation and Conservation

Kauaʻi pioneer Valdemar Knudsen was a prominent figure in establishing the Kōkeʻe area as a recreational mountain retreat in the late 1800s. Originally from Norway, Knudsen was well traveled prior to settling on Kauaʻi. In 1852 on his way to California crossing the Isthmus of Panama he contracted malaria and had a rough recovery. Heeding the advice of a doctor to seek a warmer climate, Knudsen, on a whim, boarded a ship bound for Hawaiʻi ending up on Kauaʻi in 1854 (Joesting 1984:198-199). On Kauaʻi, Knudsen established himself as a successful rancher raising Longhorn cattle and horses at Waiawa (Joesting 1984:201).

Knudsen was fascinated with the Halemanu area and built himself a hut using nearby and accessible resources. He would later import lumber to build a more permanent dwelling at Halemanu for his family to enjoy as a mountain retreat. The Knudsens lived at their Halemanu house through the summer to escape the hot and dry summers at their Waiawa home (Duensing 2006:3).

Knudsen passed his estate onto his sons Augustus and Eric. Under Augustu's leadership Kōkeʻe became well known as a camp site and recreational area. Augustus Knudsen also responded effectively to environmental problems at Kōkeʻe. Herds of wild cattle had invaded the native forests, ate the underbrush, and trampled the roots of native trees causing devastaing deforestation. Knudsen saw to the removal of the cattle to protect the native forests as well as the watershed. Their relentless hunting had nearly eliminated the wild cattle problem by 1882. Once the cattle were gone the native koa began regenerating. Knudsen also led reforestation efforts, planting nonnative trees such as Australian koa and ironwood (Duensing 2006:6).

The recreational residences of the Kōkeʻe Camps and Puʻu ka Pele Lots played a unique role in Hawaiʻi's recreational and conservation history (Duensing 2006:22). At the beginning of the twentieth century, the ability to pursue leisure activities or to travel was enjoyed primarily by people of significant economic means. This was true of the sort of people who like the Knudsen's would retreat to Kōkeʻe. Between 1918 and 1951, more than 100 rustic cabins were built on three tracts of lots at Kōkeʻe, Halemanu, and Puʻu ka Pele (Figure 8). These rustic cabins were mountain retreats for well-to-do Hawaiʻi residents eager to escape hot and dry summers. Numerous references are made to the refreshing climate of Kōkeʻe.

Figure 8. Lessees cottages ca. 1960s Kōkeʻe State Park (Hawaiʻi State Archives)

> The most important objective of the Koke'e Camps, was to escape the hot summer days of the seaside towns in favor of the cool "bracing" air, rushing streams, songs of upland birds, and scenic beauty of the mountains and Waimea Canyon (Duensing 2006:5).

The Kōkeʻe Camps and Puʻu ka Pele Lots hold the unique distinction of being the only summer homes permitted on public land in Hawaiʻi (Duensing 2006:1).

> The Koke'e Camps and Pu'u ka Pele Lots differed from other islands' summer regions as these tracts were formally planned and were built within publicly owned forest reserves. The camps, which were modeled after recreational residences built in the U.S. National Forests, were significant as they were a contemporary and local expression of a national trend. (Duensing 2006:22)

The first applicants for the Kōkeʻe Camps were from Kauaʻi's most prominent families or who with ties to the Knudsen family already had permanent camp structures at Kōkeʻe. Camp site leases were overpriced which excluded many local families from enjoying the camps. Camp permits issued to clubs however made the camps more available to the general public (Figure 9).

Figure 9. Kōkeʻe State Park rental cabin ca. 1960s (Hawaiʻi State Archives)

4.6.1 Trout Fishing and Plum Picking

Trout fishing and plum picking were recreational activities uniquely associated with Kōkeʻe during the twentieth century. Trout fishing began as early as 1921 and was a popular annual activity during the summer months. The territorial government would seasonally stock Kōkeʻe streams, as it did in 1940 with 25,520 trout eggs supplied by the U.S. Bureau of Fisheries. Kauaʻi forester A. J. MacDonald began

planting plum trees along Kōkeʻe's trails and roads around 1930. The Civilian Conservation Corps enrollees stationed at Kōkeʻe during the Great Depression planted additional trees. An estimated 18,000 trees were eventually planted in Kōkeʻe. At some point, plum picking became so popular that the territory implemented a 'plum season' each year, which restricted plum picking to specified dates and decreed strict limits on the amount of fruit each person could harvest from government land (Duensing 2006:20).

4.6.2 The Civilian Conservation Corps and WWII period activities

During the 1930s the Civilian Conservation Corps (CCC) had a camp near Kanaloahuluhulu. The CCC were tasked with improving public lands, forests, and parks. They engaged in several conservation activities including reforesting eroded cliffs at Puʻu ka Pele. Most of these efforts involved planting alien species such as haole koa (*Leucaena sp.*), silver wattle (*Acacia podalyriifolia*), eucalyptus (*Eucalyptus ps.*), and ironwood (*Casuarina equisetifolia*). The CCC's most notable projects, perhaps, were planting an experimental fruit orchard at their camp and assisting in planting Methley plums throughout the region (Duensing 2006:21).

During WWII martial law strictly limited access to Kōkeʻe which was occupied by the U.S. military. During this time, the military improved and extended the road which made the camps accessible all year round. Prior to the road improvements, the dirt road was impassable during the winter rainy season. (Duensing 2006:22).

4.7 Present Land Use

The Kōkeʻe and Waimea state parks play a significant role in maintaining cultural traditions. Readers should refer to the *Cultural Impact Assessment for Kōkeʻe and Waimea Canyon State Parks* (Chiogioji et al. 2004) for a comprehensive discussion of cultural resources, practices, and beliefs associated with the Kōkeʻe and Waimea Canyon Parks. Similarly, for a comprehensive discussion of the cultural resources, practices, and beliefs associated with the Alakaʻi Swamp area readers should refer to the *Cultural Impact Assessment for the Alakaʻi Protective Fence Project* (Hammatt 2008). Lastly, for a comprehensive discussion of cultural resources, practices, and beliefs associated with the Nāpali coast readers should refer to *"Hana Ka Lima, ʻAi Ka Waha" A Collection of Historical Accounts and Oral History Interviews with Kamaʻāina Residents and Fisher-People of Lands in the Haleleʻa-Nāpali Region on the Island of Kauaʻi* (Maly and Maly 2003).

5 CULTURAL RESOURCES, PRACTICES, AND BELIEFS

The following is an overview of traditional and contemporary cultural resources, practices, and beliefs associated with the project area and with its native forest birds. This overview is the result of archival research and interviews with individuals knowledgeable about contemporary cultural practices undertaken within the project area or associated with native forest bird species.

The project area encompasses a large portion of Kauaʻi's surviving native rainforest, a landscape imbued with cultural significance. The several wahi pana (storied places) found in these areas contain numerous cultural resources strongly associated with Native Hawaiian cultural traditions, practices, and beliefs. These resources include traditionally gathered natural resources such as medicinal and ceremonial plants, and trees. Several of these resources are collected and used by contemporary cultural practitioners. Considering a significant part of the project area are public lands, the Native Hawaiian community has had uninterrupted access to these lands which has enabled a continuity of their cultural use.

This section also discusses cultural resources, practices, and beliefs associated with native forest birds. The practice of Hawaiian featherwork for example, is symbolically linked to the wellbeing of native forest birds as they are a source of inspiration to the continuation of the heritage practice.

Two of the previously mentioned Cultural Impact Assessments, those for the Kōkeʻe and Waimea Canyon State Parks (Chiogioji et al. 2004) and the Alakaʻi Protective Fence Project (Hammatt 2008), cover large parts of the present project area. Cultural resources, practices, and beliefs identified and described in these two previous studies remain largely unchanged, and present cultural practitioners use these areas in much the same ways as described in these two previous CIAs. Hunters are hunting the same animals and hula and *lāʻau lapaʻau* (traditional medicine) practitioners are gathering the same plant resources.

5.1 Native Forest Birds: Biocultural Connections

As critical players within the native ecosystem, native forest birds have a role in maintaining natural processes and the balance of the native forest. They provide critical services such as pollination to dozens of endangered native plants. Hawaiʻi is renowned for all the examples of tightly coevolved flower-pollinator systems. The distinct crescent-shaped beak of the ʻiʻiwi is uniquely adapted to pollinate certain native plants. The ʻakekeʻe has a specially adapted bill that allows it to pry open ʻōhiʻa buds to forage for invertebrates. The Puaiohi and Kauaʻi ʻamakihi are important seed dispersers. Puaiohi is the largest native forest bird in Kauaʻi and therefore plays a pivotal role in dispersing the larger seeded native plant species where it is still present. In these ways, the existence of native forest birds supports and nurtures the existence of other native species, which are themselves culturally significant components of the native ecosystem.

5.2 Native Plant Resources: Lāʻau lapaʻau, lei, woodworking

The project area contains numerous plant resources used for cultural purposes. Hawaiian spiritual beliefs and customs that rely on plant resources continue to be honored and practiced in the project area. *Lāʻau lapaʻau* practitioners continue to access the project area to gather native plants used to make medicines. Several cultural practitioners and the local community gather plant resources in the project area for seasonal events like May Day and graduation. Unfortunately, many of the most popular plant resources used to make lei for these seasonal events are in scarce supply. Many factors contribute to the scarcity of these popular native plant resources. Indiscriminate gathering practices, invasive species, and changing weather conditions in recent years have created conditions where these highly sought after plants are not as abundant as they once were. As a result, cultural practitioners sometimes choose not the gather these resources and opt for more widely available native plants.

5.3 Cultural and Historic Sites

Numerous cultural and historic sites are found within the project area ranging from traditional Native Hawaiian habitation sites to CCC era rustic cabins. Due to the nature of the proposed project activities, it is anticipated that no cultural and historic sites will be physically impacted by project activities.

5.3.1 Trails

The movement of goods and people within the project area in traditional times took place along an established system of footpath trails. These ala hele (trails) extended both laterally along the shoreline and mauka to makai. The coastal trails were referred to as ala kahakai (ala meaning “path, road, trail” [Pukui

and Elbert 1971:14], and kahakai meaning "beach, seashore" [Pukui and Elbert 1971:103]). They served to connect the coastal settlements strung along the shoreline and also linked adjacent ahupuaʻa, allowing for travel, trade, and exchange to take place on a broader level.
The trails that ran inland were referred to as ala piʻi (ala meaning "path, road, trail" [Pukui and Elbert 1971:14], and piʻi meaning "to go inland" [Pukui and Elbert 1971:301]). They were also known as "ala piʻi uka" or "ala piʻi mauna" (uka meaning "inland, upland, towards the mountain" [Pukui and Elbert 1971:337], and mauna meaning "mountain"]Pukui and Elbert 1971:223]). The ala piʻi gave the area's residents access to the upper slopes where crops such as ʻ*uala* (sweet potato, *Ipomoea batatas*), *uhi* (yam, *Dioscorea spp.*), and dryland kalo were grown.

In his book *Kauaʻi Tales,* Wichman makes the observation that moʻolelo convey important information useful to navigating the network of trails on Kauaʻi.

> It is possible, using these stories, to generally reconstruct where the ancient roads and trails went. In order to get to Kōkeʻe from Hanalei, for instance, it was necessary to go up Wainiha valley to Maunahina before climbing to Kilohana, a trail that was used by army engineers during World War II. In order to climb down into Kalalau from Kōkeʻe it was helpful to know the rocks of the Nāʻiwi family and use them as guideposts. On a smaller scale, it was easier to remember the place names along Waioli stream in Hanalei if you could link these places to a romantic story of a young man's search for the woman of his dreams. (Wichman 1985:155)

Kia manu or bird hunters would have used these networks of trails to access the forest to collect bird feathers. These trails would also have provided access into forest for traditional gathering of culturally significant plant resources.

There were at least three trails into Kalalau. The most frequented in traditional times was the Kalou trail, a footpath that followed the ridge on the western side of Kalalau Valley, leading from the mountains to the sea (Wichman 1998:144). Kalou trail is completely overgrown today and extremely dangerous (Wichman 1998:146). Some place names along the network of trails in this area reference the many dangers along their path.

5.4 Hunting

For an in-depth discussion of hunting practices within the Waimea and Kōkeʻe State Parks refer to the cultural impact assessement for that area (Chiogioji et al. 2004). According to Bill DeCosta, an interviewee for this CIA, the hunting practices described in Chiogioji et al. 2004 remain unchanged. Hunters continue to hunt primarily pig, goat, and black-tailed deer in the project area. For more information on the cultural significance of contemporary hunting practices, refer to the full interview transcript with Bill DeCosta included in Appendix D.

5.5 Hawaiian Featherwork

Hawaiian featherwork is an example of a cultural practice that has adapted and evolved in reaction to changing circumstances and the availability of materials. The profession of the *kia manu* is no longer practiced, and there are stringent state and Federal regulations in place regarding the gathering of traditional feathers in Hawaiʻi (Caldeira et al. 2015:26). Featherwork practitioners today source their feathers from manufactured feather suppliers. Though featherwork practitioners no longer use the feathers of native birds, the knowledge of producing feather creations still exists and is still practiced. Contemporary Hawaiian featherworkers use their creations to bring attention and awareness to the plight of native forest birds.

5.5.1 Lei Hulu

As shown in Figures 10 and 11, lei hulu practitioners of the 1930s were using nonnative bird feathers (peacock and pheasant) in their creations. Similar lei hulu , made in the traditional style, are still being created today.

Figure 10. Minnie Maioho sewing a pheasant feather *lei humupapa* ca. 1935 (Hawaiʻi State Archives)

5.6 Native Forest Birds in Mele, Oli, and Hula

A respondent to the request for information letter for the current CIA shared that there is an area below Alakaʻi where *kumu hula* (hula teachers) would test their student's chanting abilities. The kumu would then interpret the elemental signs which would indicate what kind of chanter the student would become. When Mary Kawena Pukuʻi was tested by her teacher Keahi Luahine the mist surrounded Alakaʻi, telling Keahi that her student who didn't have a strong voice, would be a teacher.

5.6.1 Mele

Mele are Hawaiian poetic compositions performed as chants or dances. Composing mele is both an art and an ancient tradition. Although both the art and the traditions of its use have continued until today, many changes through time have altered the form of the poetry and the functions of mele in Hawaiian culture (Nogelmeier 2001:1).

Although many of Hawaiʻi's native forest birds have gone extinct, they continue to hold relevance to contemporary Hawaiian culture because their legacy is preserved in classic and beloved *mele* or songs.

Figure 11. Lau hala hat with a peacock feather *lei pāpale* (hat band) ca. 1935 (Hawai'i State Archives)

The mele *Manu ʻŌʻō* is one example. The ʻōʻō bird has long been presumed extinct but the memory of the bird lives on with this song which has become a Hawaiian music and hula classic.

Manu ʻŌʻō

ʻO ka manu ʻōʻō i Malama	The black honey-eater at Mālama
A he nani kou hulu ke lei ʻia	Your beautiful and soft feathers are worn as a lei
Mūkīkī ana ʻoe i ka pua lehua	You sip the nectar of lehua blossoms
Kāhea ana ʻoe i ka nui manu	And beckon to the flocks of birds
Hui:	Chorus:
Hō mai ʻoni mai	Share with me, come to me
Ko aloha ma nēia kīhene lehua	Pour your love on the lehua cluster
No Hilo ē ka ua Kanilehua	The Kanilehua rain of Hilo
Popohe lehua a i Hanakahi	Decorative lehua of Hanakahi
Hoʻokahi aʻu mea nui aia ʻoe	One greatest thing I love is you
ʻO kou aloha ka i hiki mai	For you love has come here to me

(Huapala.org translation by Huapala and Wainani Traub)

Native forest birds continue to inspire contemporary *haku mele* (composers). Two of the interviewees for this cultural assessment have composed mele in honor of native forest birds. The compositions of present

and future haku mele are intangible cultural expressions and contributions to a long legacy of reverence for native birds.

5.6.2 Eō e Emmalani i Alakaʻi Hula Festival

Since the 1980s an annual hula festival, Eō e Emmalani i Alakaʻi, has been held at Kōkeʻe State Park in the Kanaloahuluhulu Meadow. The hula festival honors Queen Emma who in 1871 (as described above) ventured into the wilderness of the Alakaʻi swamp. Kumu Hula Roselle Bailey and Marsha Erickson, director of the Kōkeʻe Natural History Museum, started the festival to attract local people and visitors to Kōkeʻe in celebration of Hawaiian culture and hula. Each year the festival begins with a historical reenactment of Queen Emma and her entourage riding into Kanaloahuluhulu meadow on horseback as the royal party did in 1871. The free event included performances by *hālau hula* (hula schools) from across the state, exhibits, and craft demonstrations.

Since its inception, the festival has been a catalyst for kumu hula and *ʻōlapa* (dancers) to learn, research, and create. The festival inspires kumu hula to revive the mele mākaʻikaʻi written for Queen Emma and to compose mele of their own. Through their performances, hālau bring to life the mele compositions written about Queen Emma's adventure, the wahi pana of Kauaʻi, the beloved plants and animals, and much more. Unfortunately, the future of the festival is uncertain as past funding sources may no longer be available. The event was held virtually in 2020.

Two interviewees for this cultural assessment, Sabra Kauka and Keahi Manea, spoke of the importance of the event.

> Hui o Laka used to sponsor Eō e Emalani i Alakaʻi an annual hula festival held in October. Hālau from all over the State come and perform during a one day event celebrating Queen Emma's trek into Alakaʻi… very important. They're not doing it anymore. The pandemic basically shut them down and I guess they decided they weren't going to do it anymore. It's a lot of work, a lot of work. And without help from the Hawaiʻi Tourism Authority I believe it would have been difficult for them to put it on. Groups that do public events like that, cultural events, in order to keep the event affordable to the participants outside funding is needed. That was a very important, a very important cultural festival. I think it should be included in your research. Because hālau came from all over the state and experienced the Kōkeʻe forest and atmosphere. Many of them stay at the CCC camp up at Kōkeʻe or in cabins that they had association with up there. So that was important. That also motivated and inspired Kumu hula to create chants, dances, oli, meleand mele related to Queen Emma's trek and related to the area Alakaʻi. And of course, plants, birds, place names were preserved because of the inspiration that kumu hula had, yeah. It all works to preservation, yeah.
>
> If you have a performance. You know this. When you know you have a performance, you knuckle down right, you knuckle down, but also you open your mind, right. You do your research and find out about the place, and you learn about the place names, and you find out about what happened there, and who went there, and what they did and why they did it. All that stuff. So, the Eō e Emalani Festival was an inspiration. A motivating event for a lot of people for many, many years. (Manea 2022)

Ms. Kauka expressed her sadness over the festival not happening in 2022.

> So many hālau. I have so many friends, kumu hula. [thinking] Oh god, the hula, beautiful. You know I'm a little disappointed this year because we're not doing the Queen Emma Festival. It's the first time in probably over 25 years that we're not going to. Well, last year we went digital. And the year before… I don't know. Anyway, Kōkeʻe

> Natural History Museum is no longer sponsoring that event. Which makes me a little sad because it's about honoring Queen Emma. Honoring her love for the forest and her trek over a hundred years ago to the Alakaʻi swamp all the way to Kilohana. Several of the hula that were created to honor that event include verses about birds. The birds that they saw and experienced. I want my students, I want my grandchildren to continue to see and experience those as well. Those places and all the creatures that inhabit that zone of the forest and the mountains. (Kauaka 2022)

Ms. Kauka spoke about the challenges the festival organizers face in carrying on the festival.

> There's no guarantee it will go on. The museum is understaffed and it's a lot of work for just a handful of people. Even though many of us with hālau have offered to kōkua. You still need that driving force in there. And I don't want to sit on their board. I'm on too many boards already. We had a director here Marsha Erickson from Volcano. I met her when she was head of Volcano Art Center. And then after Volcano Art Center she was hired to be our director here at Kōkeʻe Museum. She along with Kumu hula Roselle Keliʻihonipua Bailey from Maui. Roselle was living here at the time. They initiated the Queen Emma, Eō e Emalani Festival. After the hurricane, Roselle and her husband moved back to Maui and retired and Marsha Erickson retired from the Kōkeʻe Museum. And we have a new director and she's good but [thinking] very much involved with hula and very committed to it. So, we'll see what we can do. It was a great opportunity for hālau from all over Hawaiʻi to come to this island to learn about Kōkeʻe, our forest, our birds, our place names, and our hula. (Kauka 2022)

6 PREVIOUS ARCHAEOLOGICAL STUDIES

6.1 Archaeological Findings in the Project Area

Although most of the project area has not been archaeologically surveyed, some Native Hawaiian cultural sites have been archaeologically recorded within the project area. It is worth noting that these cultural sites correlate with traditional Native Hawaiian land use. Habitation and intensive cultivation were concentrated in valleys and along the coast, while the high elevation forests and wetlands that comprise the majority of the terrain within the project area were not heavily utilized by Native Hawaiians. Many of the activities that took place in the uplands left little to no trace on the archaeological record. People did travel through the uplands to hunt birds, visit sacred sites, harvest trees for lumber, or gather other natural resources. These visitors to the area constructed temporary shelters and places of worship and created some of the trails that are still in use today (Yent 2004:6).

A few sites related to these activities, such as part of a shelter near Waimea Canyon Lookout (SIHP # 50-30-06-707), have been documented outside of the project area, but the only upland site recorded within the project area is Kaʻawakō, a small heiau at the summit of Waiʻaleʻale (Hammatt and Shideler 2008:10, 15-16, 21).

The folklorist Thomas Thrum, writing in 1906, described the heiau of "Kaawako" as:

> A long stone set on edge on bank of the Waialeale pool, on the summit of the mountain which derives its name therefrom. A very sacred place on which offerings are laid to this day.

Later archaeologists described it as a somewhat more substantial structure.

> Kaawako is a small rectangular structure about five by seven feet and two feet high, made of smooth lava slabs, on the summit of Waialeale, between two knolls, in the open country near the pond. This is very sacred; to this day you must throw on it the most valuable thing you have with you—money, food, tools, or whatnot, --to propitiate the gods of the mist lest they envelop you and you lose your way in that tangle of woods and gulches and level plateaus of the interior of Kauai. (Hammatt & Shideler 2008:10)
>
> -The site measures approximately 4.5 m long N/S by 4.2 m long E/W with a facing approximately 4 boulders long on two sides and a height of approximately 80 cm. Because the site was almost certainly situated on a much eroded hummock determining where nature ends and culture begins is not clear-cut. There appeared to be a boulder alignment extending off of the shrine for approximately 4 m. (Hammatt & Shideler 2008:21)

This significant cultural site is not located near any access routes that will be utilized for the project and therefore will not be impacted by the project.

Nearly all recorded archaeological sites within the project area are located in Kalalau Valley. Native Hawaiian communities in Kalalau built homes, practiced intensive irrigated agriculture, and built several heiau along a coastal trail. Some of the heiau, habitational structures, large agricultural terraces, and irrigation features in Kalalau Valley are located very near or even on trails used by modern hikers and hunters (Major and Carpenter 1999). These trails, however, will not be used for project related access and therefore the sites in Kalalau should not be impacted by the project.

7 PREVIOUS CULTURAL STUDIES

The following previous cultural studies have been conducted for lands within the project area. Recorded oral histories also contain mentions of cultural practices and changing land use in northwestern Kauaʻi through the 20th century. Summarized and excerpted below are several of the studies with information most relevant to the assessment of the current project area.

7.1.1 "Hana Ka Lima, ʻAi Ka Waha" A Collection of Historical Accounts and Oral History Interviews with Kamaʻāina Residents and Fisher-People of Lands in the Haleleʻa-Nāpali Region on the Island of Kauaʻi (Maly and Maly 2003)

The primary focus of this study was the conducting of oral history interviews with individuals familiar with the Haleleʻa-Nāpali region of Kauaʻi. Nearly all the interviewees in this study are tied to families with generations of residency in the Haleleʻa-Nāpali region. All but one of the interviewees were brought up in families that worked the lands and fished using traditional Hawaiian techniques, observed traditional customs and beliefs, and fished for subsistence.

The present CIA is not concerned with fishing practices as the proposed project activities will not occur along coastal areas and will not impact fishing practices. The preparers of the present CIA mention this study (Maly and Maly 2003) to show that the coastal regions of the present project area contain numerous cultural resources, practices, and beliefs and these are discussed at length in Maly and Maly 2003.

7.1.2 Cultural Impact Assessment for Kōkeʻe and Waimea Canyon State Parks (Chiogioji et al. 2004)

The purpose of this cultural impact assessment was to consider the effects future development of the Kōkeʻe and Waimea Canyon State Parks may have on Native Hawaiians, their culture and their right to practice traditional customs. The assessment focused on historical and archaeological research, and information-gathering interviews with kūpuna and *kamaʻāina* (native born residents) knowledgeable of the Kōkeʻe and Waimea Canyon State Parks project area, and cultural resources, practices and beliefs within the encompassing ahupuaʻa of Waimea (Chiogioji et al. 2004:1).

The following 20th century activities within the parks and their impacts on traditional Hawaiian culture are discussed at length in this study: the presence of cattle during the first decades of the century, the opening of leased cabin sites at Kōkeʻe beginning in 1919, the planting of tree stands and construction of new trails by the Civilian Conservation Corps during the 1930s and 40s, the construction of military and communications facilities beginning in the 1960s, and the development of the parks themselves beginning in the late 1940s (Chiogioji et al. 2004:17).

The findings of the *Cultural Impact Assessment for Kōkeʻe and Waimea Canyon State Parks* show that the park lands are used for several traditional cultural and customary purposes. Kumu Roselle, an interviewee for the study, sees the parks as "not just for recreation" but as "a living area of a living culture" (CIA2004:52).

In regard to future development within Kōkeʻe and Waimea Canyon State Parks, Chiogioji et al. had the following recommendation:

> As a precautionary measure, personnel involved in the design and implementation of future development within Kōkeʻe and Waimea Canyon state parks should be informed of the traditional Hawaiian cultural practices and resources identified with the parks area. Future development should complement and enhance the Hawaiian traditions associated with the parks area. Additionally, personnel should be made aware of the possibility of inadvertent cultural finds, and made aware of the appropriate notification measures to follow. (Chiogioji et al. 2004:147-148)

The present proposed project will not involve development of the park areas. The proposed project would retain and strengthen the native bird populations thereby enhancing Native Hawaiian traditions associated with the parks by preserving the culturally significant resources that are the native birds.

7.1.3 Cultural Impact Assessment for the Alakaʻi Protective Fence Project (Hammatt 2008)

The purpose of this cultural impact assessment was to provide information pertinent to the assessment of the construction of a feral pig and goat proof fence across the Alakaʻi Plateau from Wainiha Pali south-east to the Summit Bog Fence and its impacts to cultural practices. This project was implemented with the intention to preserve the ecological integrity and hydrologic function of the Alakaʻi, Kauaʻi`s watershed core. In order to abate further habitat destruction from invasive plant species and feral ungulates such as pigs and goats the protective fence was implemented as a solution that removed these threats.

This cultural impact assessment identified several general cultural concerns expressed by the community. These concerns focused on the preservation and care of natural and cultural resources within the project area. The recommendations provided by cultural practitioners interviewed for this cultural assessment included the following; involving local cultural practitioners and the community in training and

educational sessions about the management of the project area; the need for cultural monitors during certain project activities; the need for public outreach and education; ensuring continued access to the project area for cultural purposes; the need for personnel involved with the construction of the fence to follow proper protocols and procedures to ensure the safety of native plants and cultural resources.

8 COMMUNITY CONSULTATION

As part of the present CIA, SWCA contacted government agencies, Native Hawaiian Organizations (NHOs), community groups, and individuals to ask for assistance in identifying individuals and organizations knowledgeable concerning the past and contemporary cultural use of the project area.

8.1 Request for Information Letters

SWCA sent request for information letters to a total of 63 organizations and individuals. This list was developed through a review of the Department of Interior's (DOI) Native Hawaiian Organization (NHO) notification list, a review of those groups and individuals referred to in previous cultural studies conducted within the project area, and those stakeholders known to the DOFAW. A detailed list of the organizations and individuals contacted is included in Appendix B of this report.

These request for information letters explained the project's purpose and requested assistance with the following aspects of the study:

- Help in identifying kamaʻāina, kūpuna, and other individuals who might be willing to share their cultural knowledge of the project area
- Information on the present and past land use of the project area
- Information on place names and cultural traditions associated with the project area
- Information on cultural sites which may be impacted by construction work within the project area
- Knowledge of traditional gathering practices within the project area, both past and ongoing
- Information on any current cultural practices being carried out within the project area
- Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area

8.2 Community Responses

Of the 63 organizations and individuals contacted, 13 responded. Four respondents recommended individuals as possible interview subjects. One respondent shared information related to the cultural history of the project area in an email response but did not elaborate further about the information shared. Five individuals agreed to be interviewed.

8.3 Interviews

The following interviewees are individuals knowledgeable about contemporary and past cultural practices undertaken within the project area or knowledgeable concerning contemporary and past cultural practices associated with the species of native forest birds this project is intended to impact in beneficial ways. The interviewees use several Hawaiian words and expressions in their speech. So as not to interrupt the flow of the interview, definitions of these words and expressions have not been included in interview

transcriptions and interview quotations presented in the text. Readers should refer to the glossary for translations.

In the process of conducting oral history interviews, it is impossible to record all of the knowledge or information that the interviewees possess. The main objective of the oral history interview process is to record the ideas and sentiments personally held by the interviewees as accurately and respectfully as possible, without judgment. Adhering to these standards ensures both the quality and quantity of information obtained from individual interviewees and facilitates the recording of information that will be of benefit to present and future generations. Furthermore, it provides a means of capturing meaningful dialogue with individuals representative of their community in a form that is respectful of cultural values.

These oral history interviews are glimpses into the lives of the interview participants. As would be expected, participants in oral history interviews sometimes have different recollections of history. Diversity in the stories told or opinions held by the interviewees should be seen as something that will enhance interpretation, preservation, and long-term management of natural and cultural resources. Every effort has been made to accurately relay the recollections, thoughts and recommendations of the people who shared their personal histories in this study. The interview transcripts presented in Appendix D of this report have been reviewed and approved by the individual interviewee (copies of consent forms are included in Appendix C).

Readers are asked to respect the interviewees and their families. If specific points of information from the interviews are quoted, it is the responsibility of the individual/organization citing the material to do so in the context as originally spoken by the interviewee. The larger interviews should not be cited without a full citation and direct permission from the interviewees or their descendants.

8.3.1 Bill DeCosta Interview

Mr. DeCosta was born and raised on the west side of Kauaʻi. His father's family has resided on Kauaʻi for four generations. Mr. DeCosta's familiarity with the project area extends back to his childhood and young adulthood spent hunting the area with his father and uncles. Additionally, as an environmental sciences teacher working in the public school system on Kauaʻi Mr. DeCosta frequented Kōkeʻe with his students. Mr. DeCosta is presently a Kauaʻi county councilman where he advocates for supporting systems of food sovereignty by supporting farmers, fishermen, and hunters, among other initiatives.

8.3.1.1 HUNTING

Mr. DeCosta discussed the importance of hunting as a cultural practice and as a means for the food security of local families. Mr. DeCosta elaborated on the importance of maintaining the public lands within the project area for hunting. Mr. DeCosta feels that the hunting within the project area is not as good as it used to be and attributes that in part to extensive fencing in recent years. Mr. DeCosta expressed his frustration with the lack of fence maintenance and explained that the large enclosures disrupt the natural movement patterns of wild animals. Mr. DeCosta believes that smaller targeted fencing can be better maintained and monitored.

Mr. DeCosta shared a contemporary place name used within the hunting community.

> There is one area named after my uncle, George Rapozo, they called him Jungaro, but his name was actually George, and this place is called Jungaro Puka. Rapozo Puka actually is the more common term now. It's a hole in the mountain between Alakaʻi Swamp and Wainiha Valley.

Mr. DeCosta recalls when private landowners restricted hunters from accessing private lands, leaving only the public lands for hunters to use. Mr. DeCosta explains that after losing access to the private lands, Jungaro Puka became known as a reliable place for hunting.

> So what happened is in the… gosh I'm not sure if I have my timeline correct, but I know the stories. Before the plantations unionized, I believe somewhere around the 1940s maybe the 1950s. There was some pushback by certain people. The Robinson family and the rest of the large landowners took away the harvesting rights of the people to go hunting on private lands. So the people could not go and catch the pig or the goat they needed to feed their families. There's a lot of people who fed their families for generations on wild meat. It's hard to fathom you know it's hard to come to realization that families use that much meat but when you have a very small paycheck and you are able to buy flower to bake bread or rice to subsidize your meat dish a lot of the wild meat was very financially able to subsidize the lifestyle. So when the private landowners took away hunting rights people were forced to go and learn the public lands that was left to hunt. That's when that area Rapozo Puka became a very popular place to go catch a pig to feed the family. It was almost like the icebox, a guarantee spot especially during the winter months. That whole back summit, Alaka'i Bog, Rapozo Puka is actually inside the Alaka'i Bog and Camp 10 Flats overlooking Wainiha Rim. Wainiha Valley is also owned by the Robinsons and the pigs migrate from in Wainiha. In the summertime they're in Wainiha for the mango and mountain apple and they migrate up into the Alaka'i Bog during the wintertime for the guava. So we had really good hunting. It's not like that anymore. A lot of the pigs cannot migrate.

8.3.1.2 CONCERNS

Mr. DeCosta spoke about his concern for biological interventions having the potential to lead to unforeseen environmental consequences or otherwise create more problems than beneficial outcomes. He also shares recollections of past environmental interventions failing to accomplish desired outcomes.

> Real quickly, that one area I told you about Hanakoa it stretches along the Nā Pali trail. DLNR has spent much time eradicating the goats in that area removing goats because the goats would nibble on some of the rare plants that are in that area. We've told them many times that the goats tend to be a weed controller, and yes, they do nibble on some of the native tress, but it's better to lose three native trees out of 12 and still keep 8 or 9 growing because the goats do a good job of keeping the large invasive grasses down. Now, because the goats were eradicated, those grasses have grown 5-6 feet tall and they have sucked out the life of all those little shrub native plants. So we try to do one environmental technique and it creates a larger havoc.
>
> We learned that on the Big Island with the palila bird and the māmane tree. The sheep would nibble on the māmane tree and it would take away all the undergrowth of the tree and only leave the top where the sheep couldn't reach. So they were thinking that if there were no sheep the māmane tree would grow much larger and would have more birds nesting in the tree. Which is true. But now the grasses got so tall because the sheep doesn't only nibble on the māmane tree they nibble on the grass. Now the grass is taller than the trees and the rats and mice can climb up the blades of grass and can eat the eggs in the nest, and also it's a fire hazard, and thirdly, when the baby māmane seeds drop on the ground they no longer have the area to catch the sunlight and propagate because the grass has choked out all the area. So, we create a larger havoc. I just thought we would have learned our lesson cause that was done back in the 1990s and it seems like we haven't.

8.3.1.3 COMMUNITY RELATIONS

Mr. DeCosta spoke generally about his desire for better collaboration and working relationships between the local community and the scientific community implementing projects on Kaua'i. Mr. DeCosta asserts that professionals educated outside of Hawai'i need to be more receptive to the knowledge, wisdom, suggestions, and recommendations of the local community who possess generational knowledge and familiarity with the project area. In Mr. DeCosta's words, "they owe it to us generations who came before them to listen to some of the things we have to say."

Mr. DeCosta hopes that the project does what it is intended to do.

> Prior to your mosquito introduction the big thing according to the environmentalists was to protect their native flora from the pigs uprooting it and also to protect the native birds from the mud wallows that the pigs would roll in causing the oil from their skin to seal the mud which held water for mosquitoes to breed their larva. So now that you introduce these male mosquitos and hopefully it does its job the way it should. We don't have to worry about those wallows holding mosquitoes anymore so maybe those large fences to keep pigs out can be something of the past. And I would like to see smaller protective enclosures around our rare trees and plants. I think it's a win-win because when you have smaller enclosures you know exactly where to go and look at the perimeter to see if any fallen branches or any wild pigs uprooted that fence. And pigs can go around a fence if they have another route to get to where they want to go. If it's a straight-line fence cutting off their natural pathway to migrate, they will find a way to uproot that fence. We are putting skirts now on the ground that goes out 4-6 feet so the pigs cannot dig but that metal skirt is galvanized it's on the forest floor which is wet and eventually that galvanized skirt will rot and I don't know if we have the funding to remove those rotten fences one day. This mosquito intervention could be a much better solution than what we have tried in the past. The sad part about it is we spend so much money fencing out wild pigs because they create the wallows for these mosquitos to breed and now we have a better solution.

8.3.1.4 BIRDWATCHING

Mr. DeCosta mentioned that many people enjoy birdwatching within the project area.

> I know many people enjoy watching birds. It's very tranquil to observe these birds in their natural state and watch them take the nectar out of the native flora with their certain beak that they have. It's amazing.

8.3.1.5 ADDITIONAL COMMENTS

Mr. DeCosta spoke about his concern for the maintenance of the large fenced-in enclosures.

> This past weekend I took a walk into Miloli'i towards Nu'alolo. I did some hunting around the enclosures some very large enclosures in the Ku'ia Reserve. I took some videos and pictures of the fence because it's in desperate need of repair. The pigs and deer are all in the area of the fence because the wood fenceposts are all rotten. It just breaks my heart that we spend you know possibly a million dollars or more to put in these enclosures. Which I spoke against. I support small enclosures around the native flora that needs to be protected. I don't like large enclosures that cannot be maintained. I specifically told DLNR we don't have the manpower to go inspect the fence for damage from fallen trees. The pigs tend to lift the fence with their snouts and create a hole that they can go in and out. Once a pig gets into a fenced area with their herd they can create

> quite a bit of damage. But no one listened to me. They put up these large enclosures and now there's a lot more game in the enclosures than there is outside. We do have hunters that DLNR allow to go into the fenced area but it's not enough it's a poor way of protecting our natural native flora that is endangered. We need to create smaller enclosures to protect the rare plants. Maybe two acre by two acre or five acre by five acre. Right now, they're enclosing hundreds and hundreds of acres up to a thousand acres and we have no funding to maintain it so what happens when a branch in a windstorm lays down the fence and then the deer take it over.

The project area is a very special place that demands respect and care.

> I want to advocate for all the families that do these cultural practices in the bog area where you guys going to introduce the mosquito across this very delicate ecosystem. We only would bring people that would respect the forest to go in to harvest with us. Whether it was the pig or the maile or the mokihana.

8.3.2 Dr. Samuel M. ʻOhukaniʻōhiʻa Gon III Interview

Dr. Gon was born and raised on Oʻahu where he still currently resides. He has family ties to Oʻahu, South Kona Hawaiʻi, and a grandmother from Waimea Kauaʻi. Dr. Gon is a multidisciplinary expert on Hawaiʻi's natural environment and cultural traditions. Dr. Gon integrates Hawaiian cultural values and knowledge into his work as a conservation biologist with the Nature Conservancy of Hawaiʻi. Dr. Gon is also a kumu hula and kumu oli. He along with co-kumu Māhealani Wong lead the hālau in residence at the Bishop Museum. Dr. Gon co-authored a chapter in the book *Royal Hawaiian Featherwork: Nā Hulu Aliʻi* and has authored several other pieces of writing on native birds and Hawaiian culture. Dr. Gon's work as a conservation biologist has taken him to Kauaʻi's forests, including locales within the current project area, several times. As someone who has dedicated his life's work to protecting Hawaiʻi's native forests, he has a deep an intimate knowledge and appreciation for native forest birds, their habitat, and their significance to traditional Hawaiian culture past and present.

8.3.2.1 FEATHERWORK

> ...the ʻiʻiwi is the last of the birds that remain alive, that were used in the highest level of Hawaiian featherwork. There were other feathers that were used, feathers of seabirds and roosters, and the like. But the ones that are pure yellow and red and black, and, to a lesser extent dark green, those were made out of birds that are no longer with us except for the ʻiʻiwi.

8.3.2.2 SUPPORT FOR THE PROJECT

Dr. Gon expressing the importance for this project to Native Hawaiian culture.

> Although the birds that are the main focus of this Kauaʻi project are not the birds of featherwork, it's clear to me that the mosquito suppression project is going to benefit all of the forest birds, including ʻiʻiwi. Kauaʻi is one of the last strongholds of ʻiʻiwi on the main islands. So that connection in itself would be enough to underscore important cultural significance of what is being done and what stands to be lost, and why any Hawaiian who has aloha for our material culture as well as the intellectual and other aspects of culture, should be interested in this. And, once you understand what the risks and the benefits are, should be supportive of this mosquito project.

8.3.2.3 NATIVE BIRDS IN MOʻOLELO, OLI, AND MELE

Dr. Gon spoke extensively on the significance of birds in Hawaiian history and culture citing several examples.

> The role of birds in the non-material side of things that is also a fascinating thing. Manu of many kinds are mentioned all the way back to the Kumulipo, and all the way forward through mele that are popular today. Ipo Lei Manu, Kapiʻolani's love song to Kalākaua directly mentions the ʻiʻiwi pōlena and compares Kalākaua to an ʻiʻiwi. That's a logical comparison since the ʻiʻiwi and the feathers of the ʻiʻiwi would have been in the royal featherwork that would mark a high chief, such as Kalākaua. So the fact that the bird connection is not just in material culture, but also in the intellectual and spiritual underpinnings is really important to understand. You can go through the mele and the oli and the pule and find mention of Hawaiian birds throughout. Some of the best romances like Lāʻieikawai have akua wahine or aliʻi wahine raised by birds and sheltered in houses thatched with feathers. And so the idea that birds were really fundamentally important as a positive and royal presence is very clear to me and many others I'm sure. And that's the kind of thing that we stand to lose if we don't do something.

Dr. Gon spoke about native birds as the *poʻe* (individuals/people) of the forest and as *kini akua* or physical manifestations of *akua* (deities).

> It's important right. It's not only things that breathe and have eyes like us, but also all the mosses and everything that's up there. You talk with folks like Kekuhi Kanahele, she's always talking about them in terms of being individuals that coexist with us. That is the kini akua. The whole concept of kini akua-- the physical manifestations of the different akua expressed in all of the living things, even clouds and stones and the like-- demands that you look at every living element of the uplands as one of their manifestations. So you know, if the birds are of the uplands, the birds occupy the wao akua and are themselves akua then it stands to reason that to put a cape of that over yourself is to imbue yourself with that. With the mana of those akua. So that connection is a real, important one to bear in mind. And the fact that we still have mele that take you all the way to today.
>
> When you look at Ka Pilina, right. I think it was Frank Hewett that composed that one. That talks about, at first, the ʻelepaio and then the ʻiʻiwi and then alludes to the wahine carried about by birds. So it's obviously an allusion to Lāʻieikawai. Although he never mentions it, and that's what makes the poetry so beautiful is that if you don't know that story it's still nice. But if you know the story, then suddenly you say, aha! I know what you're alluding to. And he is essentially extending that long tradition into a song of today.

8.3.2.4 COMMENTS ON THE HISTORY OF EXTINCTION

Dr. Gon speaking on the history of extinction of native forest birds and the role that mosquitoes play in their decline.

> I've seen five different birds that were in existence when I was younger go extinct. Birds like poʻouli and ʻōʻū, Maui nukupuʻu and the like. So, it's kind of a sad statement that within one person's lifetime so many of them would go extinct, and we know just from the history of birds since the turn of the twentieth century many of them have gone. And it's due to a combination of things, certainly, but the main factor is disease. And if we think of birds as the poʻe of the forest, as beings that have every much a right to exist as any Hawaiian would, then we're allowing for this kind of pandemic or genocide to occur. It's been happening to them for a century. So yeah, if you think about the mosquitoes,

> introduced in 1826, and then songbirds that carry malaria thereafter, and then the ornithologists noticing the evidence of disease and then the disappearance of birds from the lowlands. All of that points pretty much to disease as a major factor in their loss. We can certainly, you know, point to the fact that all the lowland forests were converted to sugarcane and other forms of agriculture as well. But the combination of the two certainly was really important.

Dr. Gon gives the example of disease-bearing mosquitoes contributing to the decline in the *ʻōʻō* of Waianae.

> We know that, for example, the ʻōʻō of Waiʻanae would feed from the lehua of the uplands. When the lehua were in bloom in the summertime, and then come down to Kalaeloa and drink nectar from the naio shrublands that were down there. And once you have birds that are doing this upland lowland alternation over the seasons, and the lowlands become infested with disease-bearing mosquitoes you're signing their death warrant, because every year when they come down to the lowlands and are exposed to them. And they haven't for the large part evolved any kind of resistance. So, ʻapapane and ʻamakihi, two of the most common birds, and [ones that] had populations high enough that they could be taken down through that bottleneck and then emerge with resistant populations. But any birds that started as rare would be taken down to a bottleneck that essentially went to zero. So you know, folks that understand this see how desperate the situation is, and how much we need to do this kind of thing.

8.3.2.5 PLANT RESOURCES

Dr. Gon speaking about the kinds of plant resources that cultural practitioners gather in the locales of the project area.

> Kōkeʻe is famous for maile and mokihana both. I would probably expand that to any plants that might be good for lei making that might be up there. And certainly the lāʻau lapaʻau community. I don't know that the state parks folks interviewed any of them but there is certainly a huge resource of plants to be found up in Kōkeʻe.

8.3.2.6 MELE AND HULA

Dr. Gon spoke about the various ways hula practitioners connect to native birds in their hula practice and how hula practitioners use the project area and forested areas in general for inspiration and to connect to the imagery and places that traditional mele, oli, and pule speak about.

> …if you're familiar with Kau ka haliʻa, which is my favorite forest entrance chant, it talks about how you're awakened out of sleep by the sound of birds on the ridges in the uplands and that it's a sign for you to get up into Laka's realm again and be a sharing companion in that realm. I have no doubt that many hula people go up to Kōkeʻe for that kind of inspiration. To be surrounded by the kini akua to gain inspiration via what you see and hear and experience up there. That's the kind of thing that's not going to show up as material culture right? You're not going up there necessarily to gather lei or even if you are, the fact that you're surrounded by the same kinds of images that we find in the mele and the oli and the pule means that kind of benefit and resource is just as real as the material resource.
>
> So the non-material, right? The hula folks would be the ones that would benefit most from that kind of thing. Whenever I'm composing mele or an oli of entrance, I'm always thinking about what kinds of sights and sounds, and feelings, and the like, do I experience when I'm surrounded by that kind of thing. And then you weave it into your mele.

Dr. Gon describes his hālau's touching performance of the *mele* (song), Manu Poʻouli.

> …when the poʻouli was declared extinct, or when at least the last observed individuals were seen in 2006 or so, Keola Donaghy composed a mele about the poʻouli and called it Manu Poʻouli, and Kenneth Makuakāne turned it into a song. It was a fairly obscure song, one of the songs on one of his albums, and nobody really thought about it that much. A few years ago, our hālau was involved in a series of concerts at the Mission Houses Museum, and one of them, the theme was Aloha. Over the course of the four concerts that were given in the year. One of the themes was aloha ʻāina. And so in that particular one we chose to choreograph for the first time a hula to Manu Poʻouli, and we invited Ken Makuakāne to be there to sing the song while it was being danced. And I had the opportunity to tell the audience about the story of the poʻouli, how it was only discovered in the 1970s, and how it was given a name by Mary Kawena Pukui, and then how we watched over the years as the population declined. I was lucky enough to see six poʻouli in one visit on the ridge that was informally called Poʻouli Ridge, because most of the poʻouli that were seen were to be found on that ridge. And how much of a sense of loss there was when it was finally decided that they are no longer. Years of repeatedly going back to the places where they knew they were and not hearing or seeing them. So I was able to give that talk to the audience then, and then we performed the hula with Ken Makuakāne and Aaron Mahi, and other folks doing the musical backup and we had only three dancers because it's a short song, three verses. At the end of each verse one of the dancers would quietly leave the stage until there was just one dancer left and at the end of the song, falls to her knees and spreads her arms out onto the ground.

While discussing mele and the differences between traditional and contemporary compositions, Dr. Gon explains that contemporary compositions have far fewer refereneces to native forest plants and animals than do older compositions. Dr. Gon offers an explanation for why that is.

> You have to go far and make an effort in order to be surrounded by completely native forest and see our native birds firsthand. So stands to reason that it's harder to do that. It's just sad to me that kind of connection is not so easily achieved. So that's another important point to make about the need to protect these birds.

8.3.2.7 PROJECT CONCERNS AND RECOMMENDATIONS

When asked about any concerns or recommendations Dr. Gon has for the project, he said the following.

> I think that any time you're using a new technology there will be many people that are concerned. And I think that it would be really important to monitor the results. Both in the suppression of mosquitoes and the response of the birds. A lot of times in conservation we find a new tool, and we jump right on it and we try it out but the follow up on seeing whether or not it's actually effective is usually lacking. Because people realize there's so many things to do in conservation and monitoring is one of the most difficult and time-consuming things to do when you could be for instance, killing more weeds or fencing more forests, things like that. So, I am concerned that this project really needs good monitoring and follow up. I'm also concerned that if the project is not successful in the first attempt that people would just give up on it. And that's not necessarily the best course. You want the thing to be successful, and you don't necessarily want to just throw your hands up and say, well, that didn't work and then move on, because we know full well that this is the first time that something's being tried in a really complex place. So I'm concerned that people will point to any kind of snags or failures as a reason to stop. I'm also concerned that there's a lot of misinformation flying around already about what this project is and is not. So, that is certainly a concern.

8.3.2.8 ADDITIONAL COMMENTS

Dr. Gon shared his thoughts on how the project will also be of benefit to humans.

> Because the control of high elevation mosquitoes is the first step, and then, if that's successful and the birds can be saved, then the next step is how can we get rid of mosquitoes everywhere in the islands. Not only as a boon to native birds, but also because of global warming and the spread of tropical diseases like dengue and the like up into our latitudes. A boon to human health as well.
>
> It is ironic that humanity or human community would be more interested in it if there was a clear threat to people. For instance, if dengue became a yearly thing and we really needed to control mosquitoes in order to get rid of dengue. Everybody would be all for it. Oh, yeah, let's find a tool to get rid of mosquitoes and the diseases that they carry. But most of them don't even think for a moment that for a century our birds have been suffering the same kind of threats. And if they were viewed as part of our communities that we would not tolerate the fact that they've been declining and been driven into extinction over the last 100 years.

Dr. Gon envisions a future where Hawaiʻi's native birds beg for french fries at McDonald's.

> I always said that if mosquitoes were controlled, my goal would be to see native birds begging for french fries at McDonald's [chuckles]. It's a weird image… we want them to be back in our lives again. That was triggered by the fact that when I visited the Galapagos and I was in the grocery store looking for something. I was in the aisle in which the rice was found and there, amidst the rice bags and rice grains that had fallen out of the bags onto the floor were Galapagos finches hopping around eating rice in the isles of the grocery store in the Galapagos. And I was like, whaaatt?! [chuckles] We're so used to, you know, native birds being found far away from where people are. But then, you know that thought it just struck me. That would be amazing if we could have, our native birds just around us in the lowlands.

8.3.3 Sabra L. Kauka Interview

Sabra Kauka is a well known and respected cultural practitioner, teacher, and kumu hula. Ms. Kauka teaches Hawaiian cultural studies at Island School in Līhuʻe, Kauaʻi. Ms. Kauka also serves the public schools of Kauaʻi through her involvement with the Department of Education's Hawaiian studies kupuna program. Ms. Kauka is also involved in surveying efforts of native sea birds on Kauaʻi.

8.3.3.1 COMMENTS ON THE DECLINE OF NATIVE BIRDS

Ms. Kauka spoke about her deep concern over the decline of native birds on Kauaʻi.

> Gosh, so many fond memories of the birds there. I have a deep concern that the forest is becoming quiet. I don't see nearly the number of birds that I did 5, 10, 15 years ago. So I'm concerned. I also have a cabin in Kōkeʻe that I share with several other friends. The last time we were up there was just a few weeks ago. There should be a lot of chatter in the trees but it's becoming quiet. So that disturbs me.

Ms. Kauka underscores how important it is to do all we can to protect native birds.

> If we do nothing and the numbers continue to decline to the point of extinction. I don't want to carry that burden. I don't want to be blamed for that. I want us to be proactive. I want us to do everything we can to save these species. I think their importance goes far

> beyond. They're so very much a part of the cycle of life on our islands, in our mountains, in our forests. I think that it's vitally important that we do everything we possibly can to save our native species.

8.3.3.2 SUPPORT FOR THE PROJECT

Ms. Kauka expressed strong support for the project.

> I am in strong support of this mosquito control effort. I have a passion for native birds. I have a deep aloha for Hawaiian culture and the importance of these birds to our culture and our history, even today.

8.3.3.3 APPRECIATION FOR THE SCIENTIFIC COMMUNITY

Ms. Kauka shared her appreciation for the scientific and conservation community on Kauaʻi.

> I support the work that many of my scientist friends here on this island are doing to try and save as many bird species as possible. Both birds and plants. I appreciate their work very much.

Ms. Kauka shared an experience doing night time surveying of birds in Nuʻalolo Kai.

> I just spent the weekend in Nuʻalolo Kai on the Nā Pali coast with some extraordinary bird scientists. Two of them from the American Bird Conservancy and some other folks. They had these two binoculars I had never used before. One was a thermal binocular the other was an avian binocular that could see at night. When I was on a work trip in June the cliffs were silent and it greatly greatly saddened me. I'm used to hearing the chicks being loud, raucous at night. Calling their parents cause they're hungry. But they asked me if it was a full moon and so I looked back on my notes and yes it was a full moon. So they explained to me the birds are quiet on the full moon. They don't make nearly as much noise. I didn't know that. So when we looked through the thermal binoculars it was amazing what we could see. There were hundreds more birds flying in the sky. I was greatly heartened by that.

Ms. Kauka shares her delight in seeing black noddies in Nuʻalolo Kai.

> In June we counted the black noddies in Nuʻalolo Kai. I would sit there with my students between 4 and 6 o'clock and count birds. Just count them as they fly pass returning to their chicks. The professional birders, you know, gave me their binoculars and they told me to look out on the horizon and I did and oh my gosh I could see hundreds of them! I was so happy. I am so grateful for their expertise, their experience, and their knowledge that they share with us.

8.3.3.4 RECOMMENDATIONS

Ms. Kauka recommended more surveying of native bird populations using a variety of methods including using thermal binoculars at night.

> I would like to see more surveys out on the Alakaʻi. I'd like to see more surveys, particularly at night when maybe you can see a little more through the thermal binoculars than you can during the day or than you can through hearing. When I go hiking up there nowadays I send my students all the way to Kilohana. Three and a half miles I think it is. I love to sit in the forest and just look, watch, and listen. But like I said the forests are becoming silent.

8.3.3.5 NATIVE PLANTS

Ms. Kauka shared her concern for native plants including maile.

> I'll tell you what, the forest has been so dry lately. It's not as abundant as it [maile] once was. For graduation this year I went to some places where I normally pick maile and it was so dry. They were nonexistent. They dried up. So I've increased the maile that I'm growing around my cabin. But you know, we're not up there all the time. It hasn't rained that much on the west side. There has been such a change in the forest. The invasive strawberry guava coming in and underneath it it's bare. The changes in the forest with the kahili ginger and all those things that I've seen over the past 35-40 years that I've been home. The changes in the forest that I see are very sad. But I really appreciate the work that the Kōkeʻe Resource Conservation Project people have done and are doing. There just needs to be more of it. We need to be more cognizant and we need to have more effort in keeping the forest as native as possible. The more native plants we have growing in the forest, the more native species, avian species and other species, can exist there.

8.3.3.6 ADDITIONAL COMMENTS

When asked, "could you share some experiences you've had with native birds up close and what that means to you?" Ms. Kauka replied, "It means the world" and then went on to describe an experience.

> About three years ago we were hiking through Alakaʻi swamp. The kids they just took off and were way ahead of me. I was just taking my time looking all around. I wanted to see everything I could. We had already gone all the way out to Kilohana and back and I was just taking my time because I wanted to observe everything I could. Off in the distance I saw a bird with black feathers and yellow under the tail. I was like OMG is that an ʻōʻō?! I thought they were extinct. I saw two of them. I just had my phone I didn't have a really good camera with a long lens so I didn't get a picture of them. I only told a few people because I didn't want people to think I was crazy or just imagining things. But I saw a couple of birds that looked like manu ʻōʻō. None of my bird photographer friends have seen them. None of my hiking friends have seen them. [thinking] Oh man, was I just imagining things? Or are they really still alive? I want them to live. I want them to be a part of the forest and a part of the world. They've been here longer than humans have on these islands.

8.3.4 Sally Jo Keahi Manea Interview

Sally Jo Keahi Manea moved to Hawaiʻi with her family in 1956 when she was 13 years old. Ms. Manea has had a lifelong passion for hula and Hawaiian culture. Even before moving to Hawaiʻi, she started learning hula at the age of 8 from a navy officer's wife. Ms. Manea has been a dedicated student to Kumu hula Roselle Bailey for several years. Ms. Manea is an active member of Ka ʻImi Naʻauao o Hawaiʻi Nei Institute which is an organization formed in 1976 by Roselle Bailey with the purpose of preserving and perpetuating Native Hawaiian culture through hula. Within the institute there are several hālau distributed across Hawaiʻi and beyond. In addition to the network of hula hālau, the institute reaches a broad global audience through various publications, theater performances, and cultural exchanges. The institute has a close relationship with the Kauaʻi Forest Bird Recovery Project. For the past 11 years, Ka ʻImi Naʻauao o Hawaiʻi Nei Institute has led the Kauaʻi Forest Bird Recovery Project in an annual blessing ceremony to mark the beginning of their research season.

8.3.4.1 PLANT RESOURCES

Ms. Manea spoke about a plot of land that she and other members of Ka ʻImi Naʻauao o Hawaiʻi Nei Institute steward and how caring for that piece of land strengethens their hula practice.

> Our institute [Ka ʻImi Naʻauao o Hawaiʻi Nei] adopted a place up in Kōkeʻe in the forest, where we clean and remove the alien species. It's about a 2-acre site up there that we maintain. We clean out the invasive species and plant the natives. So that's how we continue our traditions here...
>
> ...we call it the classroom. We call it that because when we were young hula students our Kumu took us to this spot and taught us. This is palapalai, it's different from this other one don't make the mistake of gathering the other one and think it's palapalai because it's gonna die. It's not the right one, you know. She would tell us, these are the birds, these are the plants that you need to know for hula and this is how we maintain we pull the weeds. Over many years we've been doing that. So we see, we're there with our hands in the dirt pulling out the guava and the blackberry and the honeysuckle, the aliens pulling them out. And watching the small little maile sprouts growing. For the first time in my decades of living on Kauaʻi and working up there we saw new Mokihana shoots sprouting in this area because we cleaned things out. So, being there, having our hands in the dirt and seeing how the forest has changed so drastically over the years on the ground. Our group was more concerned with the plants, right, because that's just what hula people do. You know. You think about the plants.
>
> We didn't have the knowledge that we needed about the birds, and the interrelationship between the birds and the plants. And so, you know, once in a while we go, "oh, there's an ʻelepaio, oh, there's an ʻiʻiwi," but not like now with our association with Cali and the other people from the Bird Recovery Project. We didn't notice that there weren't as many birds because we're looking at the ground, you know. I think other hula people are more concerned. Seems like. Well, I should only speak for us, but I think this might be true of others that they're focused on the plants, and they're not really realizing the interconnection, you know, that you gotta have it all because if you don't have ʻōhiʻa you don't have a lot of birds that live with ʻōhiʻa as their food source and shelter.
>
> Being there, going up there and digging into the dirt it connects us to the plant aspect real firmly, but it wasn't until we opened ourselves up to the Forest Bird Recovery project people, until we collaborated with them, and opened ourselves up to this different aspect. It took that collaboration for us to really understand the larger picture. And I have a feeling that there are other hula groups that are like us, that they think about the plants, but not so much the birds and the relationship of it all.

Ms. Manea spoke about her concern over the spread of invasive plant species and how the institute's stewardship over a small area is a reminder to be hopeful for the revitalization of native species.

> And, you know, when we come out from cleaning our spot up there. We look at the all the encroachment of all the weeds, and all the you know how there's so much guava, and there's so much other bad stuff. The mosquitoes are just a new example. And we think well, we just have our little itty bitty tiny little dot that we worked on here that we put our few hours in, and we pulled a few weeds here in this little spot. But we are able to see those new sprouts coming up. The new natives thriving after we pulled out all the bad guys. But when you walk out you look and you see all this vast huge forest that's endangered. It's not just the birds that are endangered, the forest is endangered. It's disheartening. It's kind of overwhelming. So you have to focus back in on the little square acre that you worked on and think about that. So that's kind of how I see this mosquito

project. That it's one small thing, but if it saves a couple of species, a few species, then it's a huge thing. And I think the researchers are dealing with that every single day. They're sad because they see their little friends dying, and feel like they can't do enough fast enough in order to stop it. It's very sad to think that we will lose a whole species. That extinction will happen before we can get the job done.

8.3.4.2 CONCERNS

8.3.4.2.1 Concerns over plant resources

You know, our group we don't go and gather maile because it's to the point now where it's not easily available. People take it indiscriminately, and they don't harvest it properly. Maybe that's a place that needs to be a focus. School kids, especially kids that are at Kekaha School, or Waimea Canyon or Hilo, or places where people traditionally go into the forest to gather maile. Even hula schools. They destroy it. They pull down branches, break branches in order to get maile from up there to pull it down. They don't harvest the right way. Those practices are not taught properly. It's disappointing. And it's hula people! After Merrie Monarch, after Prince Lot hula festival. In the past, you go up into Kōkeʻe and you see the place just trampled. Those are my concerns and recommendations. Really not related to the forest birds, but related to the forest. We're not doing a good enough job of teaching the real nitty gritty of conservation to our young people. We're not doing a good enough job.

Kumu hula need to encourage. Perhaps yours did. Mine did. From early on we were told you plant palapalai in your yard. You don't go to the forest, you plant kupukupu you get yourself an ʻōhiʻa tree. You don't depend on the forest. That's not difficult, it's not hard to do that. That's another thing that we need to do as practitioners is to encourage growing your own stuff so you don't have to go mauka. We're fortunate on Hawaiʻi Island and Kauaʻi especially we still have a lot of forest area.

8.3.4.3 MELE

On the topic of native forest birds as a source of inspiration to contemporary Hawaiian *haku mele* (composers), Ms. Manea shared that she wrote a song honoring native forest birds.

Because of the mosquito project and the materials that the Maui and Kauaʻi Forest Bird Recovery Project people have put out related to ʻākohekohe, kiwikiu, ʻakikiki and ʻakekeʻe, I wrote a song! Just as you speak, it's a song for today, and it's a song about these four birds. My idea was, you know the song Nā Moku ʻEhā? It goes like, [singing] Hanohano Hawaiʻi lā lei ka lehua lā kuahiwi nani lā ʻo Mauna Kea. Four islands, the name of the island, the name of the flower, and the name of the mountain. So I did that with the birds. I did the name of the bird, the habitat, a characteristic of the feathers, and then another characteristic peculiar to that bird. It has five verses total. One verse about each bird, and the hāʻina. Our music group is practicing it. The song had its debut at the Lehua Island Restoration Art show opening on Kauaʻi a couple of weeks ago. The Island Restoration people sponsored the opening of an art show in Kukui Grove Center for our Kauaʻi society of artists. We were part of the entertainment there. So we debuted the song that evening. Kumu Roselle's daughter Sharon did the melody. I did the words. She sees the native birds as kind of flitting, flying back and forth [waves hands in the air]. You know, kind of like that. So she did a melody that's really lively. So there's an example of what you're talking about.

Ms. Manea shares how Ka ʻImi Naʻauao o Hawaiʻi Nei perform mele about native birds in partnership with the activities of the Kauaʻi Forest Bird Recovery Project.

> So one of the performances that we did for the Kauaʻi Forest Bird Recovery Project... When they wanted to go into the forest to catch the remaining family of ʻakikiki in one particular area in Halepaʻakai. They wanted to catch them, to take them over to Maui to be in captivity. They asked us to do some kind of a ceremony or blessing before that. So we took bird verses from five different songs. In Hawaiian music a lot of times a song will only have one verse about a bird. So we found different songs, and we took the bird verses, and we put them into a medley. And one of them is a song that Diana Aki wrote. It's called Manu Mele. One of the primary verses in this five verse mele is from her song that's a favorite for a lot of us who live here on Kauaʻi.

8.3.4.4 HULA

Ms. Manea and interviewer Wainani Traub discusses how as hula practitioners they are taught to acknowledge traditional place names, native plants, and animals. And how doing so heightens their engagement with cultural places.

> WT: In my experience with hālau there's power to just speaking these place names, and the plants and animals. It's like they're just kind of hanging out waiting for someone to activate them. And once you do, you know, amazing things do happen.
>
> SJM: Yeah, exactly. Our group is very fortunate that we have a lease on a property up there. Roselle and her husband Jim acquired a part interest in this cabin in the seventies when they moved to Kauaʻi. When they left Kauaʻi they turned it over to Ka ʻImi Naʻauao so now we manage that cabin up there. So we have a place up there. It has all the photos and the memorabilia from years and years of hula. Because we have a place, it enables us access yeah, access to the forest. So whenever we go up there we always go up to Kalalau, the upper lookout, the lower lookout. We go to all the spots. And usually when we go to Kalalau, it's our natural reaction to oli, [chanting] O Kalalau pali ʻaʻala. Yeah, that particular oli. And whoever's there, it engages them instantly. You know, it's what you say, it's what you're saying. Just speaking the history, and the place names in that fashion engages everybody that's surrounding us whether it's visitors from the mainland or whether it's local people who are there. If it's Eō e Emalani time in October then there are usually other hālau people there and sometimes they join in. Just everybody becomes one thought, and it goes in the same direction. It's exactly what you were talking about.
>
> We're fortunate, we're grateful every single day for what we have here on Kauaʻi. And yet, sad that we can't do more.

8.3.4.5 ʻIʻIWI ENCOUNTERS

When asked about any experiences Ms. Manea has had up close with native forest birds she shared the following story.

> …on Hawaiʻi Island I go and visit my friend who lives in Volcano every year... Her lanai is surrounded by ʻōhiʻa. It's a stop-over spot for ʻiʻiwi. So one of my favorite things to do when I'm with Lorna is in the early morning and in the late afternoon to just sit on the lanai there and quietly watch all the birds as they fly around. And it seems like what they're doing is, in the afternoon especially, it's like they're reporting in. You know, they're coming in and they're resting on the very top branches and some more birds come and they're talking to each other and then that one goes up this way and that one goes up

> this way, and somebody else comes it's like they're like, [narrates birds' conversation] "oh, yeah we were over by the so and so, and there were lots of ʻōhiʻa, there were lots of berries over there, lots of insects in this particular tree, and you might check it out tomorrow." You know what I mean? Reporting in on their activities during the day. Where everybody went, what they saw, and what they did before they go home to rest. So that's one of my experiences. But it's not here [on Kauaʻi]. You know... For me it's only been, "oh, look! There's an ʻelepaio! Oh, look! There's an ʻiʻiwi. Or you heard that, that's a [native brid]," you know. And not more than that for me.

8.3.5 Dr. Keao NeSmith Interview

Dr. Keao NeSmith was born and raised on Kauaʻi. Dr. NeSmith has a deep grasp of the Hawaiian language and has contributed extensively to Hawaiian language revitalization efforts. Unlike the majority of Hawaiian language speakers today who acquired the language in a school setting, Dr. NeSmith learned to speak the Hawaiian language at home growing up surrounded by kupuna who spoke fluently in Hawaiian. Dr. NeSmith has been involved in community preservation efforts of heiau and other cultural sites on Kauaʻi for several years. Currently, Dr. NeSmith is an independent researcher and consultant supporting archaeology in the public and private sectors.

8.3.5.1 PLACE NAMES

Dr. NeSmith spoke about some of the place names in the project area including those with associations to birds.

> There are many place names, all across the top. The high elevations up over there with bird names... figure out how that came to be. How those names came about. What's the story associated with the area and then what's the relevance and significance culturally for those names and those birds...ʻIʻiwi polena is one of the places. Lots of bird names associated with the ridges going down Nāpali side.... Waiʻalae, ʻalae is a bird name... Kilohana is called that because it's a vantage point when you get to the top of it you can turn 360 and you can see the different gulches in the different directions.

8.3.5.1.1 Kanaloahuluhulu

Dr. NeSmith clarified the potential *kaona* or hidden meanings for the place name Kanaloahuluhulu.

> WT: I initially thought that Kanaloahuluhulu was a reference to birds. But then I read one version of a moʻolelo that explained that huluhulu refers to a hairy beast.
>
> KN: Right. But it could also be kaona for hulu manu. Huluhulu is rarely used to mean hulu manu. So that was intentional. That kind of play in meaning is intentional. Kanaloahuluhulu, which is interesting because Kanaloa is often associated with ocean. But Kanaloa has connections with forests, and also with Kāne. Since there are springs in the area there is Kāne involved, but Kāne is almost always paired together with Kanaloa and together they produce springs. Huluhulu in this case actually refers to the foliage. The forest itself. Same for up Mauna Kea. Puʻu Huluhulu is that crater, that hill where everybody gathers during the protests. So it's the same reference. That's a kīpuka. It's all lava fields all around, except for that one area which is a kīpuka hulu nahelehele forest. So the reference is to the vegetation on the hill. The honua is the body and the huluhulu is the vegetation growing on the body.

8.3.5.1.2 Nā Keiki a Nā ʻIʻiwi

Dr. NeSmith tells the moʻolelo to which the place name Nā Keiki a Nā ʻIʻiwi derives. One version of this moʻolelo is discussed in the ethnohistorical literature section of this cultural impact assessment.

> Nā keiki a ʻiʻiwi. It's rendered a couple of different ways. Nā keiki a nā ʻiʻiwi, nā keiki a Nāʻiwi. When you're on the ocean looking up or on the big beach of Kalalau looking up, there is a couple of rock features or points going up the ridge. They are associated with the menehune. The menehune kids came down to play with the kids of Kalalau but they took too long, and in the morning when the sun was rising, as they were trying to make it home, they turned to stone when the sun hit them. And so they became known as Nā keiki a Nāʻiwi. That's also kaona, a play on words because Nāʻiwi or Nāʻiʻiwi as in the birds.

8.3.5.2 HULA

Dr. NeSmith describes a wahi pana within the project area where hula was performed ceremonially.

> Some of the most sacred hula that would be performed on heiau for ritual ceremony are either composed up over there or performed up over there. For example, Pōhaku Waʻawaʻa. When you go pass Kanaloahuluhulu and you take the highway, and it winds up further, and then you hit that stretch that goes up to the second Kalalau lookout. There is a place you can stop on the side of the road and walk through the forest and on the edge of that ridge is actually a heiau, and there's a rock over there in the shape of Kauaʻi. I've been to it a number of times. That spot is the point that divides different ahupuaʻa going down. It's a merging point. That area also has a bird name too. I'm trying to remember. Right next to that rock, only several walking steps from that rock, there's a heiau. The remains of a heiau. It looks like a platform and that's the kind of place where hula would be performed because it's prominent it's up there considered a leyline and so it's super sacred for that. That's the kind of place where these hula would be performed, and the association with birds is that you're high up in the forest, and that's where these birds are. They [birds] associate with the gods and that's what the intent of the hula is for.

8.3.5.3 GATHERING PLANT RESOURCES

Dr. NeSmith shared his thoughts on gathering maile and mokihana.

> Yeah. Locals aren't doing well in taking care and respecting the growth cycle. It's unfortunate. I would encourage maile farming instead of raiding the forest. I wish DLNR would start a campaign to encourage farming. It's a big deal on the Big Island. Maile farming is a big deal. In Panaewa and Hilo. I have friends over there with their backyard just loaded with maile. So, instead of having to go into the forest and cause all kinds of destruction. A lot of locals go in there and just shred the maile rip it apart and then it dies, or it never grows well again. For someone who wants to make a lei, you want nice long strands. You can't find nice long strands anymore. It's hard to find. You find only tiny branches here and there that are not suitable for making lei. And when people do find nice long ones they just go ahead and shred the whole thing, and don't consider you know you have to leave some. Mokihana same story.
>
> Mokihana doesn't get shredded like maile gets shredded because maile is a vine. But Mokihana, the berries and stuff like that. People take more than they need. Just because it's May and close to graduation, you know. People will just go absolutely raid because they get desperate. So graduation comes and everybody goes and raids all the maile. It's

> greedy. People get greedy and they have no consideration for the next people coming after them. For myself, I prefer to find my nice long strands, and I cut them off. I cut them off and take them home and then do the stripping instead of strip on the plant, because sometimes you pull on the thing and you pull out the whole plant roots and all. You gotta get it right. You gotta get a nice firm grip. Sometimes the bark is woody. When it's woody that means it's too old and if you try shred it off it'll just lift up the whole plant. Another problem is people don't get a good grip, and instead of getting a nice straight pull it breaks apart at different points and it's not usable so it gets tossed to the ground and in the meantime they left the plant mangled.

Dr. NeSmith describes the revitalization of wood carving using kauwila wood.

> Lately people have been getting into old but new types of Hawaiian crafts like wood carving. Kauwila is one type of wood. Another problem is that Kōkeʻe is a state parks so you cannot just harvest that kind of thing. You cannot just take out a chain saw and cut down kauwila because you want the wood for carving. You have to get permissions. It's very difficult. For cultural practitioners there should be that kind of access, and that access should be made easy not difficult. It should be registered so we know how much of it is going on. Poaching should be regulated. But then, for those who want to have access should have access. The answer can't be no just cause it's a State Park. That should not be the answer that shuts it down, it should be the answer that makes it possible.

8.3.5.4 COMMENTS

Dr. NeSmith spoke about the threats native birds face and their importance culturally.

> If the mosquitoes keep rising and keep dominating the forest, we're going to lose the birds and then the imported birds will take over. Egrets in particular because they're so aggressive. Barn owls are also super aggressive. I've seen barn owls attack native pueo because they're larger. In midair they'll just attack them, and they'll have a big fight. So sometimes you'll see pueo missing an eyeball and stuff like that from encountering barn owls.
>
> So if we lose those things then everything will just fall to textual knowledge, you know. Mele talking about animals that the new generations will never have seen. There already are many that this generation has never seen that are mentioned in mele. Stuff like that. So they are integral to Hawaiian culture. We don't choose to lose them. We would never do that. They're national treasures. So if they're lost it's because of some catastrophe, some kind of accident. We didn't choose to let them die out. I guess the biggest threats right now would be climate change and the warming temperatures and deforestation. If there was more forestation and more forestation of native trees coming down the mountain theoretically it'll bring the cloud levels back down. Which would bring back more rain. We need those things.

8.3.5.5 NATURAL CYCLES

Dr. NeSmith explains the interconnectedness of the health of the forest and speaks about his concern over the spread of invasive species.

> ...one thing leads to another. We need to be able to control invasive plants. You control invasive plants, then you allow native plants to grow back. And that's what attracts the native birds and so feeds the cycle. It's the native plants that feed the whole cycle. They

> also feed our culture. They feed our mele. They feed our identity. So if we allow things like the black wattle and albizia to take over, then, what's the point in saving the birds. One of the biggest natural catastrophes that's happened on Kauaʻi is allowing the farming of albizia down below in Kōloa side because it spreads super fast, it grows super fast, and the seeds have spread all the way up to the top of Kawaikini so we actually see that kind of the spread of albizia way up there. That had never been seen before, and the way they grow they spread out and just cover the ground which eliminates the possibility for native plants to grow. I think the biggest mismanagement to have happened is to not realize that things grow in a cycle. The trees provide living sustenance for the birds. The birds thrive and have their role because they're also pollinators and then that goes back into the cycle and allows further propagation of native plants. It's all connected. So if we allow for these intrusive plants then that breaks that cycle and creates another cycle.

8.4 An Overview of Interviewee Comments and Recommendations

While each interviewee has a unique connection and association with the project area, the following paraphrased topics, comments, concerns, and recommendations is a distilled list that reflects the most commonly shared sentiments of the interview participants.

Overall, the interviewees were supportive of the project. Although one interviewee was cautiously wary of the project because of the failures of past biological interventions in Hawaiʻi's history.

Each interviewee hopes the project succeeds and accomplishes what it is intended to do.

The urgency with which we need to respond to the decline of the native forest bird populations. Interview participants do not want to lose any more bird species to extinction.

A desire for better collaboration between scientists and the local community.

Positive relationships between the scientific community and local community does exist but they would like to see more mutually beneficial partnerships.

Appreciation for the present conservation efforts that are ongoing while also acknowledging that even more support is needed.

Hunting is an important cultural practice for contemporary *ʻohana* (families).

While good beneficial partnerships do exist, generally speaking, there is a "gap" between the local people and non-local researchers. Each can learn from one another but there needs to be a desire and openness on both sides to do so.

Many people experience profound positive impacts to their wellbeing from watching and listening to native forest birds.

The project area is a very significant and special place that demands respect and care.

The value of composing new hula and mele about native forest birds to tell contemporary stories.

Two interviewees referenced the Eō e Emmalani i Alakaʻi annual hula festival and the significance of that event in bringing together community and sparking interest in the history, cultural places, and biological communities of the project area.

There is a cohesive whole of the forest. The health of native plants are necessary for the health of native birds and so on.

The importance of providing opportunities for young people to participate in conservation efforts.

Desire to see local children and young adults pursue careers in conservation and preservation.

Desire to provide future generations the opportunity to experience and interact with native forest birds.

8.4.1 Concerns

All interviewees shared a great concern for the declining native bird populations and stressed the importance of native birds to Hawaiian culture past, present, and future.

Some interviewees are concerned that the project will take a while to implement.

Some interviewees shared concerns over misinformation associated with the proposed project.

Plant resources such as maile and mokihana are not as abundant as they once were. Invasive species (guava, kahili ginger, albizia) choking out the forest, unsustainable gathering practices, and the dry weather are all contributing factors. Concerns over invasive plant species choking the native plants from the forest.

Mr. DeCosta discussed the importance of hunting as a cultural practice and as food security for local families. He noted that, as hunting rights on private lands have been taken away, families depend more on hunting within public lands.

8.4.2 Recommendations

The feedback from interviewees knowledgeable about contemporary cultural practices undertaken within the project area or associated with native forest bird species resulted in the following recommendations.

Interviewees underscored the importance of a monitoring program for the success of the project. Interview participants recommended close monitoring of both mosquito populations and of native forest bird populations.

Some interviewees spoke about the existing positive relationships between the scientific community and local community. While these relationships do exist, the interviewees expressed a desire for there to be more mutually beneficial partnerships and opportunities for the scientific community and local community to engage with each other.

Interviewees recommended strong public messaging and public education for the project.

Interviewees recommended exploring options to expedite the project.

9 SUMMARY AND RECOMMENDATIONS

The findings of the CIA indicate that the proposed action is unlikely to adversely impact cultural resources, practices, and beliefs. Instead, the implementation of the project would enhance traditional cultural resources, practices, and beliefs as well as contemporary cultural practices.

9.1 Potential Project Impacts

The purpose of the present CIA is to assess the potential impacts of the proposed project on traditional cultural resources, customs, practices, and beliefs, as well as on any current cultural practices being

undertaken within the proposed project area. From the research gathered through this CIA, the proposed project is unlikely to adversely impact cultural resources, practices, and beliefs.

As the project is designed to protect surviving native bird populations, one of the primary impacts of this project is the anticipated positive outcome that a reduced mosquito population would have toward protecting and preserving natural and cultural resources, particularly native forest birds. As these birds are cultural resources themselves, their existence and presence within the forest environments they inhabit are important to maintaining cultural continuity between traditional and contemporary cultural customs, practices, and beliefs.

9.1.1 Cultural Resources

The project area is rich in cultural resources. Not least among these are the native forest birds that the current project is intended to protect. Several other cultural resources found within the project area are frequently used and accessed by cultural practitioners.

9.1.2 Archaeological Remains

Although most of the project area has not been archaeologically surveyed, some Native Hawaiian cultural sites have been recorded. Habitation and intensive cultivation were concentrated in valleys and along the coast, while the high elevation forests and wetlands that comprise the majority of the terrain within the project area were not as heavily utilized by Native Hawaiians. Many of the activities that took place in the uplands left little to no trace on the archaeological record. People did travel through the uplands to hunt birds, visit sacred sites, harvest trees for lumber, or gather other natural resources. These visitors to the area constructed temporary shelters and places of worship and created some of the trails that are still in use today.

Nearly all recorded archaeological sites within the project area are located in Kalalau Valley. Native Hawaiian communities in Kalalau built homes, practiced intensive irrigated agriculture, and built several heiau along a coastal trail (Major and Carpenter 1999). Some of the heiau, habitational structures, large agricultural terraces, and irrigation features in Kalalau Valley are located very near or even on trails used by modern hikers and hunters.

9.1.3 Potential Impacts to Cultural Sites

The potential physical impacts that the proposed project would have on the land, both archaeologically and culturally, would be minimal and no greater than the current level of use by the public and by DOFAW and its project partners in maintaining the State Parks, Forest Reserves, and Natural Area Reserves located within the project area.

It is expected that the project would have no impact to the physical condition of constructed cultural sites (archaeological sites). Mosquito release and other project related activities would be limited to existing routes of travel (fence line corridors, trails, and roads), established helicopter landing zones, and field camps already utilized for other resources management activities. No new roads, trails, landing zones, or camps would be created to support this project. The intent is for the proposed project to have as little physical impact on the landscape as possible.

The impact to established trails, some of which form part of the Nā Ala Hele trail network (Figure 4) and may be of traditional age, will not be substantially greater than that associated with current use.

The activities associated with the project would be located well away from known cultural sites. No archaeological sites have been recorded near planned project access routes, landing zones, or field camps. Many of the known archaeological sites within the project area such as Ka'awakō are far from the trails and areas where the project activities will take place. Therefore, these sites will not be impacted by the project. Some of the heiau, habitational structures, large agricultural terraces, and irrigation features in Kalalau Valley are located near trails used by modern hikers and hunters (Major and Carpenter 1999). These trails, however, will not be used for project related access and therefore the sites in Kalalau should not be impacted by the project.

9.1.4 Hunting

Hunting as an important cultural practice for many local 'ohana who depend upon it for their subsistence. With the growing restrictions on hunting on private lands, these families have come to depend more and more on access to public lands, such as those within the project area. In his interview, Mr. Bill DeCosta noted that past efforts to reduce mosquito populations have involved the construction of large fences to keep wild pigs out certain natural areas, as the mud wallows that the pigs create hold water for mosquitoes to breed their larva. He feels these straight-line fences cut off the natural migration pathways of wild pigs and have a negative impact on the subsistence hunting of these animals. Mr. DeCosta's feeling was that the proposed action could be a much better solution to the problem of reducing mosquito populations than spending money fencing wild pigs out of forest areas. He sees it as "a win-win" for both subsistence hunters and native bird populations.

9.1.5 Potential Auditory Impacts

Some auditory impacts would be associated with aerial operations and pedestrian teams conducting project activities. The levels of noise disturbances would vary with release method. Helicopter and drone release methods would constitute the greatest auditory disturbance. While helicopter and drone use could potentially act as a distraction to subsistence hunters and/or cultural practitioners carrying out cultural activities within the project area, these distractions would be minor and temporary. Project related aerial activities and the noise generated by them is not anticipated to be significantly greater than the current existing levels. The auditory impacts associated with the proposed project would not be greater than existing noise conditions generated from commercial helicopter tourism. It should also be noted that none of the interviewed participants noted noise as an impediment to cultural practice.

9.1.6 Potential Positive Impacts

The potential long-term beneficial impacts to the conservation of native forest bird species would enhance cultural resources, practices, and beliefs.

Of greater consideration to the natural and cultural environment of the project area would be the consequences of not taking action to decrease mosquito populations. If mosquito populations are not controlled and decreased, then the twin threats of avian malaria and avian pox will continue to impact native bird species, likely resulting in more extinctions. The real impacts to be considered therefore will be to the resources, the birds and the ecosystem that supports them and that they in turn support.

The control of southern house mosquito within the project area would potentially reduce the incidence of avian malaria and avian pox transmission to the six most vulnerable native forest bird species. Although the reduction of southern house mosquitos would benefit all six species, the four species that are endemic to the island, 'akekee, 'akikiki, 'anianiau, and Kaua'i 'amakihi, are of the greatest concern as the loss of these species would result in their global extinction. Of these four species, 'akekee and 'akikiki are at imminent risk of extinction within the next decade (Paxton et al. 2022). Therefore, the successful

management of southern house mosquitos and the diseases they vector would, if all other limiting factors are also managed (e.g., mammalian predators, genetic impacts associated with small population sizes), allow these populations to successfully recover. To not undertake a project of this type would potentially result in the loss of more native bird species.

As has been demonstrated throughout this CIA, native bird species factor prominently in traditional Hawaiian cultural practices, customs, and beliefs. Efforts, such as the proposed use of *Wolbachia*-based Incompatible Insect Technique (IIT), that are designed to reduce the incidence of avian malaria and avian pox transmission to native forest bird species would result in positive outcomes for the species themselves and the cultural heritage associated with them.

The porposed project would have an advantageous outcome for cultural resources, practices, and beliefs associated with the project area. If no measures are taken to reduce mosquito populations, it is likely that the prevalence of disease-carrying mosquitoes would continue to increase jeporadizing the health and wellbeing of native forest birds.

9.1.7 Potential Impacts from No Action Alternative

Under the no action alternative, there would be severe consequences to the natural and cultural environment of the project area. If mosquito populations are not controlled and decreased, the twin threats of avian malaria and avian pox would continue to impact native bird species, likely resulting in more extinctions. As native forest birds are themselves cultural resources, their extinction would represent the loss of a cultural resource.

In addition, native forest birds form part of the larger native ecosystem and play an active role in preserving that ecosystem. Native honeycreeper species serve as pollinators and seed dispersers for certain native plants. Their decline or loss could contribute to longer term population declines of native plant species, adversely impacting the contemporary cultural practices that make use of and depend on those species.

9.2 Recommended Mitigation Measures

The following suggested mitigation measures are recommended to reduce project impacts.

9.2.1 Cultural Sites

Considering that much of the project area has not been archaeologically surveyed, previously unrecorded cultural sites are likely to be present within the project area. Such sites are, however, less likely to be present in the uplands where the majority of the project related activities would take place.

Due to the nature of the proposed project activities, it is anticipated that no cultural and historic sites will be physically impacted by project activities. Project personnel would avoid impacts to cultural sites by staying on designated roads and trails. Project related activities would be limited to existing routes of travel (fence line corridors, trails, and roads), established helicopter landing zones, and field camps already utilized for other resources management activities. No new roads, trails, landing zones, or camps would be created to support this project.

9.2.2 Cultural Practices

Although no changes in public use or access are anticipated to be required for project operations, DOFAW would continue to provide notice of any changes in use or access to DOFAW-managed areas, including areas frequented by cultural practitioners, through social media announcements or updates on the DOFAW website. DOFAW also maintains a hunter email list that could be used to notify hunters about any changes to access or use of public hunting areas. If changes in public access do arise, DOFAW would consult with the ʻAha Moku representative for the area to ensure that dispersal and monitoring efforts are coordinated with cultural practitioners who may be using those areas to gather forest plants, hunt, or carry out other cultural practices. The use of ground transportation and aircraft would be minimized to the greatest extent possible to reduce noise disturbances to cultural practitioners and recreationists.

9.2.3 Community Engagement and Education

Since 2018, the Birds, Not Mosquitoes Project has worked collectively to inform, engage, inspire, and connect people with Hawaiian forest birds, their conservation crisis, and the tools being pursued to protect these unique and irreplaceable parts of Hawaiʻi. Partners of the Birds, Not Mosquitoes Project have conducted over 66 "Talk Stories" (small, targeted meetings) with elected officials, community leaders, cultural practitioners, and internal stakeholders. Partners have also given over 100 larger presentations at conferences, classrooms, workshops, and conservation gatherings. The Birds, Not Mosquitoes Project is working to highlight the cultural importance of the honeycreepers by working with hālau to celebrate Hawaiian forest birds.

Partners, including DOFAW, have also created and distributed materials, print, and video, that capture the story of the forest birds and how *Wolbachia* IIT will help us protect endemic Hawaiian honeycreepers from avian malaria. The Birds, Not Mosquitoes Project social media and website are actively maintained to share information and updates about the project with the public. The Birds, Not Mosquitoes Project, in collaboration with educational partners, engages K-12 students across the state in a native bird and civics curriculum through championing a "Hawaiian Honeycreeper Day" resolution at the state legislature. Educational efforts to explain the proposed action are continuing and build on prior work in this area. Strong public messaging and public education is ongoing, including but not limited to continued communication with cultural stakeholders regarding the progress and success of the proposed program.

In addition, the Birds, Not Mosquitoes Project collaborates with ʻĀhuimanu, a group creating new biocultural expressions (oli, mele, hula, moʻolelo, ʻōlelo noʻeau) to communicate about the native Hawaiian forest birds, the extinction crisis, and possible solutions. Activities include composition, use, and sharing of *O ka lele a nei ʻāuna* (a chant which pairs the native birds of Hawaiʻi with guardians from the land and sea to guide the birds back into abundance), ʻaha (ceremonies that celebrate and uplift the native birds of Hawaiʻi) and a Manu Podcast in collaboration with *Ka Leo o ka Uluau* to highlight the manu in the mele *O ka lele a nei ʻāuna*.

10 GLOSSARY OF HAWAIIAN WORDS USED IN THE TEXT

ahupua'a	traditional land division usually extending from the mountains to the sea and encompassing a range of environmental zones that were known and used by the land's early Hawaiian residents. It was "so called because the boundary was marked by a heap (*ahu*) of stones surmounted by an image of a pig (*pua'a*), or because a pig or other tribute was laid on the altar as tax to the chief" (Pukui and Elbert 1971:8).
'ahu 'ula	feather cloak or cape, symbols of chiefly status
'āina	land
ala hele	trail, pathway, route, road, *ala* meaning trail, *hele* meaning to go or to walk, walking trail
'alalā	Hawaiian crow (*Corvus tropicus*)
ala pi'i	inland trail, *mauka* to *makai* trail, *ala* meaning trail, *pi'i* meaning to go inland. Also known as "*ala pi'i uka"* or "*ala pi'i mauna"* (*uka* meaning "inland, upland, towards the mountain," and *mauna* meaning "mountain"), these trails connected areas of coastal habitation with more inland settlements and planting areas
ali'i	chief, individual of chiefly blood
ali'i nui	high chief
'ahu 'ula	feather cloak or cape
'elepaio	(*Chasiempis sclateri*)
hālau hula	hula school
heiau	traditional temple or shrine
hō'ailona	sign, symbol
hōlua	a wooden sled used for sport, also the sledding course, usually a grassy slope or a created stone paved ramp
hula	the traditional Hawaiian dance form
iholena	a favorite and common native variety of banana
'ili	traditional land division, smaller in size and next in importance to an ahupua'a, usually a subdivision of an ahupua'a
ilina	burial site, grave, tomb, cemetery
imu	earth oven
inoa	name
'iole	hawaiian rat (*rattus exulans Hawaiiensis*)
kāhili	feathered standards signifying chiefly status

kahuna	priest, expert in any profession
kalo	taro (*Colocasia esculenta*)
kamaʻāina	native born resident of an area, literally "land child."
kāne	male, man
kaukau aliʻi	a lower order of chiefs who served the aliʻi nui
kia manu	birdcatcher
kini akua	physical manifestations of akua; the countless spirits and gods
konohiki	land stewards, sometimes minor aliʻi
kuahiwi	mountain
kula	plain or open country
kumu	teacher
kumu hula	hula teacher
kumu oli	teacher of traditional Hawaiian chant
lāʻau lapaʻau	traditional healing
laukahi	a herbaceous plant native to Oʻahu and Kauaʻi (*Plantago grayana*)
lau hala	leaf of the *hala* or Pandanus tree (*Pandanus tectorius*). Traditionally these leaves were often stripped of their thorns and woven into mats, baskets and other domestic items
lei hulu	feather garland (lei)
lei humupapa	a style of lei (garland) typically made of feathers sewn to a backing
lei pāpale	hatband
loʻi	irrigated terrace typically used for cultivating wetland taro
loko iʻa	fishpond
loko kuapa	shoreline fishponds
luna	plantation overseer
mahiole	wicker helmets decorated by feathers and worn by chiefs in battle
makaʻāinana	common people
makai	toward the sea

mea kokua helper, typically a spouse or other family member who accompanied a leprosy patient to confinement at the Kalawao leprosy settlement on Molokaʻi

mele song, chant, poem of any kind

mele mākaʻikaʻi travel chant

moi a delicacy fish (*Polydactylus sexfilis*)

moku district, land section, or island

moʻo water spirit or lizard goddess

moʻolelo story, tradition, legend, history

moʻoʻāina a parcel of land, smaller than an ili, and typically used in agriculture

ʻōhiʻa lehua indigenous forest tree (*Metrosideros polymorpha*).

ʻōlapa dancer

ʻōlelo noʻeau traditional Hawaiian proverbs and poetical sayings

oli a chant that was not danced to, to chant

ʻōpae shrimp

paʻakai sea salt

papa hōlua wooden sled with two runners

pīkoi tripping club, of wood or stone with a rope attached

poʻe people, population; plural marker

pōhaku stone

puapua nui a variety of banana

pule prayer

tūtū grandmother

ʻ*uala* sweet potato (*Ipomoea batatas*)

ʻuaʻu (sometimes spelled ʻuwaʻu) Hawaiian petrel *(Pterodroma sandwichensis*)

uhi yam (*Dioscorea spp.*)

wahi inoa place names

wahi pana storied place, those places about which there is a story or tradition

wao realms of traditionally uninhabited wilderness

wao *akua* wilderness of the gods

wao kānaka the forest realm of human activity

wao kele the remote and rainy forested uplands (also *wao ma'u kele*)

wao lā'au timber and forest area

wao nāhele inland forest

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APPENDIX B1

Request for Information Letter

SWCA
ENVIRONMENTAL CONSULTANTS
Sound Science. Creative Solutions.®

1200 Ala Moana Boulevard, #380
Honolulu, Hawaii 96814
Tel 808.548.7922 Fax 808.548.7923
www.swca.com

Re: Cultural Consultation for the Environmental Assessment of using *Wolbachia*-based Incompatible Insect Technique for the suppression of Southern House Mosquito (*Culex quinquefasciatus)* populations in the Kōkeʻe and Alakaʻi Wilderness areas of Kauaʻi

Aloha,

On behalf of the State of Hawaiʻi Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), SWCA Environmental Consultants (SWCA) is conducting a cultural impact assessment (CIA) for the proposed use of Wolbachia-based Incompatible Insect Technique (IIT) in the suppression of mosquito populations and protection of critical high-elevation native forest bird habitat within approximately 59,204 acres of forest reserves, state parks, and private lands in the Kōkeʻe and Alakaʻi Wilderness areas of Kauaʻi. The project area encompasses the ahupuaʻa (traditional land divisions) of Waimea, Wainiha, Makaweli, Hanakāpīʻai, Hanakoa, Pōhakuao, Kalalau, and Honopū. The project area also includes some high elevation areas of Lumahaʻi, Hanalei, Wailua, Hanamāʻulu, and Hanapēpē ahupuaʻa. These ahupuaʻa are within the moku (districts) of Kona, Nāpali, Haleleʻa, and to a lesser extent, Puna.

The native forest birds of Kauaʻi face several threats to their survival. Already, 10 of the 16 native honeycreepers of Kauaʻi have gone extinct, and 3 of the remaining 6 species are endangered or threatened. Although several factors contribute to the continuing decline in native bird populations, the main threats to Hawaiian forest birds are avian malaria (Plasmodium relictum) and avian pox (Avipoxvirus spp.); diseases principally spread by the non-native southern house mosquito (Culex quinquefasciatus). Despite the danger that these diseases pose to native forest birds, there has not, until recently, been a viable method to control mosquito populations within natural areas in Hawaiʻi.

The Incompatible Insect Technique (IIT) has recently been successfully tested in numerous cities in the U.S. and throughout the world to control mosquitoes that carry human diseases. The technique utilizes lab-raised male mosquitoes that carry a select strain of Wolbachia, a bacteria that naturally occurs in up to 70% of insects, and that is naturally found in native and introduced arthropods in Hawaiʻi. When Wolbachia carrying male mosquitoes, which do not bite or carry diseases, are released into a target habitat and mate with female mosquitoes, the Wolbachia bacteria prevents the healthy development of resulting eggs. This causes a general decline in the mosquito population in the target area. The development of IIT to combat mosquito-borne diseases that affect humans presents a unique opportunity to further develop the technique to control mosquitoes that spread avian diseases to native forest bird species in Hawaiʻi. The mosquito species targeted in this process are also a vector of human diseases, such as West Nile Virus and lymphatic filariasis, and can transmit heartworm to pets. The IIT approach is also being considered for implementation by the National Park Service to control species in forest bird critical habitat on the island of Maui. It is notable that this technique does not use any genetically modified organisms or involve genetic engineering of bacteria or mosquitoes.

The DLNR proposes to employ IIT to reduce mosquito populations within the Kōkeʻe and Alakaʻi Wilderness areas of Kauaʻi. This effort is consistent with the agency's statutory missions and responsibilities. The project would involve mass-rearing and releasing of male mosquitoes that carry a strain of Wolbachia that is

incompatible with existing female mosquitoes in the area. The mosquitoes would be released from both the ground, along established roads and trails, and the air, from helicopters or drones (when the appropriate technology becomes available). Only existing routes of travel will be used, and no new roads, trails, or helicopter landing pads will be constructed to support this effort. There will be no additional maintenance or vegetation removal beyond normal management program operations along the routes of travel. Noise disturbances from project actions will be nominal and not greater than existing noise conditions.

The release will take place within 59,204 acres of northwestern Kaua'i (Figure 1). This area includes portions of the Kōke'e State Park, Hono o Nā Pali Natural Area Reserve, Ku'ia Natural Area Reserve, Nā Pali Coast State Wilderness Park, Nā Pali-Kona Forest Reserve, the Alaka'i Wilderness Preserve, as well as privately owned lands (Figure 2). The Kōke'e State Park, Nā Pali-Kona Forest Reserve, and the Alaka'i Wilderness Preserve overlap with the extant native forest bird habitat, including critical habitat for 'akeke'e and 'akikiki, on the island. Extensive pre- and post-release monitoring would be implemented to determine the impacts of releasing the Wolbachia infected male mosquitoes on the local mosquito population.

The project area encompasses a large portion of Kaua'i's surviving native rainforest, a landscape imbued with cultural significance. The several wahi pana (storied places) found in these areas are integrated cultural and natural landscapes strongly associated with Native Hawaiian cultural traditions, practices, and beliefs. As the project is designed to protect surviving native bird populations, this CIA is particularly concerned with recording the past and present cultural significance of native forest birds and the environments they inhabit.

The purpose of the present CIA is to assess the potential impacts of the proposed releases of male mosquitoes with incompatible Wolbachia and the various activities associated with it on traditional cultural resources, customs, practices, and beliefs, as well as on any current ongoing cultural practices within the project area.

As part of this study, SWCA is attempting to identify and consult with individuals and organizations possessing knowledge of the past and present cultural uses of the project area, as well as the cultural practices and beliefs associated with the native forest birds that will be beneficially impacted by the project. We are seeking your kōkua and mana'o regarding the following aspects of our study:

- Help identify kama'āina, kūpuna, and other individuals who might be willing to share their cultural knowledge of the project area and its cultural resources
- Information on the present and past land use of the project area
- Information on place names and cultural traditions associated with the project area
- Information on cultural resources that may be impacted by project activities
- Knowledge of traditional gathering practices within the project area, both past and ongoing
- Information on any current cultural practices being carried out within the project area
- Any other cultural concerns the community might have related to cultural practices within or in the vicinity of the project area

We appreciate any information you would be willing to share regarding the project area and those individuals knowledgeable about its past and present cultural uses. Please contact us at Wainani.Traub@swca.com or by phone at (808) 646-6309. We look forward to hearing from you.

Mahalo no kou kōkua 'ana mai,

Wainani Traub
Staff Anthropologist

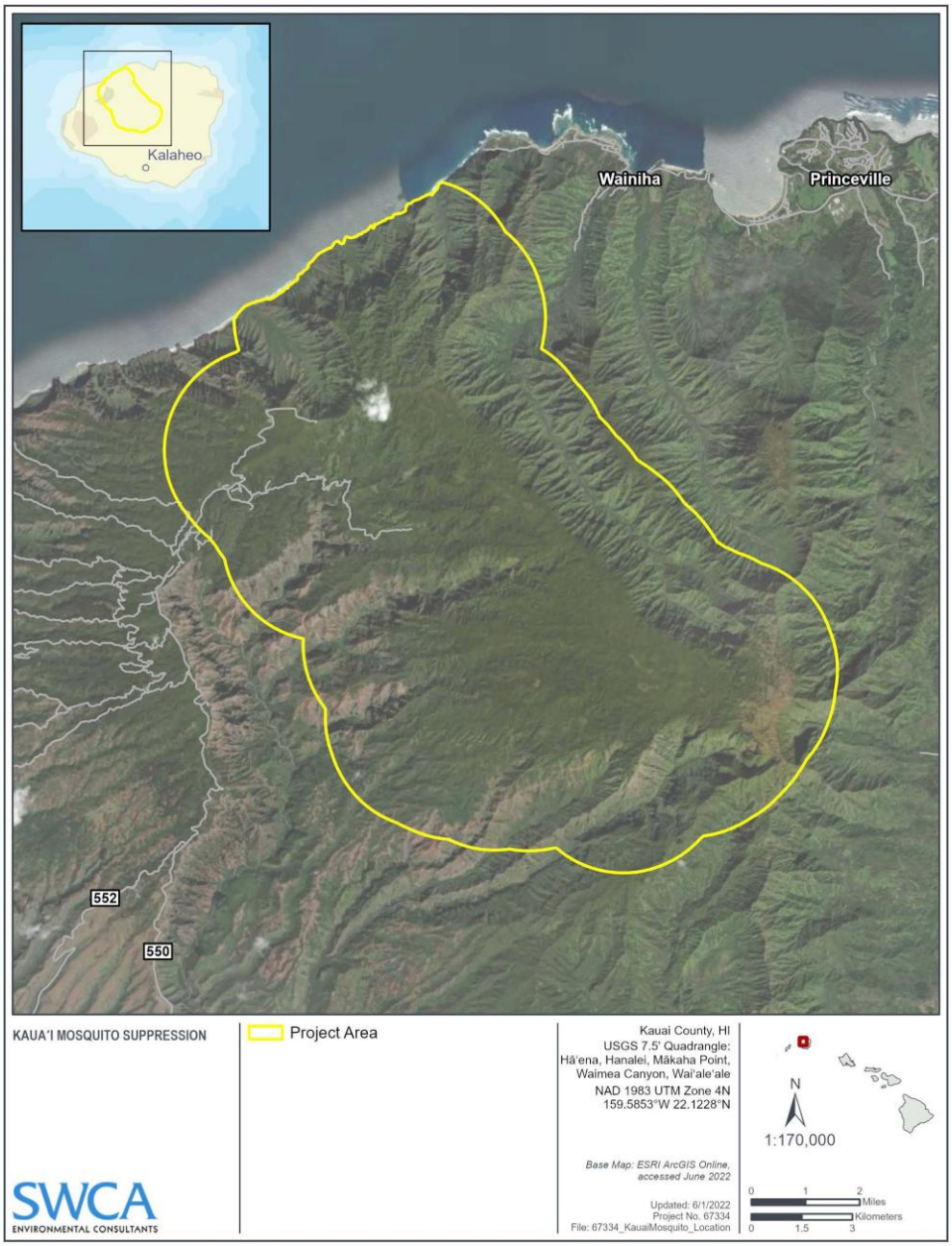

Figure 1. Boundaries of the project area.

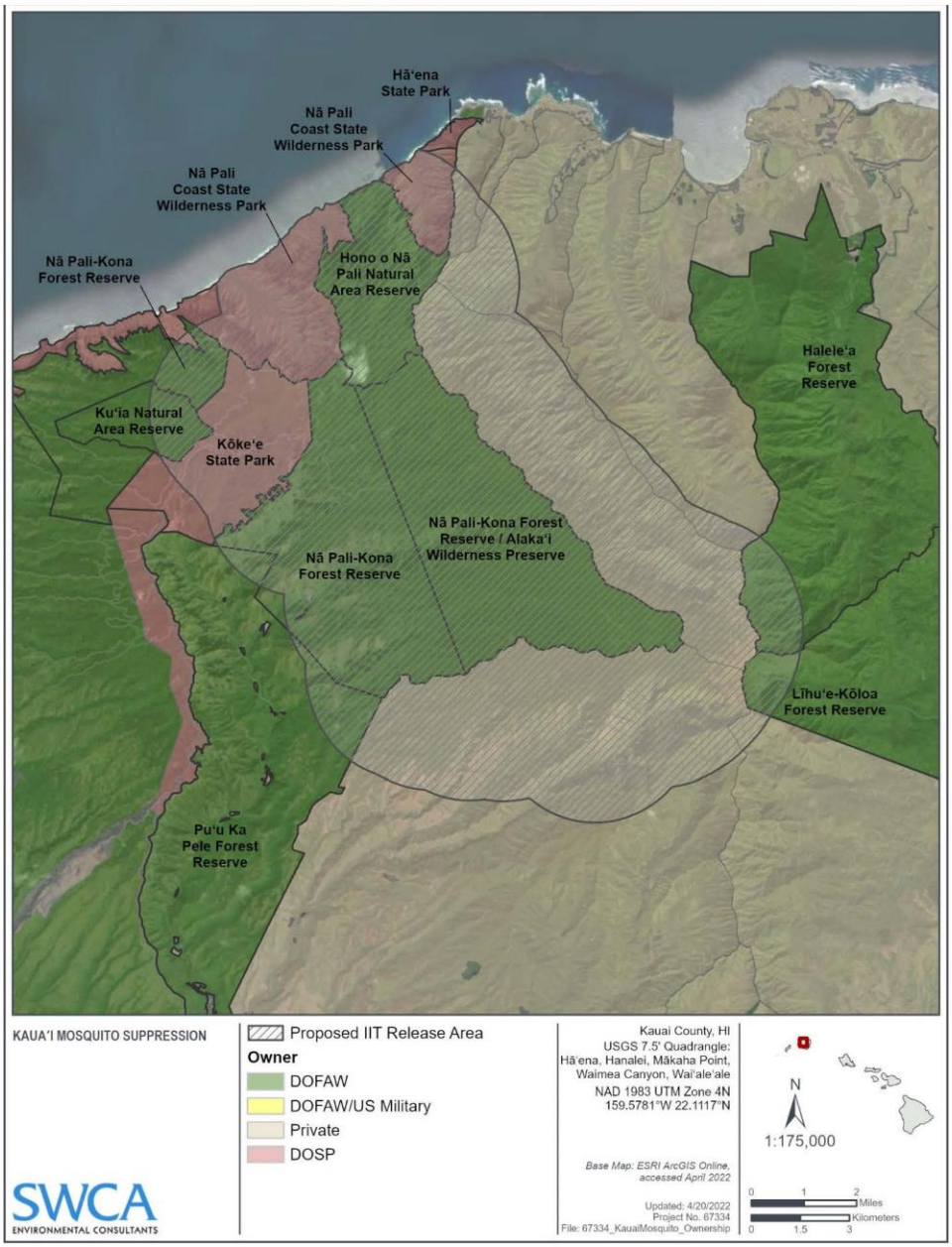

Figure 2. State Parks, Forest Reserves, and Natural Area Reserves within and overlapping the project area.

APPENDIX B2

Table of Individuals and Organizations Contacted

Contact	Title	Agency, Organization, or Affiliation	Initial Outreach (date)	Contact Response (date)	Response Details
S. Ka'āhiki Solis	Cultural Historian (Oahu, Kauai, and Niihau)	State Historic Preservation Division	6/27/2022	6/28/2022	Recommended organizations and individuals to contact. Provided a CIA checklist
Kauanoe Hoomanawanui	Burial Sites Specialist (Kauai and Niihau)	State Historic Preservation Division	6/27/2022		No response
David Buckley	Kauai Lead Archaeologist	State Historic Preservation Division	6/27/2022		No response
Dr. Tamara Luthy	Ethnographer	State Historic Preservation Division	6/27/2022		No response
Carol Lovell	Kawaihau Representative	Kaua'i Ni'ihau Island Burial Council	6/27/2022	7/5/2022	Recommended individuals and a book
Ka'āina S. Hull	Director	County of Kaua'i Planning Department	6/27/2022		No response
Dale Cua	Regulatory Planning Chief	County of Kaua'i Planning Department	6/27/2022		No response
		Kauai Historic Preservation Review Commission	6/27/2022		No response
		Kaua'i County Council	6/27/2022		Received auto reply. Interviewed councilman Bill DeCosta
Dan Ahuna	Kaua'i and Ni'ihau Trustee	Office of Hawaiian Affairs	6/27/2022		No response
Sylvia M. Hussey Ed.D.	Ka Pouhana, Chief Executive Officer	Office of Hawaiian Affairs	6/27/2022	6/27/2022	Forwarded the email to OHACompliance@oha.org with message
Casey K. Brown	Ka Pou Nui, Chief Operating Officer	Office of Hawaiian Affairs	6/27/2022		No response
Ramona Hinck	Ka Pou Kihi Kanaloa, Resource Management Director and Chief Financial Officer	Office of Hawaiian Affairs	6/27/2022		No response
Lisa Watkins-Victorino	Ka Pou Kihi Kāne, Research Director	Office of Hawaiian Affairs	6/27/2022		No response
Alice Silbanuz	Ka Pou Kihi Lono, Community Engagement Director (Interim)	Office of Hawaiian Affairs	6/27/2022	6/27/2022	Forwarded the email to others in OHA (Capsun Poe and Casey Brown)
Kalani Fronda	Land Assets Director	Office of Hawaiian Affairs	6/27/2022		No response
Mr. Noa Mau-Espirito		Na Mookupuna o Wailua	6/27/2022		No response
Ms. Kanoe Ahuna	President and Director	EAO Hawaii Inc.	6/27/2022		No response

Kamealoha Hanohano Pa-Smith	Program Administrator	Hanalei River Heritage Foundation	6/27/2022		No response
Mr. Kamealoha Smith	Board Member	Mahamoku Ohana Council	6/27/2022		No response
Sherri Cummings	President	Malama Anahola	6/27/2022		No response
Ms. Mililani Trask	Convenor	Na Koa Ikaika Ka Lahui Hawaii	6/27/2022		No response
Ms. Donna Kaliko Santos		Nā Kuleana o Kānaka ʻŌiwi	6/27/2022		No response
Lance Kamuela Gomes	Konohiki Chief	Wahiawa Ahupuaa LCA 7714B Apana 6 RP 7813	6/27/2022		No response
ʻĀnela Jackson	President	ʻAha Mālama, Corp.	6/27/2022		No response
Mr. Hailama Farden	President	Association of Hawaiian Civic Clubs	6/27/2022		No response
Mr. Joseph Kūhiō Lewis	Chief Executive Officer	Council for Native Hawaiian Advancement	6/27/2022		No response
Mr. Adrian Nakea Silva	Chairman	Hui Huliau Inc.	6/27/2022		No response
Ms. Dreanalee Kalili	Treasurer	Imua Hawaii	6/27/2022		No response
Ms. Taffi Wise	Executive Director	Kanu o ka ʻĀina Learning ʻOhana	6/27/2022		No response
Naʻunanikinau Kamaliʻi		Kawaileo Law A Limited Liability Law Company	6/27/2022		No response
Ms. Mililani Trask	Convenor	Na Koa Ikaika Ka Lahui Hawaii	6/27/2022		No response
Mr. Dennis W. Ragsdale	Advocate General	Order of Kamehameha I	6/27/2022		No response
Ms. Sheri-Ann Daniels Ed.D.	Executive Director	Papa Ola Lokahi	6/27/2022		No response
Mr. Jan E. Hanohano Dill	President and COB	Partners in Development Foundation	6/27/2022		No response
Mr. Laʻakea Suganuma	President	The Mary Kawena Pūkuʻi Cultural Preservation Society	6/27/2022	6/30/2022	Replied with story about Keahi Luahine testing the chanting ability of Mary Kawena Pukui at a place below Alaka'i.
Walter Ritte	Executive Director	ʻĀina Momona	6/27/2022		No response
Trisha Kehaulani Watson	Vice President	ʻĀina Momona	6/27/2022		No response
		Na Pali Coast ʻOhana	6/27/2022		No response
Sam ʻOhu Gon		The Nature Conservancy of Hawaii, Cultural Practitioner, BLNR, etc.	6/27/2022	8/17/2022	Interview conducted on 8/22/2022
Leināʻala Pavao Jardin	Kumu Hula	Hālau Ka Lei Mokihana O Leināʻala	7/11/2022		No response
Lahela Spencer	Kumu Hula		6/27/2022		No response
		Kauaʻi Museum	6/27/2022		No response
Leilani Darryl		Kauaʻi Cultural Center	6/27/2022		No response

Kiersten Faulkner	Executive Director	Historic Hawai'i Foundation	6/27/2022		No response
Randy Wichman	Interim President	Kaua'i Historical Society	6/27/2022		Received auto reply
Chris Faye		Hui o Laka - Koke'e Natural History Museum	6/27/2022		No response
Lucas Behnke	Kauai TNC Director	The Nature Conservancy	6/27/2022		No response
Ms. Sabra Kauka	Cultural practitioner, ethnobotanist, teacher	Na Pali Coast 'Ohana; Na Kahu Hikina A Ka La	6/27/2022	8/22/2022	Interview conducted on 8/24/22
Hob Osterlund	Writer and Photographer	Kauai Albatross Network; Kauai Wildlife Coalition	6/27/2022		No response
Maka'ala Ka'aumoana		Hanalei Watershed Hui; Kauai Wildlife Coalition; Hui Ho'omalu i ka 'āina	6/27/2022		No response
Aletha Kaohi		Interviewee from previous CIA	7/8/2022		No response
Presley Wann	President	Hui Maka'āinana o Makana	7/7/22	7/28/2022	Expressed interest initially. Did not respond to follow up emails
Dr. Keao NeSmith	Board member	Friends of King Kaumuali'i	7/7/22		Interview conducted on 10/6/22
Maureen Fodale		Friends of Kaumualii	7/7/22	7/8/22	Talked with Wainani on the phone 7/8 Maureen will forward the RFI letter to Aletha Kaohi, Keao NeSmith, Mike DeMotta, Cali Crampton, and others. Aletha's family story about uncle with Hansen's hid in forest communicated with family using bird calls
		Kauai Community College Hawaiian Studies Department	6/28/2022		No response
		Hanalei Canoe Club	6/28/2022		No response
Bill DeCosta	Councilman	Kauai County Council	6/27/2022	7/1/2022	Interview conducted on 7/5/22
Keahi Manea	Kumu	Ka 'Imi Na'auao o Hawai'i Nei Institute	7/11/2022	7/19/2022	Interview conducted on 8/24/22
Kēhaulani Kekua	Kumu Hula	Hālau Palaihiwa o Kaipuwai	7/11/2022		No response
Kāhealani Hāmākua	Kumu		7/11/2022		No response
Dr. Mehana Blaich Vaughan	Associate Professor	Department of Natural Resources and Environmental Management, UH Mānoa	7/11/2022		No response
Julia Diegmann	Outreach Specialist	Kauai Forest Bird Recovery Project	7/8/2022	7/8/2022	Recommended organizations and individuals

APPENDIX B3

Interview Consent Forms

SWCA INFORMED CONSENT FORM, INTERVIEWS

Date of Interview(s): 7/5/2022 **Project Name/Number:** KAUA'I MOSQUITO SUPPRESSION EA (CIA COMPONENT) (0067334-000-HON)

Name of Interviewee: Bill DeCosta

Name of SWCA Interviewer: Wainani Traub **Project Proponent:** DLNR DOFAW

Both the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) and SWCA are very grateful to you for your participation in this information gathering process and for sharing your mana'o with us. We value and respect your knowledge regarding the traditional cultural history, resources, customs, practices, and beliefs associated with the proposed project area, as well as any contemporary cultural practices taking place there, and wish to accurately convey this information in the Cultural Impact Assessment being prepared for the project. For this reason, we are requesting that you allow us to share the information obtained during our discussions.

****

When signing below, I show that:

- ☐ I have been informed about this project and know that I will be asked my opinion about places of traditional or cultural importance that may be impacted by the project. I also feel comfortable asking for further information about any parts of the project that are not yet clear to me.
- ☐ I fully understand that my participation in the study is voluntary and that I am free to withdraw my consent and discontinue participation at any time.
- ☐ I understand that, if at any time during our talk, I feel uncomfortable answering a question, that I can let the interviewer know, and that I do not have to answer it.
- ☐ I am providing information about this area with the understanding that SWCA may provide this information to the project proponent to advise them regarding the appropriate treatment of these lands and any important cultural places or practices related to it.
- ☐ I understand that the treatment of any human remains on these lands will be handled sensitively, and that State Guidelines will be followed by the appropriate Agency and the landowners.

✓ Yes ___ No	I have given my permission for the interviewer to record our conversation about this project so that my words will be as accurately noted as possible in the report.
✓ Yes ___ No	I have given my permission for this, and additional, interviews and/or field visits to be recorded on videotape.
✓ Yes ___ No	I have given my permission for photograph(s) to be taken of me for this project.
___ Yes ✓ No	If any audio, video, or photographs are made of me, I wish to be sent copies of these.
✓ Yes ___ No	I would like my name to appear in the report acknowledging my contribution to this work (If not, I understand that my name will remain in the contracting agency's files).
✓ Yes ___ No	If photographs are used of me in any project work, I wish that I be identified by name in the caption. (This way, later generations will be able to identify me in the photos).
✓ Yes ___ No	May this information be used in other future projects? (If not, my permission is required if the information obtained from this interview or field visit is used for any other project besides this one)

Please note any stipulations or clarifications of these points you might have on the back of this page.

Interviewee's Signature: Bill DeCosta

SWCA Interviewer's Signature: Wainani Traub

Thank you very much for your participation in this process.

Please note below any other stipulations or clarifications regarding your participation in this project.

SWCA INFORMED CONSENT FORM, INTERVIEWS

Date of Interview(s): 8/22/2022 **Project Name/Number:** Kaua'i Mosquito Suppression CIA component

Name of Interviewee: Samuel M. 'Ohu Gon III, PhD

Name of SWCA Interviewer: Wainani Traub **Project Proponent:** DLNR DOFAW

Both the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) and SWCA are very grateful to you for your participation in this information gathering process and for sharing your mana'o with us. We value and respect your knowledge regarding the traditional cultural history, resources, customs, practices, and beliefs associated with the proposed project area, as well as any contemporary cultural practices taking place there, and wish to accurately convey this information in the Cultural Impact Assessment being prepared for the project. For this reason, we are requesting that you allow us to share the information obtained during our discussions.

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___ Yes X No If any audio, video, or photographs are made of me, I wish to be sent copies of these.

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Please note any stipulations or clarifications of these points you might have on the back of this page.

Interviewee's Signature: Samuel M. 'Ohu Gon III

SWCA Interviewer's Signature: Wainani Traub

Thank you very much for your participation in this process.

Please note below any other stipulations or clarifications regarding your participation in this project.

SWCA INFORMED CONSENT FORM, INTERVIEWS

Date of Interview(s): 8/24/2022 **Project Name/Number:** Kaua'i Mosquito Suppression Project CIA component

Name of Interviewee: Sabra L. Kauka

Name of SWCA Interviewer: Wainani Traub **Project Proponent:** DLNR DOFAW

Both the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) and SWCA are very grateful to you for your participation in this information gathering process and for sharing your mana'o with us. We value and respect your knowledge regarding the traditional cultural history, resources, customs, practices, and beliefs associated with the proposed project area, as well as any contemporary cultural practices taking place there, and wish to accurately convey this information in the Cultural Impact Assessment being prepared for the project. For this reason, we are requesting that you allow us to share the information obtained during our discussions.

****

When signing below, I show that:

- ☑ I have been informed about this project and know that I will be asked my opinion about places of traditional or cultural importance that may be impacted by the project. I also feel comfortable asking for further information about any parts of the project that are not yet clear to me.
- ☑ I fully understand that my participation in the study is voluntary and that I am free to withdraw my consent and discontinue participation at any time.
- ☑ I understand that, if at any time during our talk, I feel uncomfortable answering a question, that I can let the interviewer know, and that I do not have to answer it.
- ☑ I am providing information about this area with the understanding that SWCA may provide this information to the project proponent to advise them regarding the appropriate treatment of these lands and any important cultural places or practices related to it.
- ☑ I understand that the treatment of any human remains on these lands will be handled sensitively, and that State Guidelines will be followed by the appropriate Agency and the landowners.

✓ Yes	___No	I have given my permission for the interviewer to record our conversation about this project so that my words will be as accurately noted as possible in the report.
✓ Yes	___No	I have given my permission for this, and additional, interviews and/or field visits to be recorded on videotape.
✓ Yes	___No	I have given my permission for photograph(s) to be taken of me for this project.
✓ Yes	___No	If any audio, video, or photographs are made of me, I wish to be sent copies of these.
✓ Yes	___No	I would like my name to appear in the report acknowledging my contribution to this work (If not, I understand that my name will remain in the contracting agency's files).
✓ Yes	___No	If photographs are used of me in any project work, I wish that I be identified by name in the caption. (This way, later generations will be able to identify me in the photos).
✓ Yes	___No	May this information be used in other future projects? (If not, my permission is required if the information obtained from this interview or field visit is used for any other project besides this one)

Please note any stipulations or clarifications of these points you might have on the following page.

Interviewee's Signature: Sabra Kauka

SWCA Interviewer's Signature: Wainani Traub

Thank you very much for your participation in this process.

Please note below any other stipulations or clarifications regarding your participation in this project.

SWCA INFORMED CONSENT FORM, INTERVIEWS

Kaua'i Mosquito Suppression Project CIA

Date of Interview(s): 8/24/2022 **Project Name/Number:** component

Name of Interviewee: Sally Jo Keahi Manea

Name of SWCA Interviewer: Wainani Traub **Project Proponent:** DLNR DOFAW

Both the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) and SWCA are very grateful to you for your participation in this information gathering process and for sharing your mana'o with us. We value and respect your knowledge regarding the traditional cultural history, resources, customs, practices, and beliefs associated with the proposed project area, as well as any contemporary cultural practices taking place there, and wish to accurately convey this information in the Cultural Impact Assessment being prepared for the project. For this reason, we are requesting that you allow us to share the information obtained during our discussions.

****

When signing below, I show that:

- X I have been informed about this project and know that I will be asked my opinion about places of traditional or cultural importance that may be impacted by the project. I also feel comfortable asking for further information about any parts of the project that are not yet clear to me.
- X I fully understand that my participation in the study is voluntary and that I am free to withdraw my consent and discontinue participation at any time.
- X I understand that, if at any time during our talk, I feel uncomfortable answering a question, that I can let the interviewer know, and that I do not have to answer it.
- X I am providing information about this area with the understanding that SWCA may provide this information to the project proponent to advise them regarding the appropriate treatment of these lands and any important cultural places or practices related to it.
- X I understand that the treatment of any human remains on these lands will be handled sensitively, and that State Guidelines will be followed by the appropriate Agency and the landowners.

X Yes ___ No	I have given my permission for the interviewer to record our conversation about this project so that my words will be as accurately noted as possible in the report.
X Yes ___ No	I have given my permission for this, and additional, interviews and/or field visits to be recorded on videotape.
X Yes X No	I have given my permission for photograph(s) to be taken of me for this project.
X Yes ___ No	If any audio, video, or photographs are made of me, I wish to be sent copies of these.
X Yes ___ No	I would like my name to appear in the report acknowledging my contribution to this work (If not, I understand that my name will remain in the contracting agency's files).
X Yes ___ No	If photographs are used of me in any project work, I wish that I be identified by name in the caption. (This way, later generations will be able to identify me in the photos).
X Yes ___ No	May this information be used in other future projects? (If not, my permission is required if the information obtained from this interview or field visit is used for any other project besides this one)

Please note any stipulations or clarifications of these points you might have on the following page.

Interviewee's Signature: Sally Jo Manea

SWCA Interviewer's Signature: Wainani Traub

Thank you very much for your participation in this process. no further comments noted. SJM.

SWCA INFORMED CONSENT FORM, INTERVIEWS

Date of Interview(s): 10/6/2022 **Project Name/Number:** Kauai Mosquito Suppression EA (CIA component) (0067334-000-HON)

Name of Interviewee: Keao NeSmith

Name of SWCA Interviewer: Wainani Traub **Project Proponent:** DLNR DOFAW

Both the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) and SWCA are very grateful to you for your participation in this information gathering process and for sharing your mana'o with us. We value and respect your knowledge regarding the traditional cultural history, resources, customs, practices, and beliefs associated with the proposed project area, as well as any contemporary cultural practices taking place there, and wish to accurately convey this information in the Cultural Impact Assessment being prepared for the project. For this reason, we are requesting that you allow us to share the information obtained during our discussions.

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When signing below, I show that:

- ☑ I have been informed about this project and know that I will be asked my opinion about places of traditional or cultural importance that may be impacted by the project. I also feel comfortable asking for further information about any parts of the project that are not yet clear to me.
- ☑ I fully understand that my participation in the study is voluntary and that I am free to withdraw my consent and discontinue participation at any time.
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Please note any stipulations or clarifications of these points you might have on the following page.

Interviewee's Signature: Keao K NeSmith

SWCA Interviewer's Signature: Wainani Traub

Thank you very much for your participation in this process.

APPENDIX B4

Interview Transcripts

Cultural Consultation Interview Concerning State Mosquito Suppression Efforts in Kōkeʻe and Alakaʻi Wilderness Areas of Kauaʻi

Zoom video conference on July 5, 2022

Interviewee: Bill DeCosta [BD]
Location: Kauaʻi

Interviewer: Wainani Traub [WT]
Location: Kāneʻohe, Oʻahu

Transcript

WT: Describe your connection to the project area, how long have you been on Kauaʻi?

BD: Local boy. Four generations. Portuguese on my dad's side, Spanish from my mom's side. Dad was a sugar plantation superintendent. Mom was a pineapple worker in her younger days when they had the pineapple factories and then ended up being a nurse aide at the care home for elderly people. I grew up on the West side of the island and I went to high school at a public high school. I grew up hunting on the Robinson terrain which is one of the private landowners. Very good hunting. Goats, pigs. Now, there's deer that have migrated over. I went to California for college got a bachelor's degree from Humboldt State University in business economics.

In 2000 I decided to be a teacher when we had a teacher shortage statewide. I taught for ten years at a high school and then I applied to be the environmental teacher. I don't believe I was the most qualified with the curriculum base but I knew the teacher before me. He was my high school teacher, and he was very smart. He knew a lot about the birds and the forest and the native flora so he taught me a lot. I thought I could carry on his legacy a lot better than any other candidate, so I took the job for the Department of Education, and I worked for 11 years up in Kōkeʻe hiking every and any trail all the way into the Alakaʻi wilderness, the bog, overlooking the Waimea rim, Awaʻawapuhi, Nuʻalolo, Waipoʻo Falls. I got so see and experience many of our native birds.

I grew up hunting in that swamp lands with my dad guys. Alakaʻi swamp and the Camp 10 rim area overlooking Mōhihi and where they call the bird house in the back of Camp 10 flats. Certain time of the year we would go on the Robinson land. Other times we would go Alakaʻi bog area in the Camp 10, Camp 8, Camp 7 area. Those are all the areas in the back of the summit on state land exactly where they are currently doing the fencing and now the mosquito introduction.

There is one area named after my uncle, George Rapozo, they called him Jungaro, but his name was actually George, and this place is called Jungaro Puka. Rapozo Puka actually is the more common term now. It's a hole in the mountain between Alakaʻi Swamp and Wainiha Valley. Actually, that hole where you overlook Wainiha Ridge in the backside of Alakaʻi bog overlooking the north side of the island, if you're facing 12 o'clock, at 10 o'clock there's a valley called Hanakoa. Hanakoa is the north side of the island. You have Hanakāpiʻai and it wraps around 11 miles to Kalalau. Hanakoa is your middle about 5 miles in. That valley during the summertime get a lot of wild pig because of the mango and mountain apple. During the wintertime the animals migrate up towards the summit of Alakaʻi and go to where they call Rapozo Puka and into the Alakaʻi Bog. We would get really good hunting cause they would come for the guava the strawberry pineapple guava the red and yellow small guava and then they would return back in the spring around February April when the guava would end and head back down to Hanakoa. That's where they would live out their summertime until July when they had mango and mountain apple and then make the same journey back up again in October when the forest had its winter crop of guava.

Now, there's a whole bunch of fences that cut off the migration between Hanakoa and the Alakaʻi Swamp area. I've been very involved with DLNR trying to explain to them if they did those things to protect the native forest and cut off the wild boar from migrating they would create a larger havoc in Hanakoa because now the pigs spend all year round in there. There is no hunting with dogs in Hanakoa there's only bow and arrow. Archery hunters are known to be very selective. They go after trophy pigs, and they have only one arrow and one shot. They're not going to waste it on a small pig. I'm a firm believer of using hunting dogs in areas to keep the pig population down. I may sound inhumane when I tell you this, but it comes with four generations of experience. Hunting dogs tend to kill off the baby pigs quicker than they do the adult pigs which help control the amount of babies that survive each year. Pigs are worse than rats and they breed twice a year 4 to 12 babies and anywhere from 6 to 8 is a good survival rate so if you don't kill off some of the babies you can end up with 20 pigs. I just told DLNR that I think they need to open the floor twice a year in the June and July months and let the pig hunters go in with the dogs to better control the population in those areas. But I don't think they listen to me.

WT: Before we get too far off. I wanted to circle back to the hole in the mountain. It was named after your uncle?

BD: Uncle. George Rapozo. Cousin to my dad guys. It's like a deep valley a deep crack that ended up sinking in so it looks like a valley. It's in the Alakaʻi area.

WT: Is that a place where he hunted?

BD: So what happened is in the… gosh I'm not sure if I have my timeline correct, but I know the stories. Before the plantations unionized, I believe somewhere around the 1940s maybe the 1950s. There was some pushback by certain people. The Robinson family and the rest of the large landowners took away the harvesting rights of the people to go hunting on private lands. So the people could not go and catch the pig or the goat they needed to feed their families. There's a lot of people who fed their families for generations on wild meat. It's hard to fathom you know it's hard to come to realization that families use that much meat but when you have a very small paycheck and you are able to buy flower to bake bread or rice to subsidize your meat dish a lot of the wild meat was very financially able to subsidize the lifestyle. So when the private landowners took away hunting rights people were forced to go and learn the public lands that was left to hunt. That's when that area Rapozo Puka became a very popular place to go catch a pig to feed the family. It was almost like the icebox, a guarantee spot especially during the winter months. That whole back summit, Alakaʻi Bog, Rapozo Puka is actually inside the Alakaʻi Bog and Camp 10 Flats overlooking Wainiha Rim. Wainiha Valley is also owned by the Robinsons and the pigs migrate from in Wainiha. In the summertime they're in Wainiha for the mango and mountain apple and they migrate up into the Alakaʻi Bog during the wintertime for the guava. So we had really good hunting. It's not like that anymore. A lot of the pigs cannot migrate. And there were a few other families that knew of the area. The Parubru family was another old time family that knew of the area.

WT: According to the 2004 CIA for Kōkeʻe and Waimea State Parks, hunters back then were hunting pig, goat, black tailed deer, and game birds. Would you say that's what people are still hunting today?

BD: Yes. Still hunting today. Also another family name that used the Alakaʻi Rim besides the Parubru family besides Dusty was this gentleman named George Perreira. He enjoyed going down into that Wainiha Rim area. I believe his hunting crew now they're older than me, they're in their 70s. A gentleman named Cesar Jardin was one, Michael Pereira, Scottie Vidinah those are all men in their 70s who hunted that area quite frequently. Now with all the fencing going on I don't believe their sons, who are a little younger than I am, find it very profitable to go back there anymore because of the lack of the harvesting ratio. You know, you like to catch a pig, right, when you go

hunting. You don't want to waste a weekend cause you got to go back to work Monday through Friday.

So those family names are very important because those are the families that kept the population under control in those areas. So that was the Parubru, Perreira, George Pereira, Dusty Perubru, Caesar Jardin, Scottie Vidinah. Those are all old-time men that enjoyed those areas besides my family the DeCostas and Rapozos.

You know I wanted to tell you this past weekend I took a walk into Miloli'i towards Nu'alolo. I did some hunting around the enclosures some very large enclosures in the Ku'ia Reserve. I took some videos and pictures of the fence because it's in desperate need of repair. The pigs and deer are all in the area of the fence because the wood fenceposts are all rotten. It just breaks my heart that we spend you know possibly a million dollars or more to put in these enclosures. Which I spoke against. I support small enclosures around the native flora that needs to be protected. I don't like large enclosures that cannot be maintained. I specifically told DLNR we don't have the manpower to go inspect the fence for damage from fallen trees. The pigs tend to lift the fence with their snouts and create a hole that they can go in and out. Once a pig gets into a fenced area with their herd they can create quite a bit of damage. But no one listened to me. They put up these large enclosures and now there's a lot more game in the enclosures than there is outside. We do have hunters that DLNR allow to go into the fenced area but it's not enough it's a poor way of protecting our natural native flora that is endangered. We need to create smaller enclosures to protect the rare plants. Maybe two acre by two acre or five acre by five acre. Right now, they're enclosing hundreds and hundreds of acres up to a thousand acres and we have no funding to maintain it so what happens when a branch in a windstorm lays down the fence and then the deer take it over.

WT: Thank you for sharing. I was going to ask about your concerns and recommendations. Getting back to the mosquito project, for this project there will be no fencing. I saw that there was a CIA done for the Alaka'i fence project. I'll see if anyone interviewed for that CIA had the same concerns you're expressing now. Still, thank you for sharing, this is something to take note of and know that this is on the hunters' minds. I don't know that this project could address these concerns directly.

BD: Prior to your mosquito introduction the big thing according to the environmentalists was to protect their native flora from the pigs uprooting it and also to protect the native birds from the mud wallows that the pigs would roll in causing the oil from their skin to seal the mud which held water for mosquitoes to breed their larva. So now that you introduce these male mosquitos and hopefully it does its job the way it should. We don't have to worry about those wallows holding mosquitoes anymore so maybe those large fences to keep pigs out can be something of the past. And I would like to see smaller protective enclosures around our rare trees and plants. I think it's a win-win because when you have smaller enclosures you know exactly where to go and look at the perimeter to see if any fallen branches or any wild pigs uprooted that fence. And pigs can go around a fence if they have another route to get to where they want to go. If it's a straight-line fence cutting off their natural pathway to migrate, they will find a way to uproot that fence. We are putting skirts now on the ground that goes out 4-6 feet so the pigs cannot dig but that metal skirt is galvanized it's on the forest floor which is wet and eventually that galvanized skirt will rot and I don't know if we have the funding to remove those rotten fences one day. This mosquito intervention could be a much better solution than what we have tried in the past. The sad part about it is we spend so much money fencing out wild pigs because they create the wallows for these mosquitos to breed and now we have a better solution.

This is my own opinion, and you can quote me. Mankind think they can solve every problem in mother nature. You know who's the biggest problem? We are. We are the biggest problem. Our

biggest problem is not mankind venturing into the forest, our biggest problem is mankind trying to fix the forest without doing their proper homework first to figure out the proper solution. The trouble with all of our environmentalists is they get their education from universities abroad and study all of the different techniques in the different ecosystems but Hawai‘i is so unique, unlike any place else in the world. We are the most unique place. The only statistical data we can gather that is worth anything is from our island itself. We gotta go back to the people who have been here for generations to assist the ones who are here currently with the degree. I’ve had no success sharing my mana‘o with these younger educated environmentalists. It seems like they have blinders on and they think they know everything. I’ve had some success and much respect for a local girl named Mapuana she’s in DLNR. Kamehameha girl, very bright, very respectful. She has taken my comments and my suggestions to heart but it’s hard when she’s not in charge. So, I want a better relationship with DLNR. I think they owe it to us, the generations who came before them, to listen to some of the things we have to say. Oh, wow I sound like a state senator! I know you thinking man, this uncle kinda one smart guy [chuckles].

WT: [chuckles] Of course, yeah. I mahalo you for taking the time to talk with me and I'm writing down exactly what you're saying. Your input will make it into the report. This is exactly the intention of the study, to listen to the older generations who know their stuff and who know that environment and how it works, all of its systems like how you describe the way the pigs move and all that.

BD: Real quickly, that one area I told you about Hanakoa it stretches along the Nā Pali trail. DLNR has spent much time eradicating the goats in that area removing goats because the goats would nibble on some of the rare plants that are in that area. We’ve told them many times that the goats tend to be a weed controller, and yes, they do nibble on some of the native tress, but it’s better to lose three native trees out of 12 and still keep 8 or 9 growing because the goats do a good job of keeping the large invasive grasses down. Now, because the goats were eradicated, those grasses have grown 5-6 feet tall and they have sucked out the life of all those little shrub native plants. So we try to do one environmental technique and it creates a larger havoc.

We learned that on the Big Island with the palila bird and the māmane tree. The sheep would nibble on the māmane tree and it would take away all the undergrowth of the tree and only leave the top where the sheep couldn't reach. So they were thinking that if there were no sheep the māmane tree would grow much larger and would have more birds nesting in the tree. Which is true. But now the grasses got so tall because the sheep doesn't only nibble on the māmane tree they nibble on the grass. Now the grass is taller than the trees and the rats and mice can climb up the blades of grass and can eat the eggs in the nest, and also it's a fire hazard, and thirdly, when the baby māmane seeds drop on the ground they no longer have the area to catch the sunlight and propagate because the grass has choked out all the area. So, we create a larger havoc. I just thought we would have learned our lesson cause that was done back in the 1990s and it seems like we haven’t.

WT: Yes, especially with all this biological stuff there's so much to take into account and weigh all the potential impacts so it's good that you're asking all these questions. Have we looked into everything that could possibly go wrong or that could possibly go right and weighed all the pros and cons. That's what the environmental assessment is supposed to do but it's good to have all of this mana‘o also in the cultural impact assessment because all of that has cultural impacts as well to our hunters and to the species that are in our forests that our culture practitioners interact with.

Getting back to specifically this project. Do you have any knowledge of cultural practices and beliefs associated with the native forest birds on Kaua‘i?

BD: Well, I don’t think anybody goes out to take yellow and red feathers to make cloaks anymore.

WT: Right. Yea.

BD: I know many people enjoy watching birds. It's very tranquil to observe these birds in their natural state and watch them take the nectar out of the native flora you with their certain beak that they have. It's amazing. You know I shared this story once before and I'm not sure that it got much recognition. I believe our native birds like the ʻiʻiwi have migrated a little lower. We've always said that they are up on the 4,000 feet 5,000 feet elevation but I've seen them down at the 3,500 feet elevation around the Miloliʻi area towards Nuʻalolo. I'm not sure if over the generations they have become acclimated to the temperatures and have relocated where there's some ʻōhiʻa where they can nest and feed on the blossoms. In the 1970s and 1980s they were not in that area so Iʻm not sure if the birds are just adjusting or whether there's just a larger population now.

It seems like we have only spoken about the damage that all these invasive species have done to the forests. We've never done any work as far as looking at…[thinking] Ok, so if there is some invasive species here and there or everywhere are these birds acclimating to different areas or are they able to relocate and do well. Have we gone to the Robinson summit where it touches Waiʻaleʻale and because they're not apart of the watershed alliance how do we know that they don't have a very vibrant native bird population on their summit in their mountains.

WT: One point I did want to let you know about is that there's going be monitoring before they implement this project and after so we will have the data that we want. So this project will provide us with Hawaiʻi-specific data.

BD: So do you guys have a plan to have those males [mosquitoes] removed incase it's not successful? Or if it has a negative impact on some other species?

WT: I'm not too sure. That's a good point. I can ask that question and get back to you on that.

BD: You know, I can't help but look at your background [zoom background image]. You see where the W is in SWCA that's Punaluʻu that whole area used to have a lot of goats before. I used to climb up with my mules down the Waimea valley, tie up and then we would hunt all around there. Such good hunting. I'm not sure what happened but the goats haven't been there for quite a while. Over a decade. We're not sure what's happening. We don't know the cause of their disappearance. I don't think it's over hunting cause the younger kids today enjoy their electronic devices more than hunting. I think the state has a lot to do with it. When it's not managed correctly or too many fences. All the goats have relocated. So the hunting is not as good as it used to be. People don't really look at hunting as being a cultural practice. Environmentalists they like to think its a hobby but it's not, it's a cultural practice.

WT: Of course it is. Yes, definitely it's cultural continuity that's how generations before fed themselves and keeping that alive is important to culture and identity.

BD: Covid. Covid taught us a big thing right. If we're cut off from the rest of the world, can we survive? Hawaiʻi can. And I believe it's because of the cultural practitioners, the hunters, the fishermen, the people laying net in the ocean or throw net, the ones that go out to the forest. It's amazing.

My grandma used to pick lilikoʻi up in Kōkeʻe to make lilikoʻi jam and lilikoʻi butter and we would pick the yellow pineapple guava and we would make jam and jelly. The honey bees love that nectar. Love it, love it, love it. I heard that we're trying to introduce some kind of something to combat the strawberry guava something to kill off the guava. They did it on the Big Island now they want to do it in Kōkeʻe. I was thinking how beneficial is it to go off killing the guava that our mountain honey bees polinate. Then what? They gonna just relocate to someplace else? I didn't understand. I had a hard time grasping what the environmentalists were thinking. I know we may have too much of it but at the same time if you're going to introduce something that's

going to eradicate the guava do we have another thing in place for the honey bees cause where do they go now. Unless you're an avid outdoorsman like myself you see the honeybees all over the mountain you know how important the honey bees are not only for taking nectar from the guava for honey but they propagate the flowers and different fruit trees and that's what allows you to have an abundance of avocado and mango and lychees. It's all because of the honeybees.

WT: Yeah on this I also wanted to ask you about what plant species are collected in that area nowadays. This previous study says the most popular plants gathered in this area were maile and mokihana. When we last spoke, you mentioned something about maile.

BD: Still yet. Maile and mokihana are the most sought after native flora that people go and gather. Also, a little bit of the pūkiawe. Pūkiawe has some really beautiful almost reddish color Christmas berries look like on it. They use it for wreaths during Christmas. I know some cultural practitioners still today who go harvest the ʻaʻaliʻi wood which back in the day Hawaiians would use to make tako spear and use on the the reef. That ʻaʻaliʻi wood is kind of a blackish hard very straight wood and they would use that as their spear. I know the ulupua. It's like a black olive. It's good for lotion. Not too many people know that. It's related to the olive family. It produces purplish black olives in the fall and those olives make a really good lotion. Palapalai fern is very important during Merrie Monarch. And there are some really nice areas where they still can go and get some in Kōkeʻe.

Also watercress was very prevalent throughout our streams at one time and I don't see much of it anymore and it's because it's not being cared for by the cultural practitioners who probably have all passed. I know my dad and my grandpa had an area where they had their own watercress that they could go and get watercress from in the cold water streams. I know where it is still today but I haven't cared for it. It's kind of sad actually cause you go and buy a bundle of watercress from your farmer today and it can be kind of costly.

So, it's more than just the hunt, Wainani, you can see that it all ties together. From harvesting pig or goat, to picking watercress, to getting liliko'i to make juice and jelly or butter. You can get a lot of resources from the forest for your everyday life. Let's not forget about a place to go to find peace of mind and relaxation. You know I believe this. Wainani, you ready for this one, this is my philosophy.

WT: [chuckles] ready.

BD: I'm not Hawaiian so I don't want to speak for Hawaiians, but my wife is Hawaiian and my sons are, and you are. So here's my philosophy about Hawaiians. They lost their lands to all these large white land owners it's obvious on every island… Alexander Baldwin, Robinson family, Parker Ranch, etc. When we became a state the state lands were designated for those Hawaiians that did not have family kuleana lands where they could go to harvest natural resources. The state said now we have all these leftover lands that we are going to manage for you not only Native Hawaiians but also for you locals here on the islands for you to enjoy. It kind of hurts our feelings when we go to the forest and we see all these educated environmentalists from other parts of the world who are not vested in our community come and tell us exactly what needs to be done and tell us this is what they studied at university. And they get all this statistical data using some tropical climate country and they think they can do the same in Hawaiʻi and it's gonna work. They do that instead of asking the generations here before them. Hey, what do you guys think? Can we work together? Can we solve this problem? Can they share their knowledge from the textbook and us from the generational mindset that was thought from when we were little kids from our kupuna. That's all. It's pretty basic you know it doesn't take rocket science.

BD: Do you have a graduate degree?

WT: I'm finishing up my master's in historic preservation.

BD: Good girl. K. Here's my thing. I think everybody who has a doctorate degree or a master's degree think they're smarter than the person with a bachelor's degree and the bachelor's degree think they're smarter than the person with a high school diploma and the high school diploma think they're smarter than the person who flunk out of high school. My dad he only finished freshman year and then he dropped out to work. The point I want to make, and I saw you shaking your head so I know you relate to what I'm gonna say. Education is not based on a piece of paper you got at a university it's based on how comprehensive we can be with everyone's information and can put it together to create that masterpiece. That's the highest level of intelligence. When you can take everybody's constructive information, piece it together and create that masterpiece.

WT: I'm trying to do that. I believe that my job is to listen to people like you who are from there who know the landscape because I am not kamaʻāina to that place at all. No matter how well I research it I'm never going to reach the understanding that you have that's built on generations of being there and growing up there. So mahalo for sharing all of your manaʻo with me.

BD: Before you say goodbye before we close. I wanted to advocate for all the families that do these cultural practices in the bog area where you guys going to introduce the mosquito across this very delicate ecosystem. We only would bring people that would respect the forest to go in to harvest with us. Whether it was the pig or the maile or the mokihana.

Only now only recently have environmentalists put out these stations to clean your boots so the seeds and weeds don't travel in or out. I want you to know that when we were growing up we had different shoes we would use for the different areas we went to go hiking and hunting. We were ʻakamai about that. And only now your environmentalists are trying to come up with something that we had generations of knowledge about.

And when you guys put those fences up, here's the full circle, Wainani, when you put those fences up you guys created one natural path for people to explore the interior of the forests. So, now, not only the generations of families that I mentioned to you who used to know the trails to go into the back of the forest, now you guys have a fence line from Alakaʻi all the way to Waiʻaleʻale that people can walk along the fence and go experience everything that only a few families could before. DLNR has made an available trail with their fence and people now can hike different areas of Kauaʻi and carry different seeds of weeds into the interior of Kauaʻi. We don't know the devastation this will do to our forests in the next 10 years.

WT: That's a good point.

BD: Did you think of that? Did that come to your mind? Was that covered in class 101 of environmental ecosystems at Stanford University.

WT: That's why we gotta talk to people like you who are practical and think that way about project impacts.

Thank you. You brought up several things that I didn't find in my research so I appreciate all your manaʻo. It was nice talking with you. I think we covered everything. Mahalo for taking the time to talk with me today. Keep doing the good work at the county council.

BD: Thank you Wainani. Aloha, bye.

WT: Aloha.

Cultural Consultation Interview Concerning State Mosquito Suppression Efforts in Kōkeʻe and Alakaʻi Wilderness Areas of Kauaʻi

Zoom video conference on August 22, 2022

Interviewee: Sam ʻOhu Gon [SOG]
Location: Nuʻuanu, Oʻahu

Interviewer: Wainani Traub [WT]
Location: Kāneʻohe, Oʻahu

Transcript

WT: Aloha good morning

SOG: Aloha

WT: Mahalo for agreeing to speak with me this morning and making the time for this. I really appreciate it. Let's start off with some biographical information.

WT: Where are you from? Where's your family from? How do you identify yourself and maybe your connection to the project area?

SOG: Yeah. So, my name is Sam ʻOhu Gon. I was born in Nuʻuanu Valley on Oʻahu, raised there and still live there, perched on the edge of Nuʻuanu on Alewa Heights. Family ties go all over the place. I have a grandmother who was from Waimea Kauaʻi. I also have relatives all over Oʻahu and in South Kona on Hawaiʻi. I am a kumu oli. A teacher of chant. I ʻūnikiʻd from Kumu John Keolamakaʻāinana Lake. Before he passed, he gave me the kuleana and the kaumaha to continue his chant classes, and with my co-kumu Māhealani Wong we are the hālau in residence at the Bishop Museum nowadays, and we conduct our classes there at Atherton Hālau and in the hālau waʻa, right next to Atherton.

My work as a conservation biologist has taken me across the island chain. Kōkeʻe has been one of the places that I've visited many many times. Although my Kauaʻi family did not spend much time up in the mountains, I certainly do. So I'm quite familiar with many of the birds that were once common there. I've seen all of the birds that are being considered in this mosquito control project in the days when they were more abundant. So that connection and my interest in Hawaiian chant and the role that birds play in Hawaiian culture all of that is what made me agree to be interviewed today.

WT: When people think of birds they automatically think of ʻahu ʻula and these cultural practices that contain elements that are no longer practiced in the same way. Obviously, no one's gathering feathers like they did 300 years ago. But the knowledge and the practice of things like lei hulu lives on. Could you speak to what does it mean for us to retain what small populations of our native forest birds that remain. What does that symbolically represent to traditional cultural practitioners who maintain knowledge of those arts of, traditional featherwork.

SOG: You may or may not know that I, with Hanalei Marzan co-authored a chapter in the book *Royal Hawaiian Featherwork*.

WT: I have it right here on my desk.

SOG: Oh, my gosh! So of course you know, we reviewed in there not only the birds of featherwork, but Hanalei did a nice summary of the methods in which the feathers were put together. That's one of the awesome things about being the hālau in residence at the Bishop Museum is that we have access to the collections, the archives, and all of that, and we get to work with the staff on projects such as that.

My work as a conservation biologist has taken me into the last remaining habits of our native birds. Like the ʻiʻiwi that's on my background here [zoom background]. I tell people that the ʻiʻiwi is the last of the birds that remain alive, that were used in the highest level of Hawaiian featherwork. There were other feathers that were used, feathers of seabirds and roosters, and the like. But the ones that are pure yellow and red and black, and, to a lesser extent dark green, those were made out of birds that are no longer with us except for the ʻiʻiwi.

SOG: Although the birds that are the main focus of this Kauaʻi project are not the birds of featherwork, it's clear to me that the mosquito suppression project is going to benefit all of the forest birds, including ʻiʻiwi. Kauaʻi is one of the last strongholds of ʻiʻiwi on the main islands. So that connection in itself would be enough to underscore important cultural significance of what is being done and what stands to be lost, and why any Hawaiian who has aloha for our material culture as well as the intellectual and other aspects of culture, should be interested in this. And, once you understand what the risks and the benefits are, should be supportive of this mosquito project.

The role of birds in the non-material side of things that is also a fascinating thing. Manu of many kinds are mentioned all the way back to the Kumulipo, and all the way forward through mele that are popular today. Ipo Lei Manu, Kapiʻolani's love song to Kalākaua directly mentions the ʻiʻiwi pōlena and compares Kalākaua to an ʻiʻiwi. That's a logical comparison since the ʻiʻiwi and the feathers of the ʻiʻiwi would have been in the royal featherwork that would mark a high chief, such as Kalākaua. So the fact that the bird connection is not just in material culture, but also in the intellectual and spiritual underpinnings is really important to understand. You can go through the mele and the oli and the pule and find mention of Hawaiian birds throughout. Some of the best romances like Lāʻieikawai have akua wahine or aliʻi wahine raised by birds and sheltered in houses thatched with feathers. And so the idea that birds were really fundamentally important as a positive and royal presence is very clear to me and many others I'm sure. And that's the kind of thing that we stand to lose if we don't do something.

I've seen five different birds that were in existence when I was younger go extinct. Birds like poʻouli and ʻōʻū, Maui nukupuʻu and the like. So, it's kind of a sad statement that within one person's lifetime so many of them would go extinct, and we know just from the history of birds since the turn of the twentieth century many of them have gone. And it's due to a combination of things, certainly, but the main factor is disease. And if we think of birds as the poʻe of the forest, as beings that have every much a right to exist as any Hawaiian would, then we're allowing for this kind of pandemic or genocide to occur. It's been happening to them for a century. So yeah, if you think about the mosquitoes, introduced in 1826, and then songbirds that carry malaria thereafter, and then the ornithologists noticing the evidence of disease and then the disappearance of birds from the lowlands. All of that points pretty much to disease as a major factor in their loss. We can certainly, you know, point to the fact that all the lowland forests were converted to sugarcane and other forms of agriculture as well. But the combination of the two certainly was really important.

We know that, for example, the ʻōʻō of Waiʻanae would feed from the lehua of the uplands. When the lehua were in bloom in the summertime, and then come down to Kalaeloa and drink nectar from the naio shrublands that were down there. And once you have birds that are doing this upland lowland alternation over the seasons, and the lowlands become infested with disease-bearing mosquitoes you're signing their death warrant, because every year when they come down to the lowlands and are exposed to them. And they haven't for the large part evolved any kind of resistance. So, ʻapapane and ʻamakihi, two of the most common birds, and [ones that] had populations high enough that they could be taken down through that bottleneck and then emerge with resistant populations. But any birds that started as rare would be taken down to a bottleneck

that essentially went to zero. So you know, folks that understand this see how desperate the situation is, and how much we need to do this kind of thing.

WT: Yes, mahalo. You touched on a lot that has come up in my research, but I hadn't made the sort of connections that you have. You mentioned the connection between birds raising aliʻi wahine. In some of the selected moʻolelo that I've chosen to include in this CIA, I do see that as a common theme but I hadn't really noticed it or made that connection in my mind so mahalo for bringing that up. And I also like how you say the birds are the poʻe of the forest. I like that imagery.

SOG: It's important right. It's not only things that breathe and have eyes like us, but also all the mosses and everything that's up there. You talk with folks like Kekuhi Kanahele, she's always talking about them in terms of being individuals that coexist with us right. That is the kini akua. The whole concept of kini akua-- the physical manifestations of the different akua expressed in all of the living things, even clouds and stones and the like-- demands that you look at every living element of the uplands as one of their manifestations. So you know, if the birds are of the uplands, the birds occupy the wao akua and are themselves akua then it stands to reason that to put a cape of that over yourself is to imbue yourself with that. With the mana of those akua. So that connection is a real, important one to bear in mind. And the fact that we still have mele that take you all the way to today.

When you look at Ka Pilina, right. I think it was Frank Hewett that composed that one. That talks about, at first, the ʻelepaio and then the ʻiʻiwi and then alludes to the wahine carried about by birds. So it's obviously an allusion to Lāʻieikawai. Although he never mentions it, and that's what makes the poetry so beautiful is that if you don't know that story it's still nice. But if you know the story, then suddenly you say, aha! I know what you're alluding to. And he is essentially extending that long tradition into a song of today.

WT: Yes, that's an idea I am exploring as well. What do we stand to lose? What potentially iconic mele could the present generation or future generations create because they visit the forest and they hear these remaining native forest birds?

SOG: Alternately, what sadness there would be if you could not do that. Right. So, speaking of sadness, when the poʻouli was declared extinct, or when at least the last observed individuals were seen in 2006 or so, Keola Donaghy composed a mele about the poʻouli and called it Manu Poʻouli, and Kenneth Makuakāne turned it into a song. It was a fairly obscure song, one of the songs on one of his albums, and nobody really thought about it that much. A few years ago, our hālau was involved in a series of concerts at the Mission Houses Museum, and one of them, the theme was Aloha. Over the course of the four concerts that were given in the year. One of the themes was aloha ʻāina. And so in that particular one we chose to choreograph for the first time a hula to Manu Poʻouli, and we invited Ken Makuakāne to be there to sing the song while it was being danced. And I had the opportunity to tell the audience about the story of the poʻouli, how it was only discovered in the 1970s, and how it was given a name by Mary Kawena Pukui, and then how we watched over the years as the population declined. I was lucky enough to see six poʻouli in one visit on the ridge that was informally called Poʻouli Ridge, because most of the poʻouli that were seen were to be found on that ridge. And how much of a sense of loss there was when it was finally decided that they are no longer. Years of repeatedly going back to the places where they knew they were and not hearing or seeing them. So I was able to give that talk to the audience then, and then we performed the hula with Ken Makuakāne and Aaron Mahi, and other folks doing the musical backup and we had only three dancers because it's a short song, three verses. At the end of each verse one of the dancers would quietly leave the stage until there was just one dancer left and at the end of the song, falls to her knees and spreads her arms out onto the ground.

WT: Wow, that must have been a really amazing performance.

SOG: Yeah, we made Ken Makuakāne cry. So that kind of expression. It would be really sad if that is the only kind of expression that we could give to the birds in the future is dirging about their passing.

I always said that if mosquitoes were controlled, my goal would be to see native birds begging for french fries at McDonald's [chuckles]. It's a weird image.

WT: [chuckles] Right. Yeah. But I get it, we want them to be that prevalent.

SOG: Yeah, we want them to be back in our lives again. That was triggered by the fact that when I visited the Galapagos and I was in the grocery store looking for something. I was in the aisle in which the rice was found and there, amidst the rice bags and rice grains that had fallen out of the bags onto the floor were Galapagos finches hopping around eating rice in the isles of the grocery store in the Galapagos. And I was like, whaaatt?! [chuckles] We're so used to, you know, native birds being found far away from where people are. But then, you know that thought it just struck me. That would be amazing if we could have, our native birds just around us in the lowlands.

I'm lucky enough to live at 900 feet right next to the forest at Kamehameha Schools. I have a big ʻōhiʻa tree taller than my house and when it blooms the ʻamakihi come out of the forest and feed on the flowers of the tree. So I'm lucky enough to get daily reminders and visits by our native birds. The fact that they're part of my personal life is a gift that most people have to hike long and hard, or go to a special place in order to see. So the reality of it, and the potential of it is very real to me. It's not like oh, you know if this happens then maybe we'll see this. I already see and hear what could be everywhere at lower elevations all the way down to sea level if we're successful in this kind of thing. Because the control of high elevation mosquitoes is the first step, and then, if that's successful and the birds can be saved, then the next step is how can we get rid of mosquitoes everywhere in the islands. Not only as a boon to native birds, but also because of global warming and the spread of tropical diseases like dengue and the like up into our latitudes. A boon to human health as well.

It is ironic that humanity or human community would be more interested in it if there was a clear threat to people. For instance, if dengue became a yearly thing and we really needed to control mosquitoes in order to get rid of dengue. Everybody would be all for it. Oh, yeah, let's find a tool to get rid of mosquitoes and the diseases that they carry. But most of them don't even think for a moment that for a century our birds have been suffering the same kind of threats. And if they were viewed as part of our communities that we would not tolerate the fact that they've been declining and been driven into extinction over the last 100 years.

WT: Right. Yes, that's a very profound point. And this project does benefit humans as well.

SOG: And that should not be failed to be mentioned. You don't have to go into detail but you can say in a sentence or two that the same kind of disease threats that we're seeing with global warming to human communities have been affecting our birds for a century.

WT: Yes, that's a good point.

SOG: The Department of Health is one of the members in the Birds Not Mosquitoes effort. So it's not that far-fetched to say, we recognize the potential human benefits of this project.

WT: How familiar are you with the project area? The Kōkeʻe and Alakaʻi Swamp area.

SOG: I've worked in Kōkeʻe for years. There was a time when our family actually had a timeshare in one of the Kōkeʻe cabins, and we would go up there and enjoy the forest on a regular basis when school was out. And in my work of course, as a conservation biologist, I've been up working with the Kōkeʻe folks. And so, you know, tromping around in the Alakaʻi along the main trails there, or helicoptering up close to the summit of Waiʻaleʻale and enjoying the forest up there. Yes, I

have direct experience in those places back in the day. It saddens me to think about Dave Boynton. Have you ever heard of his name?

WT: No, no I haven't.

SOG: Dave Boynton was a powerful advocate for conservation of native plants and animals and ecosystems and was an educator. He created essentially the Kōkeʻe environmental education center that's up there. Whenever I was up in Kōkeʻe and had a chance to go hiking with him, I would. He was the one that showed me various places where birds like ʻakekeʻe and the like could still be found. So when he had a major hiking accident and fell off a huge cliff and died I remember composing a kanikau for him and offering it at his hoʻolewa up in Kōkeʻe.

SOG: Have you spoken with Sabra Kauka?

WT: Yes, I've reached out to her but haven't gotten through yet. I'll keep trying because several people have recommended her.

SOG: She does work with birds. Although mostly sea birds and their rehabilitation and release. But I know she's also up in Kōkeʻe a lot, and has a lot of aloha for our native forest birds up there. She might not have much direct conservation experience with them but she would also be able to tell you how important birds are in our Hawaiian cultural legacy.

SOG: So get in touch with her again, and tell her that you've also spoken with me, and that I recommended you chat with her.

WT: I will do that.

SOG: So are there other questions that you have?

WT: Yes, I would like to ask, in your opinion, if some of what was documented in previous CIAs still holds true today. A 2004 CIA done for the State Parks, Kōkeʻe and Waimea Canyon, identified the cultural practices that were ongoing at that time. I don't know how familiar you are with the hunting practices around there. But this study said that at that time the animals being hunted were pig, goat, black tail deer, and a variety of game birds. Would you say that's still what's being hunted?

SOG: Yes, those are the primary ones. We have folks in the Nature Conservancy offices on Kauaʻi in particular, Nicolai Barca, who is not only up in the remote areas all the time but his primary job is ungulate control on the Alakaʻi flats. So he is really familiar with the hunting community, and he himself is a member of that community and also a member of the conservation community which makes him a really interesting dual presence. He's often on the, I don't know if you're familiar with the Hawaiʻi conservation Facebook group.

WT: No, but I will look into that.

SOG: Yeah, he's often there engaged in discussions about the importance of hunting versus total exclusion of animals, and where total exclusion is important. And where community hunting can provide both for sustenance subsistence food as well as control of ungulates in areas where you don't need to be at zero. He's also looked into the Hawaiian language newspapers for the earliest references to hunting in the conventional style of today and mention of pigs and native forests and things like that. So if you're interested in that aspect of it, he would be a good person to chat with. And of course I'm sure he has seen many of the native and rare birds that are up there.

WT: [asks for contact information] Ok, mahalo.

SOG: Yeah. You can tell him that you have chatted with me, and that I recommended that you talk with him about hunting on Kauaʻi.

WT: I also wanted to talk with you about gathering of plants. This 2004 study said that maile and mokihana were the most sought after.

SOG: Probably. I mean, you know, those are lei material. The folks that gather for medicinal work, or for hula would be going for more than just that, right. But certainly, you know, Kōkeʻe is famous for maile and mokihana both. I would probably expand that to any plants that might be good for lei making that might be up there. And certainly the lāʻau lapaʻau community. I don't know that the state parks folks interviewed any of them but there is certainly a huge resource of plants to be found up in Kōkeʻe.

WT: Going back to hula folks. How do you see the hula community using that area?

SOG: I think mostly, you know, if you're familiar with Kau ka haliʻa, which is my favorite forest entrance chant, it talks about how you're awakened out of sleep by the sound of birds on the ridges in the uplands and that it's a sign for you to get up into Laka's realm again and be a sharing companion in that realm. I have no doubt that many hula people go up to Kōkeʻe for that kind of inspiration. To be surrounded by the kini akua to gain inspiration via what you see and hear and experience up there. That's the kind of thing that's not going to show up as material culture right? You're not going up there necessarily to gather lei or even if you are, the fact that you're surrounded by the same kinds of images that we find in the mele and the oli and the pule means that kind of benefit and resource is just as real as the material resource.

So the non-material, right? The hula folks would be the ones that would benefit most from that kind of thing. Whenever I'm composing mele or an oli of entrance, I'm always thinking about what kinds of sights and sounds, and feelings, and the like, do I experience when I'm surrounded by that kind of thing. And then you weave it into your mele. That's what kind of saddens me about many of the modern compositions today is that they have nothing of that. It is all conceptual stuff. Aloha and ʻohana things like that, without any mention of the plants and animals that used to inspire some of the best songs.

WT: Do you think that is because people aren't interacting with the plants and animals.

SOG: Yes, it's very clear. They interact much more with the ocean, right? Because the ocean is so much easier to get to. You have to go far and make an effort in order to be surrounded by completely native forest and see our native birds firsthand. So stands to reason that it's harder to do that. It's just sad to me that kind of connection is not so easily achieved. So that's another important point to make about the need to protect these birds.

WT: Yes, that's a great observation about our contemporary Hawaiian music. I hadn't thought about that.

SOG: Yeah, pick your four favorite pieces of Hawaiian language compositions that were done in the last five years, and I doubt that you'll get much more than maybe lehua if you're lucky. Probably because lehua and rapid ʻōhiʻa death have been in the forefront of people's minds for the last five years. But try to find anything else, and then compare that to some of the early works in which you have so many different plants and animals named, you know.

Take, for example, Waikā. One of my favorite songs. Just in the first lines it names a wind and a rain, and then talks about the ʻōhāwai, the Clermontia of the goddess Uli, who is a forest goddess. And then the bud of the koaiʻe tree and the yellow face of the koʻokoʻolau. All in the first verse! Like, Wow! And then when you go up into the forest of Waikā, you can see all of those plants. I mean that's the cool thing, is that they're still there. They're not singing about a place that was turned into sugar cane fields a hundred years ago. So that's why that's one of my favorite songs. Emerson tried to translate Waikā. Waikā ia a modern song based on an ancient chant. So you can find the words to Waikā in Emerson's... the one that he did on hula.

WT: Unwritten Literature.

SOG: Yes, Unwritten Literature. In Unwritten Literature, luckily one of the indexes is on first lines of chants, right. So you could try to find kū aku la ʻoe i ka malanai and see whether or not that's in there. That's supposed to be a chant of the Kīpuʻupuʻu warriors and has been turned into a beautiful song but it's really interesting that that part of it has been converted in that way. And it is really interesting that a song about warriors would mention so many beautiful plants in the very first verse.

WT: I just love all this. I've been out of hālau for too long I miss researching mele.

SOG: Yeah that's really that's an important part of hula as far as I'm concerned. I remember being honored by Kihei De Silva when he wrote his essay on Waikā he actually cited me in talking about the ʻōhāwai, because if you look at Emerson's translation he doesn't know what the heck an ʻōhāwai is. He translated it into "tinkling of water droplets in an upland pool" or something. It's like, what?!

WT: Oh yes, I don't always trust translations. I oftentimes will write my own translations.

SOG: So when I suggested that Emerson just didn't get it right and wasn't familiar with native plants, and suggested that nolu ka maka, right, bruised is the bud of the ʻōhāwai a Uli is so easy. Especially when the line before talks about how niniau ʻeha ka pua o ke koaiʻe, right, so that the flowers of the koaiʻe are hurt. Nolu ka maka o ka ʻōhāwai fits right in with that previous line. In that it is the same kind of action on a different plant. Yeah, it's just neat. So the fact that Kihei saw the little mini essay that I wrote, I think, for Moanalua Gardens Foundation, and acknowledged that was kind of a neat thing.

WT: Yeah, I just love to see our contemporary kanaka scholars revisiting those old materials and offering fresh new interpretations that were first interpreted by Western scholars who may not have got it quite right.

SOG: You know, there's often no way to really concisely and elegantly convert into English some of the things that are expressed in ʻōlelo. But you try to come close because not everybody speaks [ʻōlelo Hawaiʻi] right.

[SOG asks WT if she's familiar with the Facebook Group 365 Days of Aloha and explains that the group page contains a lot of interesting native bird content, resources, and information]

Kiwikiu probably wont be [on the 365 Days of Aloha Facebook page] because of the recency of that name right.

WT: What do you mean by that? It was named not too long ago?

SOG: Yeah, it used to be the Maui Parrotbill.

WT: Oh, I didn't know that.

SOG: Yeah. I worked with Larry Kimura to put together the name kiwikiu for the Maui Parrotbill. And then I composed a mele inoa for it.

SOG: So, other questions?

WT: I think we covered most everything. Oh, in the sort of closing chapters of the report, there'll be a place for recommendations and concerns. So if you want to state any specific concerns you may have, or you probably have more recommendations.

SOG: Well, you know. I think that any time you're using a new technology there will be many people that are concerned. And I think that it would be really important to monitor the results. Both in the suppression of mosquitoes and the response of the birds. A lot of times in conservation we

find a new tool, and we jump right on it and we try it out but the follow up on seeing whether or not it's actually effective is usually lacking. Because people realize there's so many things to do in conservation and monitoring is one of the most difficult and time-consuming things to do when you could be for instance, killing more weeds or fencing more forests, things like that. So, I am concerned that this project really needs good monitoring and follow up. I'm also concerned that if the project is not successful in the first attempt that people would just give up on it. And that's not necessarily the best course. You want the thing to be successful, and you don't necessarily want to just throw your hands up and say, well, that didn't work and then move on, because we know full well that this is the first time that something's being tried in a really complex place. So I'm concerned that people will point to any kind of snags or failures as a reason to stop. I'm also concerned that there's a lot of misinformation flying around already about what this project is and is not. So, that is certainly a concern.

WT: Mahalo. Those are good points. Anything else you would like to share?

SOG: No, except that I think that this, your part, is a good way to open the door to people to get more familiar with just how important birds are in Hawaiian culture. People don't appreciate them as much as they should.

WT: It's definitely a very interesting project to work on it's not your typical CIA that's looking at land development and impacts of development. It's very different from the other projects I've worked on. Mahalo nui for sharing all your manaʻo and ʻike. I'll be following up just to make sure that I'm conveying what you said here accurately in the report. There will be a full transcription of our interview in the report if you're okay with that.

SOG: I'm okay with that. and I'm also pleased, because so many times when I'm interviewed I look at the transcription, and because the people weren't fluent they get stuff horribly wrong [chuckles] and I'm not going to be as worried about that with you.

SOG: I need to jump onto another meeting but I've really enjoyed chatting with you. And I hope you do follow up with some of the folks I recommended.

WT: I will. Mahalo nui. Aloha.

SOG: Aloha.

Cultural Consultation Interview Concerning State Mosquito Suppression Efforts in Kōkeʻe and Alakaʻi Wilderness Areas of Kauaʻi

Facetime video conference on August 24, 2022

Interviewee: Sabra Kauka [SK]
Location: Kauaʻi

Interviewer: Wainani Traub [WT]
Location: Kāneʻohe, Oʻahu

Transcript

WT: I want to hear your manaʻo on this project. You were highly recommended by several people. So maybe let's start with where are you from, who's your family, how do you identify yourself?

SK: Ok, well my name is Sabra Kauka I live here on the island of Kauaʻi and I am in strong support of this mosquito control effort. I have a passion for native birds. I have a deep aloha for Hawaiian culture and the importance of these birds to our culture and our history, even today.

WT: Yes. Mahalo. What's your familiarity with the project area? Kōkeʻe and the Alakaʻi?

SK: Oh, many many years, decades of hiking there. Taking my students there. Gosh, so many fond memories of the birds there. I have a deep concern that the forest is becoming quiet. I don't see nearly the number of birds that I did 5, 10, 15 years ago. So I'm concerned. I also have a cabin in Kōkeʻe that I share with several other friends. The last time we were up there was just a few weeks ago. There should be a lot of chatter in the trees but it's becoming quiet. So that disturbs me.

WT: Mmh. Yes, we definitely understand the urgency for this action to be taken. Do you have concerns or recommendations for this project?

SK: I think we have to put a stop to the spread of the invasive mosquito as soon as we can before we have no native birds left.

WT: Mmhm.

SK: I just spent the weekend in Nuʻalolo Kai on the Nā Pali coast with some extraordinary bird scientists. Two of them from the American Bird Conservancy and some other folks. They had these two binoculars I had never used before. One was a thermal binocular the other was an avian binocular that could see at night. When I was on a work trip in June the cliffs were silent and it greatly greatly saddened me. I'm used to hearing the chicks being loud, raucous at night. Calling their parents cause they're hungry. But they asked me if it was a full moon and so I looked back on my notes and yes it was a full moon. So they explained to me the birds are quiet on the full moon. They don't make nearly as much noise. I didn't know that. So when we looked through the thermal binoculars it was amazing what we could see. There were hundreds more birds flying in the sky. I was greatly heartened by that.

So, I would like to see more surveys out on the Alakaʻi. I'd like to see more surveys, particularly at night when maybe you can see a little more through the thermal binoculars than you can during the day or than you can through hearing. When I go hiking up there nowadays I send my students all the way to Kilohana. Three and a half miles I think it is. I love to sit in the forest and just look, watch, and listen. But like I said the forests are becoming silent.

WT: You mentioned students. Who are your students?

SK: I teach Hawaiian studies and hula at Island School. I have two jobs. One is teaching at Island School Hawaiian studies and hula. Kindergarten through fifth grade Hawaiian studies and high school 9-12 hula. I have 15 girls in my hālau this year and I have about 140 students in elementary. My second job is working with the Department of Education as the coordinator for the Hawaiian Studies kūpuna component on Kauaʻi and that includes working with all the people teaching Hawaiian Studies from Hanalei to Kekaha. All the schools. I love that job. I've been in that job for many years. I love both jobs and working in both areas. Actually our focus this year in DOE Hawaiian studies is the native birds. We're going to be pulling out all sorts of things in storage, in the library, and reviving them.

WT: I hear that you've done work with sea birds. And though this project is geared towards benefitting the forest birds, do you see this benefitting sea birds?

SK: I don't think the sea birds have been as negatively impacted by avian malaria by mosquitos as the forest birds have… I was so happy to see as many birds as we did this past weekend. Being with the scientists was very helpful to me too.

In June we counted the black noddys in Nuʻalolo Kai. I would sit there with my students between 4 and 6 o'clock and count birds. Just count them as they fly pass returning to their chicks. The professional birders, you know, gave me their binoculars and they told me to look out on the horizon and I did and oh my gosh I could see hundreds of them! I was so happy. I am so grateful for their expertise, their experience, and their knowledge that they share with us.

WT: Could you speak to cultural impacts of this project? Positive or negative. What do we stand to lose culturally if no action is taken or what do we potentially stand to gain culturally?

SK: Oh my gosh. If we do nothing and the numbers continue to decline to the point of extinction. I don't want to carry that burden. I don't want to be blamed for that. I want us to be proactive. I want us to do everything we can to save these species. I think their importance goes far beyond. They're so very much a part of the cycle of life on our islands, in our mountains, in our forests. I think that it's vitally important that we do everything we possibly can to save our native species.

WT: Did you mention hālau, are you a kumu hula?

SK: I teach hula as well. It's my high schoolers that I take along on hikes. It's my high schoolers that I take into Nuʻalolo Kai. It's my high schoolers that I take to my cabin in Kōkeʻe. So many of them have graduated this year. Gosh, I'm going through a little bit of withdrawls cause some of these girls have been with me for four years, the young men maybe only two years. But I'm so happy to see them going on. One of them is quite interested in Hawaiian studies. She's going to U.H. Mānoa. Others are interested in science and have gone onto colleges in North America. There's one several years ago who graduated and went to U.H. Hilo and now she's graduated from U.H. Hilo. She's in the Kanakaʻole hālau. I keep reminding her, okaayy sweetie when are you coming home? We need you here. And by the way I'm putting my grandson through this private school [Island School] and I told everybody when he graduates, I graduate [retire from the school]. And I remind her of that, and I tell her, I hope you're home by then because I've been grooming her for umpteen years. You know, go away, get your degrees, study all you can, and then come home.

WT: Yes. Definitely. We need our own people doing the work, right.

SK: Yeah.

WT: Could you share some experiences you've had with native birds up close and what that means to you?

SK: Oh golly. It means the world. About three years ago we were hiking through Alakaʻi swamp. The kids they just took off and were way ahead of me. I was just taking my time looking all around. I wanted to see everything I could. We had already gone all the way out to Kilohana and back and I was just taking my time because I wanted to observe everything I could. Off in the distance I saw a bird with black feathers and yellow under the tail. I was like OMG is that an ʻōʻō?! I thought they were extinct. I saw two of them. I just had my phone I didn't have a really good camera with a long lens so I didn't get a picture of them. I only told a few people because I didn't want people to think I was crazy or just imagining things. But I saw a couple of birds that looked like manu ʻōʻō. None of my bird photographer friends have seen them. None of my hiking friends have seen them. [thinking] Oh man, was I just imagining things? Or are they really still alive? I want them to live. I want them to be a part of the forest and a part of the world. They've been here longer than humans have on these islands.

WT: Mahalo for sharing that. That must have been really special.

What sort of cultural activities do you or groups you know about engage in in that area?

SK: In the area of hiking, in the area of hula, in the area of making feather lei. There's so many people here. There's so many people on Kauaʻi. So many hālau. I have so many friends, kumu hula. [thinking] Oh god, the hula, beautiful. You know I'm a little disappointed this year because we're not doing the Queen Emma Festival. It's the first time in probably over 25 years that we're not going to. Well, last year we went digital. And the year before… I don't know. Anyway, Kōkeʻe Natural History Museum is no longer sponsoring that event. Which makes me a little sad because it's about honoring Queen Emma. Honoring her love for the forest and her trek over a hundred years ago to the Alakaʻi swamp all the way to Kilohana. Several of the hula that were created to honor that event include verses about birds. The birds that they saw and experienced. I want my students, I want my grandchildren to continue to see and experience those as well. Those places and all the creatures that inhabit that zone of the forest and the mountains.

WT: Yeah, a few other people I've spoken with have also mentioned the Queen Emma Festival. Sad that it's not happening this year. Hopefully there will be funding in the future and support for it because it seems like it has definitely made an impression on people. A gathering and exchange of ideas and hula and mele like you say.

Are you familiar with gathering practices? Hunting or gathering of plant resources taking place around that area?

SK: Well, maile. Picking maile. But I'll tell you what, the forest has been so dry lately. It's not as abundant as it once was. For graduation this year I went to some places where I normally pick maile and it was so dry. They were nonexistent. They dried up. So I've increased the maile that I'm growing around my cabin. But you know, we're not up there all the time. It hasn't rained that much on the west side. There has been such a change in the forest. The invasive strawberry guava coming in and underneath it it's bare. The changes in the forest with the kahili ginger and all those things that I've seen over the past 35-40 years that I've been home. The changes in the forest that I see are very sad. But I really appreciate the work that the Kōkeʻe Resource Conservation Project people have done and are doing. There just needs to be more of it. We need to be more cognizant and we need to have more effort in keeping the forest as native as possible.

The more native plants we have growing in the forest, the more native species, avian species and other species, can exist there.

WT: Mmhm. Definitely.

Any other thoughts that you want to share?

SK: I support the work that many of my scientist friends here on this island are doing to try and save as many bird species as possible. Both birds and plants. I appreciate their work very much. Thank you for your support of our native birds and our native forests.

WT: Yeah. Of course. Have to.

SK: You better let me know if you ever make it over here.

WT: [chuckles] Yes, I want to very much. Maybe for the next Queen Emma Festival.

SK: Oh, don't wait that long. Come sooner. There's no guarantee it will go on. The museum is understaffed and it's a lot of work for just a handful of people. Even though many of us with hālau have offered to kōkua. You still need that driving force in there. And I don't want to sit on their board. I'm on too many boards already. We had a director here Marsha Erickson from Volcano. I met her when she was head of Volcano Art Center. And then after Volcano Art Center she was hired to be our director here at Kōkeʻe Museum. She along with Kumu hula Roselle Keliʻihonipua Bailey from Maui. Roselle was living here at the time. They initiated the Queen Emma, Eō e Emalani Festival. After the hurricane, Roselle and her husband moved back to Maui and retired and Marsha Erickson retired from the Kōkeʻe Museum. And we have a new director and she's good but [thinking] very much involved with hula and very committed to it. So, we'll see what we can do. It was a great opportunity for hālau from all over Hawaiʻi to come to this island to learn about Kōkeʻe, our forest, our birds, our place names, and our hula. So, ok Wainani do you have any other questions for me?

WT: No, I think we touched on everything I wanted to. Mahalo again for your time. I'll be contacting you to make sure I get the transcript right.

SK: I get such a kick out of these transcripts! The automatic kine. Especially Hawaiian words. It's hilarious. The hamajang stuff that comes out. Alright Wainani, mahalo nui.

WT: Mahalo nui.

SK: Aloha. A hui hou.

WT: A hui hou. Mālama pono.

Cultural Consultation Interview Concerning State Mosquito Suppression Efforts in Kōkeʻe and Alakaʻi Wilderness Areas of Kauaʻi

Zoom video conference on August 24, 2022

Interviewee: Sally Jo Manea [SJM]
Location: Kauaʻi

Interviewer: Wainani Traub [WT]
Location: Kāneʻohe, Oʻahu

Transcript

SJM: Hi! hi! hello!

WT: Aloha, good morning. Mahalo for making time to meet with me today. I'll start with introducing myself. I'm Wainani Traub from Kona Hawaiʻi. I'm a product of kula kaiapuni. Growing up, attending Hawaiian immersion and dancing hula from a very young age all that instilled in me a value driven commitment to serve my community and the way that I do that in my professional life is through historic preservation and being an advocate for our historic places, and cultural heritage tied to place. I'm almost done with my master's degree in historic preservation through the University of Oregon. Before that I received a bachelor's in pacific history from UH Hilo. I've worked as a cultural anthropologist at SWCA Environmental Consultants for a little over a year now primarily doing archival research and writing cultural and archaeological compliance reports. So that's a little bit about myself. Can you introduce yourself?

SJM: Sure. My full name is Sally Jo Manea. I was born in Ohio. My father got stationed at Pearl Harbor. He was a navy officer, got stationed at Pearl Harbor in 1956. So, at the age of 13 I moved to Hawaiʻi with the rest of my family. My father eventually retired from the navy, and we stayed in Hawaiʻi. So I've lived in Hawaiʻi since then. I'm 79 now, so that's a lot of years living here. I graduated from Punahou. I graduated from University of Hawaiʻi with a nursing degree.

WT: My mom is a Punahou grad.

SJM: Oh, yeah, is her name Traub?

WT: Her maiden name is Tokunaga.

SJM: Oh, so mixed huh? [chuckles]

WT: [chuckles] yup.

SJM: So from age 8 on the mainland on a navy base I started learning hula and fell in love with it. A navy wife was our teacher. Hawaiian woman, married to a navy officer. She was our hula teacher. After I moved here, after the family moved here, I continued with hula continued with interest in Hawaiian language. Started learning Hawaiian at U.H. It was my language of choice. In those days the options were Spanish, French and Hawaiian so I studied Hawaiian language from that time, and have continued my study until now of both hula and Hawaiian language and music. My kumu hula is Roselle Bailey from Maui. She lived here on Kauaʻi from the early 1970s until the mid 1990s. So I'm a student of hers and have continued my study until now. I taught hula for 10 years, but I haven't taught for several years, mostly because of physical disability, but also because I just wanted to retire from that and become a musician, and a singer rather than a hula dancer.

I continue with our cultural organization Ka ʻImi Naʻauao o Hawaiʻi Nei, under which, is our hula hālau. Our group here on Kauaʻi has a long standing association with the Kauaʻi Forest Bird Recovery Project. We've done annual blessings for their research season for the last 11 years.

We've learned a lot about our native birds from them and they've learned a lot about cultural traditions from us.

Our institute [Ka ʻImi Naʻauao o Hawaiʻi Nei] adopted a place up in Kōkeʻe in the forest, where we clean and remove the alien species. It's about a 2-acre site up there that we maintain. We clean out the invasive species and plant the natives. So that's how we continue our traditions here. The Forest Bird Recovery Project staff have encouraged us to create music and chants, and hula related to our work with them. So they have really been an inspiration and motivation to us as we have been to them. So it's been a great association, so our group continues to help them in as many ways as we can within the limits of what we can do right. So that's me.

WT: That's awesome. It is so good to hear that you folks are creating mele and hula and using that space in those ways, and just the great relationship that your hui has with the Forest Bird Recovery Project. They're the ones who recommended that I reach out to you.

SJM: I need to tell you one other thing. Our Kumu Roselle Bailey has encouraged the people in our Institute to become what you have become. Archivist, and you know, preservationists. The next time I talk with her I'm going to tell her about you, because she will be delighted to hear that there is a young woman, cultural practitioner, involved in this work. Because this is something that she has continuously made known to us that she desired to have just what you're doing. So you're the manifestation and the fulfillment of a dream for our kumu, even though you don't know each other.

WT: Aww. Mahalo. I keep hearing that from people especially when I interview people. It's nice to be reassured that I'm in the right space and doing the good work.

I would love to hear what your thoughts are with regard to cultural practices and beliefs associated with native forest birds up there. Just any thoughts along those lines.

SJM: Well, you know, because we go clean and maintain this one spot. We call it the classroom. We call it that because when we were young hula students our Kumu took us to this spot and taught us. This is palapalai, it's different from this other one don't make the mistake of gathering the other one and think it's palapalai because it's gonna die. It's not the right one, you know. She would tell us, these are the birds, these are the plants that you need to know for hula and this is how we maintain we pull the weeds. Over many years we've been doing that. So we see, we're there with our hands in the dirt pulling out the guava and the blackberry and the honeysuckle, the aliens pulling them out. And watching the small little maile sprouts growing. For the first time in my decades of living on Kauaʻi and working up there we saw new Mokihana shoots sprouting in this area because we cleaned things out. So, being there, having our hands in the dirt and seeing how the forest has changed so drastically over the years on the ground. Our group was more concerned with the plants, right, because that's just what hula people do. You know. You think about the plants.

We didn't have the knowledge that we needed about the birds, and the interrelationship between the birds and the plants. And so, you know, once in a while we go, "oh, there's an ʻelepaio, oh, there's an ʻiʻiwi," but not like now with our association with Cali and the other people from the Bird Recovery Project. We didn't notice that there weren't as many birds because we're looking at the ground, you know. I think other hula people are more concerned. Seems like. Well, I should only speak for us, but I think this might be true of others that they're focused on the plants, and they're not really realizing the interconnection, you know, that you gotta have it all because if you don't have ʻōhiʻa you don't have a lot of birds that live with ʻōhiʻa as their food source and shelter.

WT: Yes, I'm intrigued by the nature/culture connections. One is how the birds disperse the seeds of the native plants, and so they engage in the continuation of those native species.

SJM: For us for the group that I'm involved with. Being there, going up there and digging into the dirt it connects us to the plant aspect real firmly, but it wasn't until we opened ourselves up to the Forest Bird Recovery project people, until we collaborated with them, and opened ourselves up to this different aspect. It took that collaboration for us to really understand the larger picture. And I have a feeling that there are other hula groups that are like us, that they think about the plants, but not so much the birds and the relationship of it all. You know what I mean, so I don't know if that answered your question.

WT: Cetainly, it did.

SJM: The other, the inspiration part of it too yeah. Because we knew that we were going to do a cultural ceremony with them related to forest conservation. It inspired and motivated us to look, pull it more closely into the language and to get our creative juices going.

So, you know the researchers are usually, the majority of the researchers are haole. From the mainland, from other places. Sometimes there are interns that are local folks, but a lot of the researchers are mainland people. So there's a gap. There's a gap between... which you are helping to fill. Thank you very much. But there's a step between the haole researcher and the local people that are working, doing the work on the ground. So this association for us has really been beneficial on both sides. I think. But you gotta open yourselves up, you know. Gotta answer the invitation, and then open yourself up, for how can we together to benefit the big picture.

And, you know, when we come out from cleaning our spot up there. We look at the all the encroachment of all the weeds, and all the you know how there's so much guava, and there's so much other bad stuff. The mosquitoes are just a new example. And we think well, we just have our little itty bitty tiny little dot that we worked on here that we put our few hours in, and we pulled a few weeds here in this little spot. But we are able to see those new sprouts coming up. The new natives thriving after we pulled out all the bad guys. But when you walk out you look and you see all this vast huge forest that's endangered. It's not just the birds that are endangered, the forest is endangered. It's disheartening. It's kind of overwhelming. So you have to focus back in on the little square acre that you worked on and think about that. So that's kind of how I see this mosquito project. That it's one small thing, but if it saves a couple of species, a few species, then it's a huge thing. And I think the researchers are dealing with that every single day. They're sad because they see their little friends dying, and feel like they can't do enough fast enough in order to stop it. It's very sad to think that we will lose a whole species. That extinction will happen before we can get the job done.

WT: Right. While we're on this sad track. What are your thoughts regarding what we stand to lose culturally if no action is taken to protect native forest birds?

SJM: Oh, more of the same. We've seen so many go. How could we not take action? That's my attitude. How could we not? If we know that there's something we can do. Mosquitoes are not native! They're not native to Hawai'i. Why would we not try this.

WT: Umhm.

SJM: Just like the rats on Lehua. Getting rid of the rats on Lehua. Rats aren't native they're aliens. Why not? We have to.

The cultural significance? I don't know if I can speak to the cultural significance. Maybe, Wainani you would be better at that than me. If there's something you can do, you gotta do it. You gotta try and do it. I don't know if that's cultural. That's just me, just my attitude.

WT: I like that attitude. Definitely.

One thing that I was discussing with Sam the other day we were discussing the potential for more cultural expression. And there have been folks who have written songs mourning the loss of these

birds, and so that would be a sad scenario right? If that's to be the cultural legacy of all this right. But if we spin it a more positive way, imagine all the potential mele, oli, hula that people of the future might create, once they go into the forest and they interact with these birds. If we're successful in retaining their populations and growing those populations right? So that's how I'm thinking about the sort of cultural side and benefits of this project is all the future, potential and present, potential for cultural practitioners to be inspired to create because of the birds existing.

SJM: You want an example? I have an example for you.

WT: Mmhm! [nodding]

SJM: So because of the mosquito project and the materials that the Maui and Kauaʻi Forest Bird Recovery Project people have put out related to ʻākohekohe, kiwikiu, ʻakikiki and ʻakekeʻe, I wrote a song! Just as you speak, it's a song for today, and it's a song about these four birds. My idea was, you know the song Nā Moku ʻEhā? It goes like, [singing] Hanohano Hawaiʻi lā lei ka lehua lā kuahiwi nani lā ʻo Mauna Kea. Four islands, the name of the island, the name of the flower, and the name of the mountain. So I did that with the birds. I did the name of the bird, the habitat, a characteristic of the feathers, and then another characteristic peculiar to that bird. It has five verses total. One verse about each bird, and the hāʻina. Our music group is practicing it. The song had its debut at the Lehua Island Restoration Art show opening on Kauaʻi a couple of weeks ago. The Island Restoration people sponsored the opening of an art show in Kukui Grove Center for our Kauaʻi society of artists. We were part of the entertainment there. So we debuted the song that evening. Kumu Roselle's daughter Sharon did the melody. I did the words. She sees the native birds as kind of flitting, flying back and forth [waves hands in the air]. You know, kind of like that. So she did a melody that's really lively. So there's an example of what you're talking about.

WT: Yeah, I love that, mahalo for sharing.

Let's see, another question I have is do you have any concerns or recommendations for this project?

SJM: It seems like it's going to take a while before the actual mechanics of the mosquito release can happen. You know, to get the Wolbachia out there might take a couple of years. I don't know. It seems like the recovery project staff are doing the best they can to, you know, catch birds, and hold them in captivity until it can happen. No, I don't really have any recommendations… If there's a way to speed things up if there's any way to speed things up. More money, more people, more whatever it takes. Going to the legislature… whatever it takes. Maybe if there's a way to use the windfall of money that's coming down from the Federal Government for Native Hawaiian issues. If there's any way to use that to get some kind of grant or some kind of funding award to help get more staff to speed things up, then go that direction. These folks are really good at writing proposals and getting grant funding.

I don't know. Maybe getting more students involved. There's so much curricula for especially the immersion schools. I know that their list of what they have to teach is so long that adding in conservation issues might be difficult. Well, how did you get motivated? At what point in your education did you hear somebody talk about archiving or conservation that changed your mind and guided you into this? So think about that, and where we collectively should try to insert influence into the education system so more young Hawaiʻi folks go into conservation so that the gaps between the haole researcher and the local pig hunter... so those gaps are reduced.

WT: Yes, those are good thoughts, definitely. And it's something that I'm thinking about too. In my own experience, I just had really good mentors and internships that led me down this path. So now that I'm in the position I am in, it's time for me to return the favor. Pay it forward, right. So

I'm thinking about how I can do that. Perhaps there is an opportunity for DOFAW to get some interns out in the field helping with this work. I'll include that recommendation. Mahalo.

Going back to hula practitioners because that's who I am, too. Right. I love to talk hula. What other plant resources, you've already mentioned maile and mokihana and palapalai, what other plants do hula practitioners gather there?

SJM: ʻŌhiʻa, of course. ʻŌhiʻa lehua, halapepe, ʻieʻie. You know there's a conference on Maui. It has become an annual conference that began a few years ago at the Kāʻanapali Beach Hotel. Gayle…what's her last name… anyways, she facilitates fiber weaving. I'm a lau hala weaver and I've been going to Ka Ulu Lauhala o Kona [weaving conference] for years and years. It used to be the only conference, except for one in Hilo every five years or so. But a few years ago on Maui, this other lau hala conference opened, but they expanded it, and they now include ʻieʻie fiber weaving. But ʻieʻie is so rare that they don't use ʻieʻie they use the mechanics of ʻieʻie weaving, but they use... ah, what you call it, the same material that they use for wicker, so that they don't strip the forest. People don't go up and take stuff. So that's just FYI there's more interest in all that. And olonā, there are people that are trying to figure out how to cultivate and how to use olonā the way it used to be used in fishing nets and stuff. I mean, we use plastic cause that's what we got now, right. It's available, and we got it. What else? [thinking]

You know, our group we don't go and gather maile because it's to the point now where it's not easily available. People take it indiscriminately, and they don't harvest it properly. Maybe that's a place that needs to be a focus. School kids, especially kids that are at Kekaha School, or Waimea Canyon or Hilo, or places where people traditionally go into the forest to gather maile. Even hula schools. They destroy it. They pull down branches, break branches in order to get maile from up there to pull it down. They don't harvest the right way. Those practices are not taught properly. It's disappointing. And it's hula people! After Merrie Monarch, after Prince Lot hula festival. In the past, you go up into Kōkeʻe and you see the place just trampled. Those are my concerns and recommendations. Really not related to the forest birds, but related to the forest. We're not doing a good enough job of teaching the real nitty gritty of conservation to our young people. We're not doing a good enough job.

WT: Yes, those same points, were mentioned in other studies. A 2004 Cultural Impact Assessment report done for Kōkeʻe and Waimea State parks mentioned the unsustainable gathering practices of maile and mokihana, because those are the most sought after, or at least they were at the time, and people were concerned, even back then that people were taking too much and not giving back to reforestation.

So I have a lot of aloha for people, like you were saying earlier, who are retaining the knowledge of the ʻieʻie weaving. They're using the method of the ʻieʻie weaving, but not using the ʻieʻie. I think that's very beautiful to you know we can adapt our cultural practices and it doesn't water it down at all in my opinion. In fact, it makes it that much more part of the story of why we need to mālama our plants in the forest. We're honoring the plant by not using the plant.

SJM: Kumu hula need to encourage. Perhaps yours did. Mine did. From early on we were told you plant palapalai in your yard. You don't go to the forest, you plant kupukupu you get yourself an ʻōhiʻa tree. You don't depend on the forest. That's not difficult, it's not hard to do that. That's another thing that we need to do as practitioners is to encourage growing your own stuff so you don't have to go mauka. We're fortunate on Hawaiʻi Island and Kauaʻi especially we still have a lot of forest area. We got mauka areas that still have things in them whereas Oʻahu suffers and I don't know about Maui because I don't live there. I don't know that much about Maui maybe they have a lot of resources as well. But it's even more important for people who live in urban areas. You can have a plant. You can have a pot of palapalai on your lanai. In Hawaiian studies in public school why can't that be a part of the curriculum? Add it to all the other stuff you have to

have in the curriculum. Not just learning about kings and queens and chiefs, but more practical ecological issues. Not just one semester of Hawaiian history, but more what we're talking about.

WT: Yeah, definitely… So this group Ka ʻImi Naʻauao that you're involved in. Is it a hālau? Could you clarify?

SJM: Okay, I'll explain it more. So, Ka ʻImi Naʻauao o Hawaiʻi Nei, is a 501(c)(3) tax exempt organization that was formed in 1976 by our Kumu hula Roselle Bailey and a group of people surrounding her. It is the Hawaiian cultural umbrella organization whose purpose is to preserve and perpetuate Native Hawaiian culture through hula. So that's the overall goal of this. For all these decades we have maintained the 501(c)(3) cultural organization status. Under the umbrella organization is our Maui hālau, we also have an Oʻahu hālau, our hālau here on Kauaʻi. Roselle's daughter Poha, who is now deceased, had a hālau in Samoa when she was living there. There's also a branch in California. So, Ka ʻImi [Naʻauao o Hawaiʻi Nei] is the umbrella. And about 10 years ago Roselle decided that she wanted "institute" put on the end of the name. She wanted, "institute" added, because she saw the 501(c)(3) as an institute of learning, which included publication. Going to a larger global audience. Theater performances, hula theater, travel and cultural exchange. A larger thing than the typical things a hula hālau does. And that's when she began to talk about internships and scholarships for people like you to get Native Hawaiian men and women interested in archival work and preservation work and conservation work. So we never really did accomplish that but we've talked about it for many, many years. So we're really happy that it's happening in other ways. Through these decades we have traveled to many different places and performed different programs different types of programs. If you go to kaimi.org our institute's website. You'll see, it's all there. We've published, we've written songs, we've choreographed hula, we've done different things that have greater exposure and publication and that's where the "institute" comes in.

WT: Mahalo for explaining that for me. So this plot of land. It's in Kōkeʻe?

SJM: Yes. It's just part of the forest. It's a flat area close to one of the dirt roads. We don't really tell people about it. We don't go regularly now we haven't really gone regularly since the lockdown since the pandemic hit. We've been out there just once since 2020. Part of it is because I'm usually the organizer and I just had back surgery about 10 weeks ago, and so I wasn't able to do the work. So we kind of let it go. It's just a spot in the forest. Many years ago, we got a permit with Department of Land and Natural Resources state parks to go and clean this area and we just renew it annually. It's just one small spot. And I'm sure the next time we go we're gonna have lots of weeds to clean because we haven't been there for 2 or 3 years. So the blackberry and the guava and everything all comes back.

WT: Mmhmm. Are you familiar with other groups who use that area? And keep in mind the project area is very large. It's not just Kōkeʻe it goes all the way to Waiʻaleʻale, the Alakaʻi swamp area, and even the Nā Pali coastline but I think the efforts will be concentrated in the higher elevation areas. Do you know of other sort of groups or individuals who use those areas in a cultural way?

SJM: Not formalized. The Discovery Center, I believe, is a DOE camp area up there. So the DOE teachers and school groups can use it for various reasons. Hui o Laka used to sponsor Eō e Emalani i Alakaʻi an annual hula festival held in October. Hālau from all over the State come and perform during a one day event celebrating Queen Emma's trek into Alakaʻi. Are you familiar with that?

WT: Yes, yes. It came up in my research. Yes, of course. Oh, that's interesting.

SJM: Yeah, very important. They're not doing it anymore. The pandemic basically shut them down and I guess they decided they weren't going to do it anymore. It's a lot of work, a lot of work. And without help from the Hawaiʻi Tourism Authority I believe it would have been difficult for them

to put it on. Groups that do public events like that, cultural events, in order to keep the event affordable to the participants outside funding is needed. That was a very important, a very important cultural festival. I think it should be included in your research. Because hālau came from all over the state and experienced the Kōkeʻe forest and atmosphere. Many of them stay at the CCC camp up at Kōkeʻe or in cabins that they had association with up there. So that was important. That also motivated and inspired Kumu hula to create chants, dances, oli, and mele related to Queen Emma's trek and related to the area Alakaʻi. And of course, plants, birds, place names were preserved because of the inspiration that kumu hula had, yeah. It all works to preservation, yeah.

If you have a performance. You know this. When you know you have a performance, you knuckle down right, you knuckle down, but also you open your mind, right. You do your research and find out about the place, and you learn about the place names, and you find out about what happened there, and who went there, and what they did and why they did it. All that stuff. So, the Eō e Emalani Festival was an inspiration. A motivating event for a lot of people for many, many years.

WT: Yeah. Just in my experience with hālau there's power to just speaking these place names, and the plants and animals. It's like they're just kind of hanging out waiting for someone to activate them. And once you do, you know, amazing things do happen.

SJM: Yeah, exactly. Our group is very fortunate that we have a lease on a property up there. Roselle and her husband Jim acquired a part interest in this cabin in the seventies when they moved to Kauaʻi. When they left Kauaʻi they turned it over to Ka ʻImi Naʻauao so now we manage that cabin up there. So we have a place up there. It has all the photos and the memorabilia from years and years of hula. Because we have a place, it enables us access yeah, access to the forest. So whenever we go up there we always go up to Kalalau, the upper lookout, the lower lookout. We go to all the spots. And usually when we go to Kalalau, it's our natural reaction to oli, [chanting] O Kalalau pali ʻaʻala. Yeah, that particular oli. And whoever's there, it engages them instantly. You know, it's what you say, it's what you're saying. Just speaking the history, and the place names in that fashion engages everybody that's surrounding us whether it's visitors from the mainland or whether it's local people who are there. If it's Eō e Emalani time in October then there are usually other hālau people there and sometimes they join in. Just everybody becomes one thought, and it goes in the same direction. It's exactly what you were talking about.

We're fortunate, we're grateful every single day for what we have here on Kauaʻi. And yet, sad that we can't do more.

WT: Hmm. Have you had experiences up close with any of the native forest birds and can speak to that experience?

SJM: You know. Not here. But on Hawaiʻi Island I go and visit my friend who lives in Volcano every year. Generally every year I go and visit her before going to the Kona Weaving Conference. I go to Volcano for a few days, and then Waimea where my sister lives, stay with her for a while, and then we go down to Kona together to go to the lau hala conference. So, anyway Lorna lives in Volcano and her lanai is surrounded by ʻōhiʻa. It's a stop-over spot for ʻiʻiwi. So one of my favorite things to do when I'm with Lorna is in the early morning and in the late afternoon to just sit on the lanai there and quietly watch all the birds as they fly around. And it seems like what they're doing is, in the afternoon especially, it's like they're reporting in. You know, they're coming in and they're resting on the very top branches and some more birds come and they're talking to each other and then that one goes up this way and that one goes up this way, and somebody else comes it's like they're like, [narrates birds' conversation] "oh, yeah we were over by the so and so, and there were lots of ʻōhiʻa, there were lots of berries over there, lots of insects in this particular tree, and you might check it out tomorrow." You know what I mean? Reporting

in on their activities during the day. Where everybody went, what they saw, and what they did before they go home to rest. So that's one of my experiences. But it's not here [on Kauaʻi]. You know... For me it's only been, "oh, look! There's an ʻelepaio! Oh, look! There's an ʻiʻiwi. Or you heard that, that's a [native brid]," you know. And not more than that for me.

WT: Yeah, I mean, even that alone is more than what most people get to experience, you know. Cause they are in these remote places that people just don't go to or get the opportunity to go to very often.

SJM: Maybe that's what we need to do. We need to get groups of kids out more, you know. Field trips out into the forest. When you were in school did you have field trips into the forest?

WT: In school I got to go to Volcanoes National Park several times. Growing up in Kona was really neat, and I didn't really appreciate it at the time, but we do have a lot of historic sites like heiau there in Kona that are still around. Being in Hawaiian immersion, they valued field trips a little bit more than maybe public schools do. So yeah, I feel like I got a lot of field trips.

SJM: Did you know Diana Aki? Was she a teacher of yours?

WT: Of course I know of her. My mom actually works a lot with the Miloliʻi community. So I know of Diana Aki of course. But I don't think I ever met her in person.

SJM: So I was fortunate on two different occasions she stayed with me here in my home on Kauaʻi. The first time was in the late 1970s when Diana and the Volcano Hawaiian Band came over and did a concert at Kilohana here. I don't even remember how it happened, but they ended up at my house playing music into the wee hours of the morning and just ended up sleeping on my floor [chuckles]. That was one time, and then another time, later on, when I was teaching hula, we did choreography to one of her songs and Roselle suggested that I invite her over for our hōʻike and she came. So she stayed with me. Oh, those are treasured memories for me!

So one of the performances that we did for the Kauaʻi Forest Bird Recovery Project... When they wanted to go into the forest to catch the remaining family of ʻakikiki in one particular area in Halepaʻakai. They wanted to catch them, to take them over to Maui to be in captivity. They asked us to do some kind of a ceremony or blessing before that. So we took bird verses from five different songs. In Hawaiian music a lot of times a song will only have one verse about a bird. So we found different songs, and we took the bird verses, and we put them into a medley. And one of them is a song that Diana Aki wrote. It's called Manu Mele. One of the primary verses in this five verse mele is from her song that's a favorite for a lot of us who live here on Kauaʻi.

Roselle's group actually visited Miloliʻi in the early days. Diana hosted them in the early seventies. They went there and danced there, did a cultural exchange with the Miloliʻi folks. So how cool, you can tell your mom or ask some of the folks that are still living down there if they remember that. I remember seeing pictures of it but I didn't go, I wasn't there. These connections go way back multi-generational.

WT: Yeah, love all that.

I don't really have any more questions for you. Do you have anything else you'd like to share?

SJM: No, I don't think so. It's been a pleasure. I've really enjoyed talking with you.

WT: I enjoyed it as well. Mahalo nui. I will be following up just to make sure that I get everything right, and that I convey all your ideas and thoughts and what you shared here accurately in the report. So Iʻll be contacting you again.

SJM: You know, I was just thinking, you asked about recommendations. I wonder if there is a way that we could advocate mandating some kind of conservation education for a certain grade level in

public school. That this kind of conservation education somehow becomes a requirement in public school and charter school curriculum.

WT: Yeah, that's a great idea. I'd be all for it, of course. Yeah, we need it because our environment needs it.

SJM: Not just forests but also the sea. My grandson's wife is a high school teacher at Kamehameha. She took a year off and got her master's degree in Hawaiian language, so that she could develop a curriculum in Hawaiian for marine biology at the tenth and eleventh grade level. So she has 2 classes, and they're electives. She's been doing it now for three years. So that's wonderful to me. Another young person that's doing the job and getting it done.

WT: Yeah, that's great. Well, mahalo for what you do with the Ka ʻImi Naʻauao o Hawaiʻi Nei Institute. Keep doing the amazing work. Mahalo again for taking some time out of your day to talk with me and contribute to this Cultural Impact Assessment. I wish you good luck and healing with your back.

SJM: Thank you. A hui hou. Until whenever it is we meet again. I'm sure we will.

WT: Mahalo.

SJM: A hui hou.

WT: A hui hou.

Cultural Consultation Interview Concerning State Mosquito Suppression Efforts in Kōkeʻe and Alakaʻi Wilderness Areas of Kauaʻi

Zoom video conference on October 6, 2022

Interviewee: Keao NeSmith [KN]
Location: Oʻahu

Interviewer: Wainani Traub [WT]
Location: Honolulu, Oʻahu

Transcript

KN: How's it.

WT: Hi.

KN: Aloha. I'm outdoors so it's a little bit noisy but not too bad.

WT: Okay, no worries. Mahalo for making time to talk with me today I really appreciate it. I'll start with just quickly introducing myself. I'm Wainani. I'm from Kona Hawaiʻi. I've worked as a cultural anthropologist at SWCA Environmental Consultants for a little over a year now primarily doing archival research and writing cultural and archaeological compliance reports. So that's a little bit about myself. Could you please introduce yourself?

KN: Aloha my name is Keao NeSmith I'm from Kauaʻi. I don't know what to call myself. I'm a freelance researcher and consultant I do cultural ethnohistoric research, stuff like that.

WT: Are you on Kauaʻi right now?

KN: No, Oʻahu.

WT: Ah, me too. Have you had any experiences up close with our native forest birds and can speak to that experience?

KN: Any place in particular?

WT: Well, the project area is the Kōkeʻe, Alakaʻi wilderness, Nāpali areas. But just in general about native forest birds wherever you have encountered them.

KN: Forest birds [thinking]. Not specifically. I've encountered them along the way. It's always amazing. But I'm not an expert in any way.

WT: Okay. How about the project area? Did you get a chance to look at the map? It's a pretty large part of Kauaʻi that they've identified as the project area.

KN: As far as my personal experience with birds. I've had many sightings and been near them of course. ʻApapane, pueo, ʻelepaio, ʻōmaʻo. There's a couple more that I've encountered as well that stand out in my memory. Other than that, my experiences relating the ethnohistory to birds as far as the lore is concerned, and also place names. So, for example, there are many place names, all across the top. The high elevations up over there with bird names, and so my job would be to figure out how that came to be. How those names came about. What's the story associated with the area and then what's the relevance and significance culturally for those names and those birds.

WT: Yes, that's come up a lot in my research. Does any particular place name stand out to you?

KN: Halemanu. That one is pretty obvious. Let me see I don't have the map in front of me right now, cause I could just look at the map and just point to all the places and names up on top the forest walk. [thinking] Sheesh, I'm drawing a blank right now all these different bird names up over there. There's

a lot, you know, including Moho as a place name reference. Did you want a list I could produce one for you.

WT: No. That's alright. I'll bring up my list and name some of the ones I've found and maybe that will trigger something for you. I have a table going of place names with references to manu. I'm just skimming through my report trying to find it.

I initially thought that Kanaloahuluhulu was a reference to birds. But then I read one version of a moʻolelo that explained that huluhulu refers to a hairy beast.

KN: Right. But it could also be kaona for hulu manu. Huluhulu is rarely used to mean hulu manu. So that was intentional. That kind of play in meaning is intentional. Kanaloahuluhulu, which is interesting because Kanaloa is often associated with ocean. But Kanaloa has connections with forests, and also with Kāne. Since there are springs in the area there is Kāne involved, but Kāne is almost always paired together with Kanaloa and together they produce springs. Huluhulu in this case actually refers to the foliage. The forest itself. Same for up Mauna Kea. Puʻu Huluhulu is that crater, that hill where everybody gathers during the protests. So it's the same reference. That's a kīpuka. It's all lava fields all around, except for that one area which is a kīpuka Hulunahelehele forest. So the reference is to the vegetation on the hill. The honua is the body and the huluhulu is the vegetation growing on the body.

WT: Ohhh, interesting. This is why I wanted to speak with you. Because you have such a deeper understanding of the language than I do. So huluhulu is the abundance of the forest and do you think that also includes birds because they were very much a part of that, too.

KN: Yeah. ʻIʻiwi polena is one of the places. Lots of bird names associated with the ridges going down Nāpali side.

KN: For example, Nā keiki a ʻiʻiwi. It's rendered a couple of different ways. Nā keiki a nā ʻiʻiwi, nā keiki a Nāʻiwi. When you're on the ocean looking up or on the big beach of Kalalau looking up, there is a couple of rock features or points going up the ridge. They are associated with the menehune. The menehune kids came down to play with the kids of Kalalau but they took too long, and in the morning when the sun was rising, as they were trying to make it home, they turned to stone when the sun hit them. And so they became known as Nā keiki a Nāʻiwi. That's also kaona, a play on words because Nāʻiwi or Nāʻiʻiwi as in the birds.

WT: Right, right. I came across that moʻolelo in my research. I was about to ask you about that one, too.

Kaleinamanu ridge is another one that came up in my research. I also noticed as I was researching all these moʻolelo that Maunahina was often said to be a place where birdcatchers lived.

KN: Yeah that's more on the Hanalei side.

WT: Hmm.

KN: But the ridge above Limahuli Manoa Valley up in there is supposed to be another area like that.

WT: Okay.

KN: The people over there at Limahuli would have information about that, too.

WT: Are you familiar with any of these kia manu moʻolelo?

KN: I've only come across a couple of them. Fred Wichman, he has a couple of books out on Kauaʻi stories and he writes about a couple of them.

WT: Yes, yes, I've check out all of his books.

KN: Oh, good.

WT: He has one on place names as well.

KN: Yeah. Good. He's a good source.

WT: Another interesting thing that came up in my research was Queen Emma's huakaʻi to Alakaʻi and Waiʻaleʻale.

KN: Yeah.

WT: There were so many mele mākaʻikaʻi written for that event and still people today composing mele about that event for the hula festival right? Are you familiar with those mele?

KN: Yeah that's where you get the mele lei. They talk a lot about the four famous mele hula lei each one a lei something. [thinking] What's that one mele about Kamaile over in Nuʻalolo is one of them. But actually there's way more than four. But as far as the different hālau are concerned, these four mele hula lei are recognized as part of the standard traditional hula that hālau should learn. And they stem from that story of Emma.

WT: Right. Right.

KN: So you might want to consult with Kumu hula about what those mele lei are.

WT: Actually, there is a book of Emma mele

KN: Oh yea you're right.

WT: So I've selected two mele from there to include in the CIA.

KN: That's good. Amy Stillman wrote about stuff like that, too.

WT Hmm. [pause] What are your thoughts regarding what we stand to lose culturally if no action is taken to protect these native forest birds?

KN: Yeah. If the mosquitoes keep rising and keep dominating the forest, we're going to lose the birds and then the imported birds will take over. Egrets in particular because they're so aggressive. Barn owls are also super aggressive. I've seen barn owls attack native pueo because they're larger. In midair they'll just attack them, and they'll have a big fight. So sometimes you'll see pueo missing an eyeball and stuff like that from encountering barn owls.

So if we lose those things then everything will just fall to textual knowledge, you know. Mele talking about animals that the new generations will never have seen. There already are many that this generation has never seen that are mentioned in mele. Stuff like that. So they are integral to Hawaiian culture. We don't choose to lose them. We would never do that. They're national treasures. So if they're lost it's because of some catastrophe, some kind of accident. We didn't choose to let them die out. I guess the biggest threats right now would be climate change and the warming temperatures and deforestation. If there was more forestation and more forestation of native trees coming down the mountain theoretically it'll bring the cloud levels back down. Which would bring back more rain. We need those things.

WT: Yeah, definitely. Do you have any concerns or recommendations for this project?

KN: Yeah, I mean, one thing leads to another. We need to be able to control invasive plants. You control invasive plants, then you allow native plants to grow back. And that's what attracts the native birds and so feeds the cycle. It's the native plants that feed the whole cycle. They also feed our culture. They feed our mele. They feed our identity. So if we allow things like the black wattle and albizia to take over, then, what's the point in saving the birds. One of the biggest natural catastrophes that's happened on Kauaʻi is allowing the farming of albizia down below in Kōloa side because it spreads super fast, it grows super fast, and the seeds have spread all the way up to the top of Kawaikini so we actually see that kind of the spread of albizia way up there. That had never been seen before, and the

way they grow they spread out and just cover the ground which eliminates the possibility for native plants to grow. I think the biggest mismanagement to have happened is to not realize that things grow in a cycle. The trees provide living sustenance for the birds. The birds thrive and have their role because they're also pollinators and then that goes back into the cycle and allows further propagation of native plants.

WT: Right. Yes, it's all connected.

KN: It's all connected. So if we allow for these intrusive plants then that breaks that cycle and creates another cycle.

WT: Mmhmm. Do you know of any stories from the older generations whether they have stories about their experiences with native forest birds that are still around or extinct?

KN: Yeah, that's where Randy Wichman comes in particularly well. [thinking] Manini family…trying to remember his name right now he actually works for DLNR. He's been working up there most of his life since he was a teenager. Manini family from Waimea. They come to mind right away. Another one is Jardine family. Sean Jardine he's a hunter also knows the top of the mountains super well and his family is from Kalaheo side. They know the area super well and can tell you all kine things. They're connected with other hunters who also know stuff. The hunters are really good at this because they get off the trails and they just wander and they'll camp out and can tell you all kinds of things.

WT: Yeah, I spoke with Billy DeCosta. He comes from a hunting family. When I interviewed him, he was just rattling off all the place names.

KN: Yeah. And when you get the hunters together, they all kind of rattle off in that same sort of way. You can cross reference them and triangulate and that's what makes them super valuable.

Yeah. So Kilohana is a big hill back way up Makaweli. A lot of hunters go up that area. Wai‘alae, ‘alae is a bird name. Kilohana is called that because it's a vantage point when you get to the top of it you can turn 360 and you can see the different gulches in the different directions.

WT: What sort of cultural practices and beliefs do you know are associated with native forest birds on Kaua‘i?

KN: Mele hula. Some of the most sacred hula that would be performed on heiau for ritual ceremony are either composed up over there or performed up over there. For example, Pōhaku Wa‘awa‘a. When you go pass Kanaloahuluhulu and you take the highway, and it winds up further, and then you hit that stretch that goes up to the second Kalalau lookout. There is a place you can stop on the side of the road and walk through the forest and on the edge of that ridge is actually a heiau, and there's a rock over there in the shape of Kaua‘i. I've been to it a number of times. That spot is the point that divides different ahupua‘a going down. It's a merging point. That area also has a bird name too. I'm trying to remember. Right next to that rock, only several walking steps from that rock, there's a heiau. The remains of a heiau. It looks like a platform and that's the kind of place where hula would be performed because it's prominent it's up there considered a leyline and so it's super sacred for that. That's the kind of place where these hula would be performed, and the association with birds is that you're high up in the forest, and that's where these birds are. They [birds] associate with the gods and that's what the intent of the hula is for.

WT: Shifting to plant resources. What do you see cultural practitioners going to the forest for? What sort of concerns do you have? Others spoke about the declined in the abundance of things like maile.

KN: Yeah. Locals aren't doing well in taking care and respecting the growth cycle. It's unfortunate. I would encourage maile farming instead of raiding the forest. I wish DLNR would start a campaign to encourage farming. It's a big deal on the Big Island. Maile farming is a big deal. In Panaewa and Hilo. I have friends over there with their backyard just loaded with maile. So, instead of having to go into the forest and cause all kinds of destruction. A lot of locals go in there and just shred the maile rip it

apart and then it dies, or it never grows well again. For someone who wants to make a lei, you want nice long strands. You can't find nice long strands anymore. It's hard to find. You find only tiny branches here and there that are not suitable for making lei. And when people do find nice long ones they just go ahead and shred the whole thing, and don't consider you know you have to leave some. Mokihana same story.

Mokihana doesn't get shredded like maile gets shredded because maile is a vine. But Mokihana, the berries and stuff like that. People take more than they need. Just because it's May and close to graduation, you know. People will just go absolutely raid because they get desperate. So graduation comes and everybody goes and raids all the maile. It's greedy. People get greedy and they have no consideration for the next people coming after them. For myself, I prefer to find my nice long strands, and I cut them off. I cut them off and take them home and then do the stripping instead of strip on the plant, because sometimes you pull on the thing and you pull out the whole plant roots and all. You gotta get it right. You gotta get a nice firm grip. Sometimes the bark is woody. When it's woody that means it's too old and if you try shred it off it'll just lift up the whole plant. Another problem is people don't get a good grip, and instead of getting a nice straight pull it breaks apart at different points and it's not usable so it gets tossed to the ground and in the meantime they left the plant mangled. So it's real bad.

Lately people have been getting into old but new types of Hawaiian crafts like wood carving. Kauwila is one type of wood. Another problem is that Kōkeʻe is a state park so you cannot just harvest that kind of thing. You cannot just take out a chain saw and cut down kauwila because you want the wood for carving. You have to get permissions. It's very difficult. For cultural practitioners there should be that kind of access, and that access should be made easy not difficult. It should be registered so we know how much of it is going on. Poaching should be regulated. But then, for those who want to have access should have access. The answer can't be no just cause it's a State Park. That should not be the answer that shuts it down, it should be the answer that makes it possible.

WT: Mmhm. Right. Going back to the project impacts. I'm not the biologist who understands how this wolbachia works but it is backed up by a lot of science. Do you have any concerns about using a biological intervention to address this problem?

KN: Yeah. That's a tough one. I've said this a few times among friends. If I could design a net or an aphid or something that would just attack albizia and nothing else and then would die when all the albizia is all gone I would absolutely let it loose. But that's a hypothetical. But it's always you know so they get this wasp that attacks the wiliwili so they get this other bug to take care of the wasp, and then after they've done their job with the wasp on the wiliwili. Now what? We're stuck with that kind of problem. We have no idea. There's no guarantee. There's no way to know. Mongoose is the classic go-to story. The next problem animal could be the skunk because it seems that they keep finding them over at the piers at the docks.

WT: Kauaʻi still doesn't have mongoose yeah?

KN: Kauaʻi no more. Well, there are reports. I got friends who work at the docks and they see them scurrying around in the warehouse. So they usually catch them in there. The skunks. Yeah, that's been on the news recently, Kauaʻi, Oʻahu, Maui.

WT: Oh, I missed that.

KN: Yeah, several times.

WT: Do you have any other thoughts you'd like to share?

KN: No, nothing else. I have to get going here.

WT: Okay, mahalo for talking with me.

KN: Mahalo nui.

Appendix C:

Federal Insecticide, Fungicide, and Rodenticide Act Section 18 Specific Emergency Use Label for Incompatible Insect Technique Application and US Environmental Protection Agency Letter of Authorization

*Wolbachia pipientis w*AlbB in *Culex quinquefasciatus* (DQB Strain)

FIFRA Section 18 Specific Emergency Use Directions.

DQB Males

The wAlbB *Wolbachia* bacterium prevents the development of *Culex quinquefasciatus* mosquito eggs in wild type *Cx. quinq.* females mated with *Cx. quinq.* males with wAlbB

ACTIVE INGREDIENT:

Wolbachia pipientis wAlbB, contained in live adult *Culex quinquefasciatus* males (DQB strain) >0.002% w/w*

* Contains a minimum of 0.7 copies *Wolbachia pipientis* wAlbB per copy of *Cx. quinq.* male mosquito DNA

For Distribution to and use only in the State of Hawaii for use in conservation of Hawaiian native birds.

This specific emergency exemption is effective from April 25, 2023 until April 25, 2024.

EPA File Symbol: 23HI01

Contains live male mosquitoes

[male release container] NET UNIT CONTENTS: *Wolbachia pipientis w*AlbB, contained in 1,000 adult male

Culex quinquefasciatus mosquitoes.

Contains Units of male release containers. Net minimum weight active

ingredient in each container is $1.58x10^{-6}$ oz. (0.045mg).

[male transfer container] NET UNIT CONTENTS: *Wolbachia pipientis*, *w*AlbB, contained in 1,000 adult male

Culex quinquefasciatus mosquitoes.

Contains Units of male transfer containers. Net minimum weight active

ingredient in each container is $1.58x10^{-6}$ oz. (0.045 mg).

[male release containers] must be used within 48 hours of receipt or refilling by applicator. [male transfer containers] must be used (applied to treatment area or used to refill [male release container]) within 24 hours of the filling timestamp.

Manufactured by:

Verily Life Sciences LLC

269 E Grand Ave., South San Francisco, CA 94080

EPA Company No. 92643

Batch Code:

email support: dqb-support@debug.com

EPA Registration No. Unregistered Pesticide

EPA Est. No.: 92643-CA-1

Filling

Timestamp:

Ref: DQB-Label-0.11 (FINAL) 2023-04-11

*Wolbachia pipientis w*AlbB in *Culex quinquefasciatus* (DQB Strain)

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. For use only

by Verily Life Sciences LLC.; persons under direct contract with Verily Life Sciences LLC for the purpose of

application of this pesticide; by Federal, state, tribal, or local government officials and their designated representatives responsible for conservation use of this product.

INSECTS SUPPRESSED:

DQB Males selectively suppress populations of *Cx. quinquefasciatus. (Cx. quinq)* where the wAlbB *Wolbachia pipientis* is incompatible with wild-type *Cx. quinq*, resulting in inviable eggs and reduced hatch rates. If used in accordance with this label to achieve a sufficient excess of DQB males over wild-type males, DQB Males are expected to suppress female *Cx. quinq*. mosquito populations.

RESTRICTIONS

- For Distribution to and use only in the State of Hawaii for the conservation of Hawaiian native birds.
- For outdoor use only.
- [male release container] must be used within 48 hours of receipt or refilling by applicator. [male transfer containers] must be used (applied to treatment area or used to refill [male release container]) within 24 hours of the filling timestamp.
- Do not use mosquito adulticide sprays in the same location as DQB Male releases within 48 hours of DQB Male releases.
- This specific exemption labeling must be in possession of the user at the time of application.

Notification Requirements: Applicators must notify Hawaii Department of Agriculture (HDOA) at least
seven (7) days prior to intended application Notification must include the following information:

- Name of applicator(s)
- Employer's name
- Phone number
- E-mail address (if applicable)
- Location (address, Tax Map Key, or GPS coordinates)
- Estimated amount of mosquitos to be released
- Estimated date of application

Completed Use Reports: Applicators must submit a completed use report to HDOA within sixteen (16)
days of application via email or hardcopy through mail. Completed use reports will be submitted on forms provided by HDOA. Contact HDOA to acquire the necessary forms.
HDOA Contact: Applicators can contact HDOA at hdoa.sec18@hawaii.gov or at 808-973-9415.

APPLICATION RATE

- Releases of male mosquitoes are to be performed at least once per week at a release rate adequate to maintain an overflooding ratio of DQB:Wild type male *Cx. quinq* >10:1 or, in the absence of trapping data, a minimum of 150 males/acre/week. Male mosquitoes are released to

the air and fly away to mate with indigenous females. If multiple containers are used, mosquito releases should be distributed as evenly as possible over the treatment area with release points spaced less than 1 km apart to ensure consistent coverage within the treatment area. To ensure highest possible efficacy adhere to this regimen until the end of the mosquito season (where applicable).

- Application rates are based on the area to be treated: each container (1000 DQB Males) is sufficient to treat 6 acres based on initial treatment rates of 150 males per acre per week. Multiple containers per week are required to achieve minimum treatment rates for most areas.
- For ongoing programs involving multiple releases per week over landscape scale (>500 acres) the applicator may use the nominal container fill (e.g. 1000 males) to compute release rates. For smaller programs the applicator will confirm the number of males in each container by entering the container barcode and batch number at https://count.debugproject.com
- Use trapping data in treatment areas or appropriate proxy locations (as reviewed by the Hawaii Department of Land and Natural Resources) to adjust release rates as required to maintain desired overflooding ratio of DQB:Wild type male *Cx. quinq*. of >10:1 and to compensate for estimated higher levels of *Cx. quinq.* in treatment areas as appropriate.
- Overflooding ratio is determined by comparing the pre- and post-release average male trap counts in treatment areas or by using molecular methods on males sampled from treatment areas (to differentiate wAlbB males from Wild Type see Crawford et al 2020[1] for similar methods). For treatment areas inaccessible for regular trapping the Hawaii Department of Land and Natural Resources may approve appropriate proxies. Contact Verily Life Sciences for more information on how to determine overflooding ratio.

METHOD OF APPLICATION

- Releases may be conducted using [male release containers] and [male transfer containers]

● [male release container] must be used within 48 hours of receipt or refilling by applicator. [male transfer containers] must be used (applied to treatment area or used to refill [male release container]) within 24 hours of the filling timestamp
● If receipt of a shipment of DQB male containers is delayed (by more than 48 hours for [male release containers], or 24 hours for [male transfer containers]) contact Verily Life Sciences.
● Keep container closed until ready to release the DQB males
● Releases may be conducted from on foot (by hand) from the ground or aerially. Male mosquitoes should fly vigorously away from the container after release.
● If males do not fly or appear damaged, contact Verily Life Sciences.
● A single release point treats an area with a radius of about 500m (~200 acres) centered around the release point.
● To cover most areas, multiple releases and containers/week are required. Release points should be <1 km apart and as evenly spaced as feasible to achieve consistent treatment.
● For point releases by hand
○ Transport containers to the predetermined release site
○ Point opening of container away from face and open
○ Gently shake or rotate the container until DQB males have dispersed
● For aerial releases

[1] Crawford, J.E., Clarke, D.W., Criswell, V. et al. (2020). Efficient production of male Wolbachia-infected Aedes aegypti mosquitoes enables large-scale suppression of wild populations. Nat Biotechnol 38, 482–492. doi: https://doi.org/10.1038/s41587-020-0471-x

Ref: DQB-Label-0.11 (FINAL) 2023-04-11

*Wolbachia pipientis w*AlbB in *Culex quinquefasciatus* (DQB Strain)

○ Aerial releases are to be performed using Verily aerial mosquito release systems.
○ Aerial releases may be conducted by either helicopter or other aircraft, including UAV, equipped with Verily aerial mosquito release systems.
○ Load aerial release equipment with the desired number of male containers to achieve the desired treatment rate over the treatment area.
○ Plan aerial releases by mapping container release points evenly across the treatment area at sufficient density to achieve the desired treatment rate when considering the overall number males released per week into the treatment area.
○ Aerial releases may be initiated manually by the user or automatically by the release equipment, as the aircraft reaches designated release points along the release routes, accounting for aircraft speed, altitude and any wind.
○ Contact Verily Life Sciences for more information on aerial release planning, and to enable automated releases.
● As an example release planning calculation: A treatment area of 3,000 acres at a target of 150 males/acre per week would require 450,000 males/week, which is 225 containers/week at nominal 1000 DQB male fill. Even distribution requires at least 15 evenly spaced release points, though more (and closer) points will enable more even and consistent treatment (each point can treat ~200 acres based on a 500m treatment radius). At 2 releases per week, each release with this minimum set of points should involve ~15 containers/point/release (225 containers per week/150 release points/2 releases per week) to gain appropriate coverage. Increasing the number of release points by decreasing the spacing between points will enable more even and consistent treatment.
● For maximum efficacy the user should ensure consistent application to all areas to be treated throughout the *Cx. quinq.* mosquito season (if applicable).

USE IN INTEGRATED VECTOR MANAGEMENT PROGRAMS

DQB Males can be used as part of an integrated vector management program. This includes the use of larvicides, adulticides, and source reduction. Any integration of mosquito adulticiding must be timed to minimize negative effects on the DQB Males that are released into the same or nearby treatment areas. Consult the pesticide label of the adulticide to determine the most appropriate timing of release of DQB Males between pesticide treatments.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE

Keep container closed until ready to use. Keep in original container unless refilling a male release container from a male transfer container according to instructions provided with the Verily field loading device. Keep male transfer containers cool (35-45°F) prior to use. Store DQB Males out of direct sunlight and at moderate temperatures 45℉ - 95℉ (7℃ - 28℃).

PESTICIDE DISPOSAL

Release all living DQB Males present in male release containers as soon as possible and within 48 hours of receipt by applicator or after refilling from transfer containers. Male transfer containers must be used (released or transferred to release containers) within 24 hours of the filling timestamp. Discard

dead individuals in trash. If not released or if the males are damaged, kill males by freezing or allow them to die by keeping inside closed container for a minimum of 7 days, then discard dead mosquitoes in trash.

CONTAINER HANDLING

Do not reuse this container for any other purpose. Return to point of sale by calling [Support phone number] for instructions on returning the empty container, or for the approved process to dispose of in trash, or in a sanitary landfill.

Instructions for refilling [mosquito release container]:

If refilling manually: inside a containment cage e.g. bugdorm, open the [mosquito transfer container] and empty its contents into an open [mosquito release container], re-sealing both immediately to prevent loss of contents.

If refilling using a Verily field loading device: load clean, empty [mosquito release containers] into the loading device in the locations indicated for “release containers,” ensuring they are engaged and sealed in the device. Load the corresponding number of Mosquito transfer containers into the loading device in the locations labeled “transfer containers”, ensuring that the Mosquito transfer containers are fully sealed in the loading device. Activate the loading device by engaging the “start” mechanism as indicated. Operate loading device until the mosquitoes are transferred and the loading operation is completed. Visually inspect mosquito release containers to ensure they have been filled. Unload the (filled) mosquito release containers from the loading device, and (empty) mosquito transfer containers. User may optionally confirm the number of DQB males in the mosquito release containers by entering the corresponding transfer container barcode and batch at https://count.debugproject.com. Return empty male transfer container(s) to the manufacturer.

WARRANTY STATEMENT CONDITIONS

The directions for use of this product are believed to be adequate and must be followed carefully. However, it is impossible to eliminate all risks associated with the use of this product. Ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of Verily Life Sciences. All such risks shall be assumed by the user or buyer.

DISCLAIMER OF WARRANTIES

Verily Life Sciences makes no other warranties, express or implied, of merchantability or of fitness that extend beyond the statements made on this label. No agent of Verily Life Sciences is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. Verily Life Sciences disclaims any liability whatsoever for damages resulting from the mis-use or mis-handling of this product.

LIMITATIONS OF LIABILITY

The exclusive remedy of the user or buyer for any and all losses, injuries, or damages resulting from the use or handling of this product, whether in contract, warranty, tort, negligence, strict liability or otherwise, shall not exceed the purchase price paid or at Verily Life Sciences’ election, the replacement of product.

Ref: DQB-Label-0.11 (FINAL) 2023-04-11
*Wolbachia pipientis w*AlbB in *Culex quinquefasciatus* (DQB Strain)

Not on main label: website https://count.debugproject.com

Ref: DQB-Label-0.11 (FINAL) 2023-04-11

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

Hawaii Department of Agriculture
Pesticides Branch
1428 South King Street
Honolulu, HI 96814

Effective Date: April 25, 2023
Expiration Date: April 25, 2024
Report Due: October 25, 2024
File Symbol: 23HI01

Attn: Esther Reichert and Greg Takeshima

The Environmental Protection Agency hereby issues a specific exemption under the provisions of Section 18 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended, to the Hawaii Department of Agriculture (HDOA) for the use of *Wolbachia pipientis* DQB strain (wAlbB) contained in live adult male *Culex quinquefasciatus* mosquitoes on up to 20,000 acres of State, Federal, and private lands to control mosquitoes (*Cx. quinquefasciatus*). This specific exemption is subject to the conditions set forth in your request dated, October 25, 2022, the label submitted April 11, 2023, as well as the following conditions and restrictions:

1. The HDOA is responsible for ensuring that all provisions of this specific exemption are met. It is responsible for providing information in accordance with 40 CFR 166.32(b). Accordingly, a report summarizing the results of this program must be submitted to EPA headquarters and EPA Region 9 within six months following the expiration date or prior to requesting a subsequent specific exemption for this use. An interim summary report may be submitted, in the later instance. In accordance with 40 CFR 166.32(a) these offices shall also be immediately informed of any adverse effects resulting from the use of this pesticide in connection with this exemption.

2. The unregistered product, DQB Males (*Wolbachia pipientis* (wAlbB) contained in live adult male *Culex quinquefasciatus* mosquitoes, active ingredient <0.3% w/w of adult male mosquitoes), manufactured by Verily Life Sciences, may be applied. All applicable directions for use, restrictions, and precautions on the container label submitted April 11, 2023, must be followed, unless otherwise modified in this authorization document.

3. DQB Males may be released by ground or aerial application at a release rate adequate to maintain an overflooding ratio of >10:1 DQB:Wild-type male *Cx. quinquefasciatus* mosquitoes, or in the absence of trapping data, a minimum of 150 males per acre per week. A maximum of 156 applications may be made per release site per year, based on an anticipated maximum of 3 releases

per week. The total amount of DQB Males to be applied per year to treat conservation lands throughout Hawaii is up to 3,000,000 male mosquitoes per week or 156,000,000 males per year. The maximum amount of *Wolbachia pipientis,* DQB strain, to be applied per year is up to ~1.83g/week or 95g/year.

4. DQB Males is for distribution to and use only in the State of Hawaii by Verily Life Sciences LLC; persons under direct contract with Verily Life Sciences LLC for the purpose of application of this pesticide; by Federal, state, tribal, or local government officials and their designated representatives responsible for conservation use of this product.

5. A maximum of 20,000 acres of State, Federal, and private lands may be treated in the counties of Honolulu, Hawaii, Kauai, Niihau, and Maui in the State of Hawaii.

6. DQB Males is for use only by Verily Life Sciences LLC; persons under direct contract with Verily Life Sciences LLC for the purpose of application of this pesticide; by Federal, state, tribal, or local government officials and their designated representatives responsible for conservation use of this product.

7. Use of DQB Males in public health programs is prohibited.

8. Do not use mosquito adulticide sprays in the same location as DQB male releases within 48 hours of DQB Male releases. If an adulticide treatment is expected to have a residual effect lasting longer than 48 hours, consult the pesticide label of the adulticide to determine the most appropriate timing of release of DQB Males between pesticide treatments.

9. This product is not for uses on food or feed.

10. Six weeks from the start of releases, quarterly monitoring for wAlbB-infected *Cx. quinquefasciatus* eggs or larvae must occur within a 10-km radius of release area. Sampling for egg rafts or larvae will be conducted from a minimum of 10 oviposition traps or larval breeding pool samples at each of at least 2 monitoring sites. A representative sample of at least 93 egg rafts, larvae, or any combination of the two, that are collected from these sites (or all collected egg rafts and/or larvae if fewer than 93 are collected across sites) must be evaluated for wAlbB in *Cx. quinquefasciatus* using PCR assays described as part of the Wolbachia infection Quality Control.

If wAlbB-infected *Cx. quinquefasciatus* offspring are detected in any of the samples from a site, then monitoring will be increased to monthly at that site, and monthly monitoring will be initiated no later than 45 days from the date of the confirmed detection of wAlbB-infected *Cx. quinquefasciatus* offspring. Monthly monitoring samples should be collected approximately every 30 days, but monthly samples will be collected no later than 45 days from the previous sample date. If monthly monitoring at a site cannot be conducted within 45 days of the date of detection or the previous sample, then releases at that site will be suspended until monthly monitoring can be conducted. If ≥10% of *Cx. quinquefasciatus* eggs or larvae sampled from a site per visit are confirmed positive for wAlbB in two consecutive visits (with the subsequent visits conducted monthly as defined above), then cessation of releases within 3km of the positive site must occur. Releases may resume if an additional sterilization method is used or once <10% of *Cx.*

quinquefasciatus eggs or larvae are positive for wAlbB during subsequent monthly monitoring. Once no wAlbB-infected *Cx. quinquefasciatus* eggs or larvae are detected at the positive site during monthly monitoring, quarterly monitoring may resume.

11. Any unused, unregistered product must either be returned to the manufacturer or distributor (unopened containers) or disposed of in accordance with the label following the expiration of the emergency exemption.

This is the first year that an emergency exemption has been requested under section 18 for use of DQB Males on Hawaii's conservation lands. The industry partner, Verily Life Sciences, has indicated they intend to work toward registration under section 3 of FIFRA in the future. Therefore, progress toward registration is adequate at this time.

In the event that the HDOA requests this use pattern next year in connection with an emergency exemption, EPA is making a preliminary determination that this use is eligible for the re-certification program (40 CFR 166.20(b)(5)).

Any future correspondence in connection with this exemption should refer to file symbol: 23HI01

If you have any questions with respect to this authorization, please contact Emergency Response Team member, Anna Katrina Briley at (202) 566-1210; briley.anna-katrina@epa.gov or Eric Bohnenblust at (202) 566-2506; bohnenblust.eric@epa.gov, Chief of the Minor Use and Emergency Response Branch.

_____

Ed Messina, Esq., Director
Office of Pesticide Protection
cc: USEPA Region 9- Regional and Tribal Coordinator, Fabiola Estrada

Appendix D:

USFWS Avoidance and Minimization Measures and Biosecurity Protocols

Avoidance, Minimization, and Conservation Measures for Listed Plants in the Pacific Islands

Project activities may affect listed plant species by causing physical damage to plant parts (roots, stems, flowers, fruits, seeds, etc.) as well as impacts to other life requisite features of their habitat that may result in reduction of germination, growth, and/or reproduction. Cutting and removal of vegetation surrounding listed plants could potentially alter microsite conditions (e.g., light, moisture, temperature), thereby damaging or destroying the listed plants and increasing the risk of invasion by nonnative plants, which can result in higher incidence or intensity of fire. Activities such as grazing, use of construction equipment and vehicles, and increased human traffic (i.e., trails, visitation, monitoring), can cause ground disturbance, erosion, and/or soil compaction, which decrease absorption of water and nutrients and damage plant root systems and may result in reduced growth and increased mortality of listed plants. Soil disturbance or removal may negatively impact the soil seed bank of listed plant species if such species are present or historically occurred in the project area.

In order to avoid or minimize potential adverse effects to listed plants that may occur on the proposed project site, we recommend minimizing disturbance outside of existing developed or otherwise modified areas. When disturbance outside existing developed or modified sites is proposed, a botanical survey for listed plant species should be conducted within the project action area, defined as the area where direct and indirect effects are likely to occur. Surveys should be conducted by a knowledgeable botanist with documented experience in identifying native Hawaiian and Pacific Islands plants, including listed plant species. Botanical surveys should optimally be conducted during the wettest part of the year (typically October to April) when plants and identifying features are more likely to be visible, especially in drier areas. If surveys are conducted outside of the wet season, the USFWS may assume plant presence.

The boundary of the area occupied by listed plants should be marked with flagging by the surveyor. To avoid or minimize potential adverse effects to listed plants, we recommend adherence to buffer distances for the activities described in Table C-1 below.

If listed plants are found to occur in a project area, the avoidance buffers are recommended to reduce direct and indirect impacts to listed plants from project activities. However, where project activities will occur within the recommended buffer distances, additional consultation is required. The impacts to plants of concern within the buffer area may be reduced by placing temporary fencing or other barriers at the boundary of the disturbance, as far from the affected plants as practicable.

The above guidelines apply to areas outside of designated critical habitat. If project activities occur within designated critical habitat unit boundaries, additional consultation is required.

All activities, including site surveys, risk introducing nonnative species into project areas. Specific attention is necessary to ensure that all equipment, personnel, and supplies are properly checked and are free of contamination (weed seeds, organic matter, or other contaminants) before entering project areas. Quarantines or management activities occurring on specific priority invasive species proximal to project areas need to be considered and adequately addressed. This information can be acquired by contacting local experts such as those on local invasive species

committees (Kauai: https://www.kauaiisc.org/; Oahu: https://www.oahuisc.org/; Maui Nui: https://mauiinvasive.org/; and Hawaii: https://www.biisc.org/).

Table D-1. Recommended Buffer Distances to Minimize and Avoid Potential Adverse Impacts to Listed Plants from Management Activities

Action		Buffer Distance (feet (meters)) - Keep Project Activity This Far Away from Listed Plant	
		Grasses/Herbs/Shrubs and Terrestrial Orchids	Trees and Arboreal Orchids
Walking, hiking, surveys		3 feet (1 m)	3 feet (1 m)
Cutting and removing vegetation by hand or hand tools (e.g., weeding)		3 feet (1 m)	3 feet (1 m)
Mechanical removal of individual plants or woody vegetation (e.g., chainsaw, weed eater)		Greater of 3 feet (1 m) or height of removed vegetation	Greater of 3 feet (1 m) or height of removed vegetation
Removal of vegetation with heavy equipment (e.g., bulldozer, tractor, "bush hog")		2x width equipment + height of vegetation	820 feet (250 m)
Use of approved herbicides (following label)	Ground-based spray application; hand application (no wand applicator; spot treatment)	10 feet (3 m)	Crown diameter
	Ground-based spray application; manual pump with wand, backpack	50 feet (15 m)	Crown diameter
	Ground-based spray application; vehicle-mounted tank sprayer	50 feet (15 m)	Crown diameter
	Aerial spray (ball applicator)	250 feet (76 m)	250 feet (76 m)
	Aerial application – herbicide ballistic technology (individual plant treatment)	100 feet (30 m)	Crown diameter
	Aerial spray (boom)	Further consultation required	Further consultation required
Use of insecticides (pollinators, seed dispersers)		Further consultation required	Further consultation required
Ground/soil disturbance/outplanting/fencing (hand tools, e.g., shovel, `ō`ō; small mechanized tools, e.g., auger)		20 feet (6 m)	2x crown diameter
Ground/soil disturbance (heavy equipment)		328 feet (100 m)	820 feet (250 m)
Surface hardening/soil compaction	Trails (e.g., human, ungulates)	20 feet (6 m)	2x crown diameter
	Roads/utility corridors, buildings/structures	328 ft (100 m)	820 feet (250 m)
Prescribed burns		Further consultation required	Further consultation required
Farming/ranching/silviculture		820 feet (250 m)	820 feet (250 m)

Definitions (Wagner et al. 1999)

Crown: The leafy top of a tree.

Herb: A plant, either annual, biennial, or perennial, with the non-woody stems dying back to the ground at the end of the growing season.

Shrub: A perennial woody plant with usually several to numerous primary stems arising from or relatively near the ground.

Tree: A woody perennial that usually has a single trunk.

Avoidance and Minimization Measures for Animal Species

Endangered ʻōpeʻapeʻa (Hawaiian hoary bat, *Lasiurus cinereus semotus*): The Hawaiian hoary bat roosts in woody vegetation across all islands and will leave their young unattended in trees and shrubs when they forage. If trees or shrubs 15 feet or taller are cleared during the pupping season, June 1 through September 15, there is a risk that young bats could inadvertently be harmed or killed, since they are too young to fly or move away from disturbance. Hawaiian hoary bats forage for insects from as low as 3 feet to higher than 500 feet above the ground and can become entangled in barbed wire used for fencing.

To avoid and minimize impacts to the endangered Hawaiian hoary bat we recommend you incorporate the following applicable measures into your project description:

- Do not disturb, remove, or trim woody plants greater than 15 feet tall during the bat birthing and pup rearing season (June 1 through September 15).

Endangered ʻuaʻu (Hawaiian petrel, *Pterodroma sandwichensis*), Threatened ʻaʻo, (Newell's shearwater, *Puffinus newelli*), and Endangered Hawaiʻi Distinct Population Segment of the ʻakēʻakē (band-rumped storm-petrel, *Hydrobates castro*):
Hawaiian seabirds may traverse the project area at night during the breeding, nesting and fledging seasons (March 1 to December 15). Outdoor lighting could result in seabird disorientation, fallout, and injury or mortality. Seabirds are attracted to lights and after circling the lights they may become exhausted and collide with nearby wires, buildings, or other structures or they may land on the ground. Downed seabirds are subject to increased mortality due to collision with automobiles, starvation, and predation by dogs, cats, and other predators. Young birds (fledglings) traversing the project area between September 15 and December 15, in their first flights from their mountain nests to the sea, are particularly vulnerable to light attraction.

To avoid and minimize potential project impacts to seabirds we recommend you incorporate the following measures into your project description:

- Fully shield all outdoor lights so the bulb can only be seen from below.

Threatened nēnē (Hawaiian goose, *Branta (Nesochen) sandvicensis*): Nēnē are found on the islands of Hawaiʻi, Maui, Molokaʻi, and Kauaʻi. They are observed in a variety of habitats, but prefer open areas, such as pastures, golf courses, wetlands, natural grasslands and shrublands, and lava flows. Threats to the species include introduced mammalian and avian predators, wind facilities, and vehicle strikes.

To avoid and minimize potential project impacts to nēnē we recommend you incorporate the following measures into your project description:

- Do not approach, feed, or disturb nēnē.
- If nēnē are observed loafing or foraging within the project area during the breeding season (September through April), have a biologist familiar with nēnē nesting behavior survey for nests in and around the project area prior to the resumption of any work. Repeat surveys after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest).
- Cease all work immediately and contact the Service for further guidance if a nest is discovered within a radius of 150 feet of proposed project, or a previously undiscovered nest is found within the 150-foot radius after work begins.
- In areas where nēnē are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.

Endangered koloa maoli, (Hawaiian duck, *Anas wyvilliana):*
Hawaiian ducks are known to utilize montane streams on Kauaʻi for nesting.
To avoid and minimize potential project impacts to the Hawaiian duck we recommend you incorporate the following applicable measures into your project description.
• In areas where ducks are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.
• If water resources are located within or adjacent to the project site, incorporate applicable best management practices regarding work in aquatic environments into the project design (see enclosure).
• Have a biological monitor that is familiar with the species' biology conduct nest surveys where appropriate habitat occurs within the vicinity of the proposed project site prior to project initiation. Repeat surveys again within 3 days of project initiation and after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest). If a nest or active brood is found:

o Contact the Service within 48 hours for further guidance.
o Establish and maintain a 100-foot 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.

Endangered Hawaiian forest birds (puaiohi, *Myadestes palmeri*; ʻakikiki, *Oreomystis bairdi*; akekeʻe, *Loxops caeruleirostris*; and threatened ʻiʻiwi, *Drepanis coccinea:*
Hawaiian forest birds' current ranges are predominately restricted to montane forests above 3,500 feet in elevation due to habitat loss and threats at lower elevations. Hawaiian forest bird habitat has been lost due to development, agriculture, grazing, wildfire, and spread of invasive habitat-altering species. Forest birds are also affected by mosquito-borne diseases. Mosquitoes are not native to Hawaiʻi; their occurrence increases in areas where ungulate presence results in small pools of standing water. Actions such as road construction and development increase human access and result in increased wildfire and invasive species threats. Grazing results in

reductions in woody vegetation and increased grass cover, which reduces forest habitat quality and results in increased wildfire risk on the landscape.

Avoid conducting activities within forest bird habitat that:

- Promote the spread or survival of invasive species.
- Increase mosquito populations or stagnant water habitat.
- Increase wildfire threat to montane forest habitats.
- Remove tree cover during the peak breeding season between January 1 and June 30.

Endangered picture-wing flies (*Drosophila musaphilia*):
Picture-wing flies live in montane forest habitat and are restricted to single islands. Larvae of each species are dependent on a single or a few related plant species. The flies are threatened by destruction of habitat from nonnative ungulates and invasive weeds, and also directly threatened by a variety of introduced invertebrates, including yellow jackets, crane flies, and several ant species.

- Avoid clearing forest vegetation within 200 feet of a site potentially occupied by endangered *Drosophila*.

Aquatic invertebrates in Hawai‘i: Newcomb’s snail (*Erinna newcombi*);
Newcomb’s snail is restricted to fast-flowing freshwater streams on Kaua‘i, where it feeds on vegetation growing on submerged rocks. Threats to the species include reduced stream flow from drought, water diversion projects, or other natural and human causes; predation by introduced snails, flies, and aquatic species; and small population dynamics.

MIGRATORY BIRD TREATY ACT

NATIONWIDE STANDARD CONSERVATION MEASURES

Listed below are effective measures that should be employed at all project development sites nationwide with the goal of reducing impacts to birds and their habitats. These measures are grouped into three categories: General, Habitat Protection, and Stressor Management. These measures may be updated through time. We recommend checking the Conservation Measures website regularly for the most up-to-date list.

1. GENERAL MEASURES

a. Educate all employees, contractors, and/or site visitors of relevant rules and regulations that protect wildlife. See the Service webpage on Regulations and Policies for more information on regulations that protect migratory birds.

b. Prior to removal of an inactive nest, ensure that the nest is not protected under the Endangered Species Act (ESA) or the Bald and Golden Eagle Protection Act (BGEPA). Nests protected under ESA or BGEPA cannot be removed without a valid permit.
    i. See the Service Nest Destruction Policy
c. Do not collect birds (live or dead) or their parts (e.g., feathers) or nests without a valid permit. Please visit the Service permits page for more information on permits and permit applications.
d. Provide enclosed solid waste receptacles at all project areas. Non-hazardous solid waste (trash) would be collected and deposited in the on-site receptacles. Solid waste would be collected and disposed of by a local waste disposal contractor. For more information about solid waste and how to properly dispose of it, see the EPA Non-Hazardous Waste website.
e. Report any incidental take of a migratory bird, to the local Service Office of Law Enforcement.
f. Consult and follow applicable Service industry guidance.

2. HABITAT PROTECTION

g. Minimize project creep by clearly delineating and maintaining project boundaries (including staging areas).
h. Consult all local, State, and Federal regulations for the development of an appropriate buffer distance between development site and any wetland or waterway. For more information on wetland protection regulations see the Clean Water Act sections 401 and 404.
i. Maximize use of disturbed land for all project activities (i.e., siting, lay-down areas, and construction).
j. Implement standard soil erosion and dust control measures. For example:
    i. Establish vegetation cover to stabilize soil
    ii. Use erosion blankets to prevent soil loss
    iii. Water bare soil to prevent wind erosion and dust issues

3. STRESSOR MANAGEMENT

3.1 STRESSOR: VEGETATION REMOVAL

Conservation Goal: Avoid direct take of adults, chicks, or eggs.

Conservation Measure 1: Schedule all vegetation removal, trimming, and grading of vegetated areas outside of the peak bird breeding season to the maximum extent practicable. Use available resources, such as internet-based tools (e.g., the FWS's Information, Planning and Conservation system and Avian Knowledge Network) to identify peak breeding months for local bird species; or,

contact local Service Migratory Bird Program Office for breeding bird information.

Conservation Measure 2: When project activities cannot occur outside the bird nesting season, conduct surveys prior to scheduled activity to determine if active nests are present within the area of impact and buffer any nesting locations found during surveys.

1) Generally, the surveys should be conducted no more than five days prior to scheduled activity.
2) Timing and dimensions of the area to be surveyed vary and will depend on the nature of the project, location, and expected level of vegetation disturbance.
3) If active nests or breeding behavior (e.g., courtship, nest building, territorial defense, etc.) are detected during these surveys, no vegetation removal activities should be conducted until nestlings have fledged or the nest fails or breeding behaviors are no longer observed. If the activity must occur, establish a buffer zone around the nest and no activities will occur within that zone until nestlings have fledged and left the nest area. The dimension of the buffer zone will depend on the proposed activity, habitat type, and species present and should be coordinated with the local or regional Service office.
4) When establishing a buffer zone, construct a barrier (e.g., plastic fencing) to protect the area. If the fence is knocked down or destroyed, work will suspend wholly, or in part, until the fence is satisfactorily repaired.
5) When establishing a buffer zone, a qualified biologist will be present onsite to serve as a biological monitor during vegetation clearing and grading activities to ensure no take of migratory birds occurs. Prior to vegetation clearing, the monitor will ensure that the limits of construction have been properly staked and are readily identifiable. Any associated project activities that are inconsistent with the applicable conservation measures, and activities that may result in the take of migratory birds will be immediately halted and reported to the appropriate Service office within 24 hours.
6) If establishing a buffer zone is not feasible, contact the Service for guidance to minimize impacts to migratory birds associated with the proposed project or removal of an active nest. Active nests may only be removed if you receive a permit from your local Migratory Bird Permit Office. A permit may authorize active nest removal by a qualified biologist with bird handling experience or by a permitted bird rehabilitator.

Conservation Measure 3: Prepare a vegetation maintenance plan that outlines vegetation maintenance activities and schedules so that direct bird impacts do not occur.

3.2 STRESSOR: INVASIVE SPECIES INTRODUCTION

Conservation Goal: Prevent the introduction of invasive plants.
Conservation Measure 1: Prepare a weed abatement plan that outlines the areas where weed abatement is required and the schedule and method of activities to ensure bird impacts are avoided.

Conservation Measure 2: For temporary and permanent habitat restoration/enhancement, use only native and local (when possible) seed and plant stock.

Conservation Measure 3: Consider creating vehicle wash stations prior to entering sensitive habitat areas to prevent accidental introduction of nonnative plants.

Conservation Measure 4: Remove invasive/exotic species that pose an attractive nuisance to migratory birds.

3.3 STRESSOR: ARTIFICIAL LIGHTING

Conservation Goal: Prevent increase in lighting of native habitats during the bird breeding season.

Conservation Measure 1: To the maximum extent practicable, limit construction activities to the time between dawn and dusk to avoid the illumination of adjacent habitat areas.

Conservation Measure 2: If construction activity time restrictions are not possible, use down shielding or directional lighting to avoid light trespass into bird habitat (i.e., use a 'Cobra' style light rather than an omnidirectional light system to direct light down to the roadbed). To the maximum extent practicable, while allowing for public safety, low intensity energy saving lighting (e.g. low pressure sodium lamps) will be used.

Conservation Measure 3: Minimize illumination of lighting on associated construction or operation structures by using motion sensors or heat sensors.

Conservation Measure 5: Bright white light, such as metal halide, halogen, fluorescent, mercury vapor and incandescent lamps should *not* be used.

3.4 STRESSOR: HUMAN DISTURBANCE

Conservation Goal: Minimize prolonged human presence near nesting birds during construction and maintenance actions.

Conservation Measure 1: Restrict unauthorized access to natural areas adjacent to the project site by erecting a barrier and/or avoidance buffers (e.g., gate, fence, wall) to minimize foot traffic and off-road vehicle uses.

3.5 STRESSOR: COLLISION

Conservation Goal: Minimize collision risk with project infrastructure and vehicles.
Conservation Measure 1: Minimize collision risk with project infrastructure (e.g., temporary and permanent) by increasing visibility through appropriate marking and design features (e.g., lighting, wire marking, etc.).

Conservation Measure 2: On bridge crossing areas with adjacent riparian, beach, estuary, or other bird habitat, use fencing or metal bridge poles (Sebastian Poles) that extend to the height of the tallest vehicles that will use the structure.

Conservation Measure 3: Install wildlife friendly culverts so rodents and small mammals can travel under any new roadways instead of over them. This may help reduce raptor deaths associated with being struck while tracking prey or scavenging road kill on the roadway.

Conservation Measure 4: Remove road-kill carcasses regularly to prevent scavenging and bird congregations along roadways.

Conservation Measure 5: Avoid planting "desirable" fruited or preferred nesting vegetation in medians or Rights of Way.

Conservation Measure 6: Eliminate use of steady burning lights on tall structures (e.g., >200 ft).

3.6 STRESSOR: ENTRAPMENT

Conservation Goal: Prevent birds from becoming trapped in project structures or perching and nesting in project areas that may endanger them.

Conservation Measure 1: Minimize entrapment and entanglement hazards through project design measures that may include:

1. Installing anti-perching devices on facilities/equipment where birds may commonly nest or perch
2. Covering or enclosing all potential nesting surfaces on the structure with mesh netting, chicken wire fencing, or other suitable exclusion material prior to the nesting season to prevent birds from establishing new nests. The netting, fencing, or other material must have no opening or mesh size greater than 19 mm and must be maintained until the structure is removed.
3. Cap pipes and cover/seal all small dark spaces where birds may enter and become trapped.

Conservation Measure 2: Use the appropriate deterrents to prevent birds from nesting on structures where they cause conflicts, may endanger themselves, or create a human health and safety hazard.

1. During the time that the birds are trying to build or occupy their nests (generally , between April and August, depending on the geographic location), potential nesting surfaces should be monitored at least once every three days for any nesting activity, especially where bird use of structures is likely to cause take. It is permissible to remove non-active nests (without birds or eggs), partially completed nests, or new nests as they are built (prior to occupation). If birds have started to build any nests, the nests shall be removed before they are completed. Water shall not be used to remove the nests if nests are located within 50 feet of any surface waters.
2. If an active nest becomes established (i.e., there are eggs or young in the nest), all work that could result in abandonment or destruction of the nest shall be avoided until the young have fledged or the nest is unoccupied. Construction activities that may displace birds after they have laid their eggs and before the young have fledged should not be permitted. If the project continues into the following spring, this cycle shall be repeated. When work on the structure is complete, all netting shall be removed and properly disposed of.

3.7 STRESSOR: NOISE

Conservation Goal: Prevent the increase in noise above ambient levels during the nesting bird breeding season.

Conservation Measure 1: Minimize an increase in noise above ambient levels during project construction by installing temporary structural barriers such as sand bags

Conservation Measure 2: Avoid permanent additions to ambient noise levels from the proposed project by using baffle boxes or sound walls.

3.8 STRESSOR: FIRE

Conservation Goal: Minimize fire potential from project-related activities.

Conservation Measure 1: Reduce fire hazards from vehicles and human activities (e.g., use spark arrestors on power equipment, avoid driving vehicles off road).

Conservation Measure 2: Consider fire potential when developing vegetation management plans by planting temporary impact areas with a palate of low-growing, sparse, fire resistant native species that meet with the approval of the County Fire Department and local FWS.

Invasive Species Biosecurity Protocols

Project activities may introduce or spread invasive species, causing negative ecological consequences to new areas or islands, resulting in potential impacts to fish, wildlife, and their habitat. For example, seeds of invasive plant species (e.g., *Chromolaena odorata*, *Senecio madagascariensis* or *Miconia calvescens*) can be inadvertently transported on equipment from a previous work site to a new site where the species are not present. Equipment used in an area infected with a pathogen or insect pest that can have ecological consequences (e.g., rapid ʻōhiʻa death [*Ceratocystis* spp.], black twig borer [*Xylosandrus compactus*], or naio thrips [*Klambothrips myopori*]), if not properly decontaminated, can likewise serve as a vector to introduce the pathogen into a new area. Vehicles must also be properly inspected and cleaned to ensure vertebrate or invertebrate pests do not stowaway and spread to other areas. These are just a few examples of how even well-intended project activities may inadvertently introduce or spread invasive species.

To avoid and minimize the potential impacts of invasive species to fish, wildlife, and their habitats, we recommend incorporating general biosecurity protocols into project planning (see protocols below). The proposed project also occurs in a geographic area and/or involves activities that risk spreading the fungi that cause rapid ʻōhiʻa death (ROD). For these reasons, the biosecurity protocol for ROD is also provided below.

The following biosecurity protocol is recommended to be incorporated into planning for the project to avoid or minimize transportation of invasive species with potential to impact fish, wildlife, and their habitat. Cleaning, treatment, and inspection activities are the responsibility of the equipment or vehicle owner and operator. However, it is ultimately the responsibility of the action agency to ensure that all project materials, vehicles, machinery, equipment, and personnel are free of invasive species before entry into a project site. Please refer to the resources listed below for current removal/treatment recommendations that may be relevant to the project.

1. Cleaning and treatment:

   Project applicants should assume that all project materials (i.e., construction materials, or aggregate such as dirt, sand, gravel, etc.), vehicles, machinery, and equipment contain dirt and mud, debris, plant seeds, and other potential vectors of invasive species, and therefore require thorough cleaning. Treatment for specific pests, for example, trapping and poison baiting for rodents, or baiting and fumigation for insects, should be considered when applicable. For effective cleaning we offer the following recommendations prior to entry into a project site:

   a. Project materials, vehicles, machinery, and equipment must be pressure washed thoroughly (preferably with hot water) in a designated cleaning area. Project materials, vehicles, machinery, and equipment should be visibly free of mud and dirt (excluding aggregate), seeds, plant debris, insects, spiders, frogs (including frog eggs), other vertebrate species (e.g., rodents, mongoose, feral cats, reptiles, etc.), and rubbish. Areas of particular concern include bumpers, grills, hood compartments, wheel wells, undercarriage, cabs, and truck beds. Truck beds with accumulated material are prime sites for hitchhiking invasive species.

b. The interior and exterior of vehicles, machinery, and equipment must be free of rubbish and food, which can attract pests (i.e., rodents and insects). The interiors of vehicles and the cabs of machinery should be vacuumed clean particularly for any plant material or seeds.

2. Inspection:

   a. Following cleaning and/or treatment, project materials, vehicles, machinery, and equipment must be visually inspected by its user and found to be free of mud and dirt (excluding aggregate), debris, and invasive species prior to entry into a project site. For example, careful visual inspection of a vehicle's tires and undercarriage is recommended for any remaining mud that could contain invasive plant seeds.

   b. Any project materials, vehicles, machinery, or equipment found to contain invasive species (e.g., plant seeds, invertebrates, rodents, cats, reptiles, etc.) must not enter the project site until those invasive species are properly removed/treated.

3. For all project site personnel:

   a. Prior to entry into the project site, visually inspect and clean all clothes, boots or other footwear, backpack, radio harness, tools and other personal gear and equipment for insects, seeds, soil, plant parts, or other debris. We recommend the use of a cleaning brush with sturdy bristles. Seeds found on clothing, footwear, backpacks, etc., should be placed in a secure bag or similar container and discarded in the trash rather than being dropped to ground at the project site or elsewhere.

4. Additional considerations:

   a. Avoid unnecessary exposure to invasive species at a particular site (to the extent practical) to reduce contamination and spread. For example, if the project involves people or equipment moving between multiple locations, plan and organize timelines so that work is completed in native habitat prior to working in a disturbed location to reduce the likelihood of introducing a pest into the native habitat.

   b. Maintain good communication about invasive species risks between project managers and personnel working on the project site (e.g., conduct briefings and training about invasive species). Ensure prevention measures are communicated to the entire project team. Also consider adding language regarding biosecurity into contracts or permitting mechanisms to provide clarity to all involved in the project.

Species-Specific Biosecurity Protocols

Rapid ʻŌhiʻa Death

ROD is caused by a fungal pathogen (*Ceratocystis* spp.) that attacks and kills ʻōhiʻa trees. ʻŌhiʻa is endemic to the Hawaiian Islands and is the most abundant native tree species, making up approximately 80% of Hawaiʻi's remaining native forests.

For more information about ROD including its current distribution, ROD science updates, and the latest on ROD protocols, please visit www.rapidohiadeath.org.

To reduce the risk of spreading ROD, the following best management practices and decontamination protocol are recommended:

Best Management Practices for ROD

1. Never transport any part of an ʻōhiʻa tree between different areas of an island or to a different island.
2. Do not use equipment from ROD-infected islands on another island unless it is very specialized equipment and follows the decontamination protocol described below.
3. Avoid wounding ʻōhiʻa trees and roots with mowers, chainsaws, weed eaters, and other tools. If an ʻōhiʻa receives a minor injury like a small broken branch, give the injury a clean, pruning-type cut (close to the main part of the trunk or branch) to promote healing, and then spray the entire wounded area with a pruning seal.
4. Always report suspect ROD ʻōhiʻa trees observed within your project area. ROD is a wilt disease that cuts off the supply of water and nutrients to the tree. The primary symptom to look for is an entire canopy or a large branch with dying leaves or red discolored leaves. Please record the global positioning system (GPS) coordinates and location and take a picture of the tree if possible. Please report suspected ROD ʻōhiʻa trees on Kauaʻi to KISC: 808-821-1490 (kisc@hawaii.edu).

ROD Decontamination Protocol

1. Clothes, footwear, backpacks, and other personal equipment
    a. Before leaving the project site, remove as much mud and other contaminants as possible. Use of a brush with soap and water to clean gear is preferred. Footwear, backpacks, and other gear must be sanitized by spraying with a solution of >70% isopropyl alcohol or a freshly mixed 10% bleach solution.
2. Vehicles, machinery, and other equipment
    a. Vehicles, machinery, and other equipment must be thoroughly hosed down with water (pressure washing preferred) and visibly free of mud and debris, then sprayed with a solution of >70% isopropyl alcohol or a freshly mixed 10% bleach solution. Use of a "pump-pot" sprayer is recommended for the solution and a hot water wash is

preferred. Be sure to thoroughly clean the undercarriage, truck bed, bumpers, and wheel wells.

b. If non-decontaminated personnel or items enter a vehicle, then the inside of the vehicle (i.e., floor mats, etc.) must be subsequently decontaminated by removing mud and other contaminants and sprayed with a solution of >70% isopropyl alcohol or a freshly mixed 10% bleach solution.

3. Cutting tools

   a. All cutting tools, including machetes, chainsaws, and loppers, must be sanitized to remove visible mud and other contaminants. Tools must be sanitized using a solution of >70% isopropyl alcohol or a freshly mixed 10% bleach solution. One minute after sanitizing, an oil-based lubricant may be applied to chainsaw chains or other metallic parts to prevent corrosion.

NOTE: When using a 10% bleach solution, surfaces should be cleaned with a minimum contact time of 30 seconds. Bleach must be mixed daily and used within 24 hours, as once mixed it degrades. Bleach will not work to disinfect surfaces that have high levels of organic matter such as sawdust or soil. Because bleach is corrosive to metal, a water rinse after proper sanitization is recommended to avoid corrosion.

REFERENCES CITED

Wagner, W.L., S. Sohmer, and D.R. Herbst. 1999. *Manual of the Flowering Plants of Hawaii*, revised edition. Honolulu, Hawaii. University of Hawaii and Bishop Museum Press.

Appendix E:

Present and Reasonably Foreseeable Future Management Actions within the Proposed Project Area

Table E-1. Present and Reasonably Foreseeable Future Management Actions within the Project Area

Activity	Present Activities					Future Activities
Hunting	Reserve	Hunting Unit	Dates	Game Type/Method	Hunter Trips (July 2021 – June 2022)	No special hunts are planned within the project area in the foreseeable future.
	Pu‘u Ka Pele, Nā Pali-Kona Forest Reserve	B	Year round; Friday, Saturday, Sunday, Monday and state holidays	Pig; all methods[6]	407	
			May through August; Friday, Saturday, Sunday, Monday	Goat; all methods		
			September through October, Friday, Saturday, Sunday, Monday	Deer; all methods		
	Kōke‘e State Park	D	December through May; Saturday, Sunday, and state holidays	Pig; archery, dog, and knife	197	
			June through August; Saturday, Sunday, and state holidays	Deer and pig; archery		

[6] All methods: rifle, shotgun, muzzleloader, archery, dogs, and knife.

Activity		Present Activities				Future Activities
	Nā Pali-Kona, Alakaʻi Wilderness Preserve	E1	Year round; Friday, Saturday, Sunday, Monday, and state holidays	Pig, goat, and deer; all methods	254	
		E2	Year round; Daily	Pig, goat, and deer; all methods	296	
	Kōkeʻe, Nā Pali-Kona, Kuia Natural Area Reserve	H	December through July; Friday, Saturday, Sunday, Monday, and state holidays	Pig, goat, and deer; all methods	1,182	
			August through November; Friday, Saturday, Sunday, Monday, and state holidays	Pig, goat, deer; all methods except dogs		
	Nā Pali Coast Wilderness Preserve, Hono Nā Pali Natural Area Reserve	G	Year round; daily	Goat and pig; archery	< 50	
	Haleleʻa Forest Reserve, Līhuʻe-Kona Forest Reserve	C	August through November; Friday, Saturday, Sunday, Monday, and state holidays	Goat and pig; all methods	810	

Activity		Present Activities	Future Activities
Traps and Bait Stations	Organization	Current Trapping Operations	
	DOFAW (including DOFAW Natural Area Reserves System)	Pacific Rim Conservation has a trap line along the Alakaʻi Boardwalk within Alakaʻi Wilderness Preserve. Tomahawk traps and A24s in Kuia and Hono o Nā Pali Natural Area Reserves (NARs).	No current plans for DOFAW to add additional traps. More traps could be added to Mōhihi management unit if additional fences are constructed.
	State Parks	Kōkeʻe State Park, Nā Pali Coast Wilderness Park, Wailua River State Park.	No changes.
	KFBRP	One plot of 125 A24 rat traps in Nā Pali Kona Forest Reserve and one plot of 200 A24s in Alakaʻi Wilderness Preserve. These plots are checked every 4 months.	Current plan to increase size, number, and density of A24 trap grids.
	TNC	Pig traps, cat traps, and mosquito traps in the Alakaʻi Wilderness Preserve. Access various sites within Alakaʻi Wilderness Preserve every other week to check snares, fences, traps, etc.	No changes.
Animal traps	Organization	Current Trapping Operations	
	DOFAW – Natural Area Reserves System	Staff manage snares in NARs. Snares have been removed from units that are ungulate free.	Hunting and deployment of snares is planned within recently completed and future fence units.
	TNC	Network of snares in the Alakaʻi Wilderness Preserve for ungulate removal. Sites are accessed every other week to check snares, fences, traps, etc. Snares are removed from units that are ungulate free.	
	Organization	Current Trapping Operations	

Activity		Present Activities		Future Activities
Fences and Fence Supply Caches	DOFAW – Forestry and TNC	The fenced units on the Alakaʻi Plateau include: East Alakaʻi (1,972 acres), Halehaha-Halepaʻakai (1,352 acres), Koaie (1,064 acres), and Drinking Glass (877 acres). Drinking Glass and Halehaha-Halepaʻakai are entirely within Alakaʻi Wilderness Preserve. The East Alakaʻi and Koaie units are partially state-owned and partially private land (Wainiha Wilderness Preserve). Approximately 5,000 forest reserve acres are fenced in total.		Discussions regarding enlarging the Mōhihi exclosure (in the Alakaʻi Wilderness Preserve) are ongoing. This fence would encompass the headwaters of the Kawaikoi and Waikoali streams (2,000 acres).
	DOFAW – Natural Area Reserves System	Hono O Nā Pali Boundary fence (approximately 3.3 miles) with additional strategic fences (approximately 1.4 miles combined). Kuia NAR has several smaller fences (approximately 4.2 miles, enclosing 131.7 acres in total).		No changes.
Camping	Agency Department	Reserves	Usage	An additional $10 processing fee will be charged for camping within Forest Reserves.
	DOFAW	Na Pali Kona Forest Reserve (5 campgrounds: Waialae Cabin, Waikoali, Kawaikoi, Sugi Grove, Lonomea)	2022: 2,475 people over 1,366 nights, 870 permits. So far in 2023: 1,464 people over 772 nights, 478 permits.	
	State Parks	Nā Pali Coast State Wilderness Park Polihale State Park Kōkeʻe State Park	All three sites are accessed daily by the public and campers. Nā Pali Coast State Wilderness Park allows 60 campers per night during summer and 30 campers per night during winter.	
Collecting	Agency Department	Action	Usage	No changes.

Activity		Present Activities		Future Activities
	DOFAW	Collection of foliage for arrangements and lei	2022: 25 in Nā Pali Kona Forest Reserve. None in Pu‘u Ka Pele Forest Reserve. So far in 2023: 18 personal collection permits for Nā Pali Kona Forest Reserve. None in Pu‘u Ka Pele Forest Reserve.	
	State Parks		Kōke‘e State Park and Nā Pali Coast Wilderness Park have current collection permits. Access is the same as for the public.	
Commercial Harvest	Agency Department	Harvest Activity	Activity	No changes.
	DOFAW	Hazardous trees that cross or have the potential to fall on or cross access roads.	2022: Two salvage harvests on Camp 10 road. So far in 2023: None.	

Activity		Present Activities		Future Activities
Access	Agency Department	Reserve	Trail or Road	No changes.
	DOFAW Nā Ala Hele	Nā Pali-Kona Forest Reserve	Awa‘awapuhi Trail, Nu‘alolo Cliff Trail, Nu‘alolo Trail, Miloli‘i Trail, Mākaha Ridge Road, Kauhao Ridge Road, Pihea Trail, Alaka‘i Swamp Trail, Kawaikōī Stream Trail, Mōhihi-Camp 10 Road, Po‘omau Canyon Vista Trail, Mōhihi-Wai‘alae Trail, Kohua Ridge Trail, Pu‘u Ki-Wai‘alae Trail, Koaie Canyon Trail.	
		Pu‘u Ka Pele Forest Reserve	Pu‘u Ki-Wai‘alae Trail.	
		Alaka‘i Wilderness Preserve	Pihea Trail, Alaka‘i Swamp Trail, Kawaikōī Stream Trail, Mōhihi-Camp 10 Road, Po‘omau Canyon Vista Trail, Mōhihi-Wai‘alae Trail, Kohua Ridge Trail, Pu‘u Ki-Wai‘alae Trail.	
		Kuia NAR	Awa‘awapuhi Trail, Nu‘alolo Cliff Trail, Nu‘alolo Trail.	

Activity		Present Activities		Future Activities
	State Parks	Kōkeʻe State Park	Official trails: Poʻomau Canyon Vista Trail, Kaluapuhi Trail, Halemanu-Kōkeʻe Trail, Kumuwela Trail, Berry Flats-Water Tank Trail. Unofficial trails: Kālepa Ridge-Airplane Trail, Honopū Trail. Kōkeʻe Resource Conservation Program (KRCP) does periodic trail maintenance.	
Administrative Trails	Organization	Location and Use		
	DOFAW/TNC	Alakaʻi Wilderness Preserve: Located within fenced units. TNC accesses sites within preserve every other week to check snares, fences, traps, etc.		No changes.
	KFBRP	Alakaʻi Wilderness Preserve: KFBRP uses the unofficial trails weekly from February through July, and about once a month for the rest of the year.		
Trails Tool Caches	Organization	Location		
	State Parks	Nā Pali Coast State Wilderness Park (Kalalau Trail).		No changes.

Activity		Present Activities	Future Activities
Research Shelters	Organization	Present Use of Shelters	
	KFBRP	Two forest bird research shelters in Nā Pali-Kona Forest Reserve and one in the Alakaʻi Wilderness Preserve. Used daily from February through June and monthly the rest of the year by crews of two to six people per shelter.	A new research shelter may be built in the future near Mōhihi Bog; however, this is dependent on the installation of a fence around the perimeter of the Mōhihi watershed. The installation of the shelter will increase camping and mosquito monitoring within this area.
	Organization	Existing Monitoring Activities within Project Area	

Activity		Present Activities	Future Activities
Monitoring Transects and Research Plots	KFBRP	Hawai‘i Forest Bird Surveys: Monitor transects every 5 years with a crew of two people for 4 months within Kuia NAR, Nā Pali-Kona Forest Reserve, and Alaka‘i Wilderness Preserve. Transects will be monitored again in 2023. Two forest bird monitoring plots in Nā Pali-Kona Forest Reserve, and one in Alaka‘i Wilderness Preserve. Plots are surveyed daily between February and June and monthly the rest of the year by crews of two to six people per plot. Three mosquito monitoring plots of 16 traps each (one in Kuia NAR, one in Kōke‘e State Park, and one in Nā Pali Kona Forest Reserve). Monitored every 6 weeks. Larval transects (1–2 kilometers long) on two to three streams in Nā Pali Kona Forest Reserve and two to three streams in Alaka‘i Wilderness Preserve.	Additional monitoring associated with mosquito release.
	TNC	Fourteen vegetation and ungulate monitoring transects within Alaka‘i Wilderness Preserve. Monitoring is undertaken once per year (older transects in ungulate-free units are monitored less frequently).	
Stream and Rainfall/Weather Monitoring Stations	Organization	Existing Monitoring Activities within Project Area	
	KFBRP	One weather monitoring station in Nā Pali Kona Forest Reserve and one in Alaka‘i Wilderness Preserve.	Planning to add a network of 12 stream sensors.
	USGS	Kawaikōī Stream: Nā Pali-Kona Forest Reserve Wai‘alae Stream: Nā Pali-Kona Forest Reserve Wai‘ale‘ale Stream: Private lands (Alexander & Baldwin, Brue Baukol Capital Partners) Hanakāpī‘ai Stream: Hono O Nā Pali NAR (per DOFAW).	No changes.
	State Parks	Hanakāpī‘ai Valley (Nā Pali Coast State Park) and Kōke‘e State Park.	No changes.

Activity		Present Activities	Future Activities
Research Shelters	Organization	Present Use of Shelters	
	KFBRP	Two forest bird research shelters in Nā Pali-Kona Forest Reserve, and one in the Alakaʻi Wilderness Preserve. Used daily from February through June and monthly the rest of the year by crews of two to six people per shelter.	A new research shelter may be built in the future near Mōhihi Bog; however, this is dependent on the installation of a fence around the perimeter of the Mōhihi watershed. The installation of the shelter will increase camping and mosquito monitoring within this area.
Helicopter Operations	Organization	Current Operations	
	DOFAW (including Natural Area Reserves System, Kauaʻi Invasive Species Committee)	DOFAW – Forestry: One trip every other month on average (approximately 5 hours flying time per month). DOFAW – NARS: Locations throughout the NARs (approximately 5 hours flying time per month).	No changes.
	State Parks	Operations conducted monthly in Kōkeʻe State Park, Nā Pali Coast State Park, Waimea Canyon State Park, Hāʻena State Park.	No changes.
	USGS	USGS flies into their stream and rain gauges quarterly (located in Nā Pali Kona Forest Reserve, private land, Hono o Nā Pali NAR)	No changes.
	TNC	Operations conducted in Alakaʻi Wilderness Preserve (approximately 4 hours flying time/month).	No changes.

Activity		Present Activities	Future Activities
	KFBRP	Alakaʻi Wilderness Preserve: Weekly flights from March through June. Nā Pali Kona Forest Reserve: Flights all year. Flight times average 5.75 hours per month from March to June and 3.25 hours per month for the rest of the year.	Mosquito monitoring will likely increase the number of helicopter flights.
	KRCP (including Kauaʻi Invasive Species Committee)	Alakaʻi Wilderness Preserve: minimum of seven camping trips or fence checks per year. Hono o Nā Pali NAR: Between zero and six operational trips per year. Līhuʻe-Koloa Forest Reserve and Nā Pali Coast State Park: Occasional operations. Total of approximately 26 flight hours in 2022.	No changes.
Landing Zones	Reserve Name	Number of Landing Zones	
	Haleleʻa Forest Reserve	2	No changes planned. Project will only utilize existing landing zones. No new landing zones will be created.
	Hono O Nā Pali Natural Area Reserve	6	
	Kōkeʻe State Park	2	
	Līhuʻe-Kōloa Forest Reserve	1	
	Nā Pali Coast State Wilderness Park	3	
	Nā Pali-Kona Forest Reserve	8	
	Nā Pali-Kona Forest Reserve/Alakaʻi Wilderness Preserve	38	
	Outside Reserves	4	
	Wainiha Preserve (TNC)	30	
	Total	94	
	DOFAW Partners	State Parks partners	No changes.

Activity	Present Activities	Future Activities
DOFAW/partner activities, management stewardship	KFBRP KRCP: invasive species control TNC: watershed management in Alakaʻi Wilderness Preserve	KRCP Hui o Laka – Kōkeʻe Museum Friends of the Kalalau Trail Kauaʻi Invasive Species Committee Pacific Islands Fish and Wildlife Office

Appendix F:

Threatened and Endangered Species and Critical Habitats in the Project Area

Table F-1. Federal Threatened and Endangered Species that would be Considered Unlikely to be Impacted by the No-Action Alternative and Proposed Action.

Species	Threat Status	Justification for not Including within Impacts Analysis
Newcomb's snail (*Erinna newcombi*) (aquatic invertebrate)	Threatened (Federal and state)	Pedestrian activities would be limited to established trails and stream crossings Incompatible mosquitos are unlikely to interact with Newcomb's snails.
Hawaiian monk seal (*Monachus schauinslandi*)	Endangered (Federal and state)	Aerial and pedestrian dispersal of incompatible male mosquitos unlikely to occur near lowland coastal habitats and nearshore coastal waters. Other project activities are unlikely to occur within lowland coastal environments. Interaction between the listed marine species and mosquitos are likely to be minimal to non-existent.
Green sea turtle (*Chelonia mydas*)	Threatened (Federal and state)	
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered (Federal and state)	
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered (Federal and state)	
Loggerhead sea turtle (*Caretta caretta*)	Threatened (Federal and state)	
Olive ridley sea turtle (*Lepidochelys olivacea*)	Threatened (Federal and state)	
Humpback whale (*Megaptera novaeangliae*) and five other endangered baleen whale species	Endangered (Federal and state)	
Sperm whale (*Physeter macrocephalus*)	Endangered (Federal and state)	
False killer whale (*Pseudorca crassidens*)	Endangered (Federal and state)	

Table F-2. Federally Listed Threatened and Endangered Plant Species Recorded within the Project Area

Scientific Name[7]	Common Name	USFWS Threat Status
Adenophorus periens	pendent kihi fern	Endangered
Alectryon macrococcus var. *macrococcus*	Mahoe	Endangered
Asplenium dielpallidum	no common name	Endangered
Astelia waialealae	paʻiniu	Endangered
Bonamia menziesii	no common name	Endangered
Brighamia insignis	ʻōlulu	Endangered
Canavalia napaliensis	ʻāwikiwiki	Endangered
Cyanea recta	Hāhā	Endangered
Cyanea rivularis	Hāhā	Endangered
Cyrtandra kealiae subsp. kealiae	haʻiwale	Endangered
Cyrtandra paliku	haʻiwale	Endangered
Dryopteris glabra var. pusilla	Hohiu	Endangered
Dubautia latifolia	Koholāpehu	Endangered
Dubautia pauciflorula	naʻenaʻe	Endangered
Dubautia waialealae	naʻenaʻe	Endangered
Euphorbia halemanui	ʻakoko	Endangered
Euphorbia remyi var. kauaiensis	ʻakoko	Endangered
Euphorbia remyi var. remyi	ʻakoko	Endangered
Exocarpus luteolus	Heau	Endangered
Geniostoma helleri	Kāmakahala	Endangered
Geranium kauaiense	Nohoanu	Endangered
Hibiscadelphus distans	Kauaʻi hau kuahiwi	Endangered
Hibiscus clayi	Clay's hibiscus	Endangered
Ischaemum byrone	Hilo ischaemum	Endangered
Isodendrion longifolium	Aupaka	Threatened
Joinvillea ascendens subsp. ascendens	ʻohe	Endangered

[7] Records within this table are from the DLNR rare plants database.

Scientific Name[7]	Common Name	USFWS Threat Status
Keysseria helenae	Mt. Wai‘ale‘ale island-daisy	Endangered
Lobelia niihauensis	Ni‘ihau lobelia	Endangered
Lysimachia daphnoides	lehua makanoe	Endangered
Lysimachia pendens	no common name	Endangered
Melicope degeneri	Alani	Endangered
Melicope haupuensis	Alani	Endangered
Melicope pallida	Alani	Endangered
Melicope paniculata	Alani	Endangered
Melicope puberula	Alani	Endangered
Melicope rostrata	Alani	Endangered
Myrsine fosbergii	Kōlea	Endangered
Myrsine knudsenii	Kōlea	Endangered
Myrsine linearifolia	Kōlea	Endangered
Myrsine mezii	Kōlea	Endangered
Nothocestrum latifolium	‘aiea	Endangered
Nothocestrum peltatum	‘aiea	Endangered
Peucedanum sandwicense	Makou	Threatened
Phyllostegia helleri	Mt. Kāhili phyllostegia	Endangered
Phyllostegia renovans	red-leaf phyllostegia	Endangered
Pittosporum napaliense	hō‘awa	Endangered
Platanthera holochila	Hawai‘i bog orchid	Endangered
Poa mannii	Mann’s bluegrass	Endangered
Poa sandvicensis	Hawaiian bluegrass	Endangered
Poa siphonoglossa	no common name	Endangered
Polyscias racemosa	no common name	Endangered
Pritchardia viscosa	loulu	Endangered
Psychotria grandiflora	Kōpiko	Endangered
Psychotria hobdyi	Kōpiko	Endangered
Pteralyxia kauaiensis	Kaulu	Endangered
Ranunculus mauiensis	Makou	Endangered

Scientific Name[7]	Common Name	USFWS Threat Status
Remya kauaiensis	Kauaʻi remya	Endangered
Schiedea helleri	no common name	Endangered
Schiedea lychnoides	Kuawawaenohu	Endangered
Schiedea membranacea	no common name	Endangered
Schiedea spergulina	no common name	Endangered
Schiedea viscosa	no common name	Endangered
Sesbania tomentosa	ʻohai	Endangered
Solanum sandwicense	pōpolo ʻaiakeakua	Endangered
Spermolepis hawaiiensis	no common name	Endangered
Stenogyne kealiae	Keal's stenogyne	Endangered
Wilkesia hobdyi	dwarf iliau	Endangered
Xylosma crenatum	no common name	Endangered

Table F-3. Federally Listed Threatened and Endangered Animal Species in the Project Area

Scientific Name	Common Name	USFWS Threat Status
Myadestes palmeri	Puaiohi, Small Kauaʻi Thrush	Endangered
Oreomystis bairdi	ʻAkikiki	Endangered
Loxops careuleirostris	Akekeʻe	Endangered
Drepanis coccinea	ʻIʻiwi	Threatened
Branta sandvicensis	Nēnē, Hawaiian Goose	Threatened
Anas wyvilliana	Koloa maoli, Hawaiian Duck	Endangered
Lasiurus cinereus semotus	Ōpeʻapeʻa, Hawaiian Hoary Bat	Endangered
Hydrobates castro	ʻAkēʻakē, Band-rumped Storm-petrel	Endangered
Erinna newcombi	Newcombʻs Snail	Endangered
Drosophila musaphilia	Hawaiian Picture-wing Fly	Endangered

Table F-4. Federally Designated Critical Habitats and Associated Species in the Project Area

Critical Habitat Unit	Species
Kauaʻi Lowland Wet Ecosystem Unit 1	*Charpentiera densiflora, Cyanea eleeleensis, Cyanea kolekoleensis, Cyanea kuhihewa, Cyrtandra oenobarba Dubautia imbricata* ssp. *imbricata, Euphorbia remyi* var. *kauaiensis, Euphorbia remyi* var. *remyi, Labordia helleri, Melicope paniculata, Melicope puberula, Phyllostegia renovans, Platydesma rostrata, Polyscias bisattenuata, Polyscias flynnii, Stenogyne kealiae*
Kauaʻi Lowland Wet Ecosystem Unit 2	*Charpentiera densiflora, Cyanea eleeleensis, Cyanea kolekoleensis, Cyanea kuhihewa, Cyrtandra oenobarba, Dubautia imbricata* ssp. i*mbricata, Euphorbia remyi* var. *kauaiensis, Euphorbia remyi* var. *remyi, Labordia helleri, Melicope paniculata, Melicope puberula, Phyllostegia renovans, Platydesma rostrata, Polyscias bisattenuata, Polyscias flynnii, Stenogyne kealiae*
Kauaʻi Lowland Wet Ecosystem Unit 3	*Charpentiera densiflora, Cyanea eleeleensis, Cyanea kolekoleensis, Cyanea kuhihewa, Cyrtandra oenobarba, Dubautia imbricata* ssp. *imbricata, Euphorbia remyi* var. *kauaiensis, Euphorbia remyi* var. *remyi, Labordia helleri, Melicope paniculata, Melicope puberula, Phyllostegia renovans, Platydesma rostrata, Polyscias bisattenuata, Polyscias flynnii, Stenogyne kealia*e
Kauaʻi Lowland Wet Ecosystem Unit 4	*Charpentiera densiflora, Cyanea eleeleensis, Cyanea kolekoleensis, Cyanea kuhihewa, Cyrtandra oenobarba, Dubautia imbricata* ssp. *imbricata, Euphorbia remyi* var. *kauaiensis, Euphorbia remyi* var. *remyi, Labordia helleri, Melicope paniculata, Melicope puberula, Phyllostegia renovans, Platydesma rostrata, Polyscias bisattenuata, Polyscias flynnii, Stenogyne kealiae*

Kauaʻi Lowland Wet Ecosystem Unit 5	*Charpentiera densiflora, Cyanea eleeleensis, Cyanea kolekoleensis, Cyanea kuhihewa, Cyrtandra oenobarba, Dubautia imbricata* ssp. *imbricata, Euphorbia remyi* var. *kauaiensis, Euphorbia remyi* var. *remyi, Labordia helleri, Melicope paniculata, Melicope puberula, Phyllostegia renovans, Platydesma rostrata, Polyscias bisattenuata, Polyscias flynnii, Stenogyne kealiae*
Kauaʻi Lowland Mesic Ecosystem Unit 1	*Canavalia napaliensis, Charpentiera densiflora, Doryopteris angelica, Dubautia kenwoodii, Euphorbia eleanoriae, Euphorbia remyi* var. *remyi, Labordia helleri, Pittosporum napaliense, Platydesma rostrata, Polyscias bisattenuata, Psychotria hobdyi*
Kauaʻi Lowland Mesic Ecosystem Unit 2	*Canavalia napaliensis, Charpentiera densiflora, Doryopteris angelica, Dubautia kenwoodii, Euphorbia eleanoriae, Euphorbia remyi* var. *remyi, Labordia helleri, Pittosporum napaliense, Platydesma rostrata, Polyscias bisattenuata, Psychotria hobdyi*
Kauaʻi Lowland Mesic Ecosystem Unit 3	*Canavalia napaliensis, Charpentiera densiflora, Doryopteris angelica, Dubautia kenwoodii, Euphorbia eleanoriae, Euphorbia remyi* var. *remyi, Labordia helleri, Pittosporum napaliense, Platydesma rostrata, Polyscias bisattenuata, Psychotria hobdyi*
Kauaʻi Lowland Mesic Ecosystem Unit 4	*Canavalia napaliensis, Charpentiera densiflora, Doryopteris angelica, Dubautia kenwoodii, Euphorbia eleanoriae, Euphorbia remyi* var. *remyi, Labordia helleri, Pittosporum napaliense, Platydesma rostrata, Polyscias bisattenuata, Psychotria hobdyi*
Kauaʻi Montane Mesic Ecosystem Unit 1	*Asplenium dielmannii, Drosophila sharpi, Euphorbia remyi* var. *remyi, Labordia helleri, Loxops caeruleirostris, Melicope knudsenii, Myrsine knudsenii, Myrsine mezii, Oreomystis bairdi, Platydesma rostrata, Polyscias flynnii, Psychotria grandiflora, Stenogyne kealiae*

Kauaʻi Montane Mesic Ecosystem Unit 2	*Astelia waialealae, Drosophila sharpi, Dryopteris crinalis* var. *podosorus, Dubautia kalalauensis, Dubautia waialealae, Euphorbia remyi var. remyi, Geranium kauaiense, Keysseria erici, Keysseria helenae, Labordia helleri, Labordia pumila, Loxops caeruleirostris, Lysimachia daphnoides, Melicope degeneri, Melicope puberula, Myrsine mezii, Oreomystis bairdi, Phyllostegia renovans, Platydesma rostrata, Polyscias flynnii, Psychotria grandiflora*
Kauaʻi Montane Mesic Ecosystem Unit 3	*Canavalia napaliensis, Charpentiera densiflora, Doryopteris angelica, Dubautia kenwoodii, Euphorbia eleanoriae, Euphorbia remyi* var. *remyi, Labordia helleri*
Kauaʻi Montane Wet Ecosystem Unit 1	*Astelia waialealae, Drosophila sharpi, Dryopteris crinalis* var. *podosorus, Dubautia kalalauensis, Dubautia waialealae, Euphorbia remyi* var. *remyi, Geranium kauaiense, Keysseria erici, Keysseria helenae, Labordia helleri, Labordia pumila, Loxops caeruleirostris, Lysimachia daphnoides, Melicope degeneri, Melicope puberula, Myrsine mezii, Oreomystis bairdi, Phyllostegia renovans, Platydesma rostrata, Polyscias flynnii, Psychotria grandiflora*
Kauaʻi Montane Wet Ecosystem Unit 2	*Astelia waialealae, Drosophila sharpi, Dryopteris crinalis* var. *podosorus, Dubautia kalalauensis, Dubautia waialealae, Euphorbia remyi* var. *remyi, Geranium kauaiense, Keysseria erici, Keysseria helenae, Labordia helleri, Labordia pumila, Loxops caeruleirostris, Lysimachia daphnoides, Melicope degeneri, Melicope puberula, Myrsine mezii, Oreomystis bairdi, Phyllostegia renovans, Platydesma rostrata, Polyscias flynnii, Psychotria grandiflora*
Kauaʻi Wet Cliff Ecosystem Unit 2	*Cyanea dolichopoda, Cyrtandra oenobarba, Cyrtandra paliku, Dubautia plantaginea ssp. magnifolia*
Kauaʻi Dry Cliff Ecosystem Unit 2	*Euphorbia eleanoriae, Lysimachia scopulensis, Schiedea attenuata, Stenogyne kealiae*
Newcomb's Snail Unit 1 Kalalau Stream	*Erinna newcombi*
Newcomb's Snail Unit 1 Hanakapiʻai Stream	*Erinna newcombi*
Newcomb's Snail Unit 1 Hanakoa Stream	*Erinna newcombi*
Kauaʻi Unit 1 Kōkeʻe	*Drosophila musaphilia*

Kauaʻi Plants Unit 11	*Adenophorus periens, Alectryon macrococcus, Asplenium dielpallidum, Schiedea viscoa, Bonamia menziesii, Brighamia insignis, Centaurium sebaeoides, Euphorbia halemanui, Ctenitis squamigera, Cyanea recta, Cyanea remyi, Cyperus trachysanthos, Cyrtandra cyaneoides, Cyrtandra limahuliensis, Cyanea rivularis, Delissia kauaiensis, Dubautia latifolia, Euphorbia haeleeleana, Exocarpos luteolus, Flueggea neowawraea, Gouania meyenii, Kadua cookiana, Kadua st. johnii, Hesperomannia lydgatei, Hibiscadelphus woodii, Hibiscus waimeae ssp. hannerae, Isodendrion laurifolium, Isodendrion longifolium, Kokia kauaiensis, Labordia lydgatei, Lipochaeta fauriei, Lipochaeta micrantha, Lobelia niihauensis, Melicope haupuensis, Melicope knudsenii, Melicope pallida, Polyscias racemosum, Myrsine linearifolia, Nothocestrum peltatum, Peucedanum sandwicense, Phyllostegia knudsenii, Phyllostegia waimeae, Plantago princeps, Platanthera holochila, Poa mannii, Poa sandvicensis, Pteralyxia kauaiensis, Remya kauaiensis, Remya montgomeryi, Schiedea apokremnos, Schiedea helleri, Schiedea kauaiensis, Schiedea membranacea, Schiedea spergulina* var. *spergulina, Schiedea stellarioides, Solanum sandwicense, Spermolepis hawaiiensis, Stenogyne campanulata, Wilkesia hobdyi, Xylosma crenatum, Zanthoxylum hawaiiense*
Kauaʻi Plants Unit 10	*Adenophorus periens, Bonamia menziesii, Cyanea asarifolia, Cyanea remyi, Cyanea undulata, Cyrtandra limahuliensis, Dubautia pauciflorula, Exocarpos luteolus, Hesperomannia lydgatei, Isodendrion longifolium, Labordia lydgatei, Labordia tinifolia* var.*wahiawaensis, Lysimachia filifolia, Myrsine linearifolia, Huperzia nutans, Plantago princeps, Pteralyxia kauaiensis, Viola helenae, Viola kauaiensis* var. *wahiawaensis.*

Appendix G:

Federal Authorization for National Historical Preservation Act Section 106 Consultation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2023-0004317-01

June 2, 2023

Mr. Alan Downer, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Blvd., Suite 555
Kapolei, HI 96707

Subject: Authorization of Hawai‘i Division of Forestry and Wildlife to Initiate and Conduct NHPA Section 106 Consultations for the Use of *Wolbachia*-based Incompatible Insect Technique for the Suppression of Southern House Mosquito Populations on Kaua‘i Project

Dear Mr. Downer:

The U.S. Fish and Wildlife Service (Service) in partnership with the Hawai‘i Division of Forestry and Wildlife (DOFAW) is developing an environmemtal assessment to analyze the release of Wolbachia-based incompatible male southern house mosquitoes in the Kōke‘e and Alaka‘i Wilderness areas to reduce avian disease and prevent extinction of threatened and endangered forest bird species on Kaua‘i. The Service’s need is to consider the provision of appropriated funds for invasive mosquito control in furtherance of the conservation and recovery of federally threatened and endangered species. The Service is therefore the Federal Agency responsible for compliance with Section 106 consultation requirements for this project under the National Historic Preservation Act, as amended (16 U.S.C. 470(f)).

Pursuant to 36 CFR § 800.2(c)(4), the Service will authorize DOFAW to initiate and conduct Section 106 consultation with the State Historic Preservation Officer (SHPO) and others but remains legally responsible for all findings and determinations. This letter serves to notify the Hawaii SHPO of this authorization.

As part of this process, DOFAW will initiate the Section 106 process, identify historic properties and an assessment of adverse effect (36 CFR §§ 800.3 through 800.5) to the SHPO. DOFAW will seek to secure concurrence or disagreement with the finding from the SHPO in writing.

To ensure that the Service agrees with DOFAW, the parties have decided to work together during consultation by following the terms below:

1. Prior to distributing any correspondence, DOFAW will provide the Service an opportunity to review documents to ensure all regulatory requirements are satisfied.
2. Prior to issuing a finding of effect, the Service be given an opportunity to review and concur.
3. DOFAW will provide the Service with all responses and correspondence received from consulting parties.

Additionally, the DOFAW will notify the Service whenever:

1. The SHPO believes that the criteria for adverse effect pursuant to 36 CFR § 800.5 applies to the project.
2. There is a disagreement between DOFAW and SHPO about the area of potential effects, identification, and evaluation of historic properties, and/or the assessment of effects.
3. There is an objection from a consulting party or the public regarding its involvement in the review process established by 36 CFR Part 800, findings and determinations, or implementation of agreed- upon resolution.
4. There is the potential for foreclosure or anticipatory demolition as defined under 36 CFR § 800.9(b) and (c).

Please contact Michelle Clark at (808) 457-7276 or by email at michelle_clark @fws.gov if you have any questions on this matter.

Sincerely,

MICHELLE BOGARDUS

Digitally signed by MICHELLE BOGARDUS
Date: 2023.06.01 21:28:23 -10'00'

Michelle Bogardus,
Deputy Field Supervisor - Geographic Operations

cc: David Smith, DOFAW
Lainie Berry, DOFAW
Sherri Mann, DOFAW

Appendix H:

Federal and State Preparatory Notice for Draft Environmental Assessment

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850

State of Hawai'i
DEPARTMENT OF LAND AND
NATURAL RESOURCES
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawai'i 96813

In Reply Refer To:
2023-0004317

October 21, 2022

Subject: Preparatory Notice for draft Environmental Assessment for the proposed "Use of Wolbachia-based Incompatible Insect Technique for the suppression of Southern House Mosquito (*Culex quinquefasciatus*) populations in the Kōke'e and Alaka'i areas of Kaua'i"

Dear Reader:

This letter serves for the Hawai'i Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) and the U.S. Fish and Wildlife Service (Service), collectively referred to herein as the "Resource Agencies", to provide notice and solicit initial comments and recommendations for the proposed "Use of Wolbachia-based Incompatible Insect Technique for the suppression of Southern House Mosquito (*Culex quinquefasciatus*) populations in the Kōke'e and Alaka'i areas of Kaua'i".

The State of Hawai'i DLNR proposes employing Incompatible Insect Technique (IIT) to reduce mosquito populations within approximately 59,204 acres (23,959 hectares) of forest reserves, state parks, and private lands in the Kōke'e and Alaka'i areas of Kaua'i to suppress mosquitoes known to vector diseases to native forest birds in critical higher-elevation native forest habitat. The proposed project is a joint project of the Resource Agencies; and in order to comply with each agencies' obligations under the National Environmental Policy Act (NEPA) and Hawai'i Revised Statutes (HRS) Chapter 343, DOFAW and the Service are preparing an environmental assessment (EA) to address the release of male mosquitoes with incompatible *Wolbachia* in the Kōke'e and Alaka'i areas shown in Figures 1 and 2 below.

The IIT approach is also being evaluated for implementation by the National Park Service (NPS) and DLNR to control species in forest bird critical habitat on the island of Maui. The EA entitled "Suppression of non-native mosquito populations to address the impacts of avian malaria on threatened and endangered forest birds on East Maui" will satisfy NEPA and HRS Chapter 343 compliance. Any public comments submitted to NPS for the East Maui EA will be independent from any comments submitted to DLNR regarding the Kauai IIT mosquito EA identified in this pre-notification letter.

The native forest birds of Kaua'i face several threats to their survival. Already, 10 of the 16 native honeycreepers of Kauai have gone extinct, and 3 of the remaining 6 species are endangered or threatened. One native thrush (puaiohi) and one native flycatcher (Kauai elepaio) also still occur within intact areas of native forest in higher elevation areas of the island. Although several factors contribute to the continuing decline in native bird populations, the main

threats to Hawaiian forest birds are avian malaria (*Plasmodium relictum*) and avian pox (*Avipoxvirus* spp.); diseases principally spread by the non-native southern house mosquito (*Culex quinquefasciatus*). Despite the danger that these diseases pose to native forest birds, there has not, until recently, been a viable method to control mosquito populations within natural areas in Hawai‘i.

The IIT has been successfully implemented in over ten countries throughout the world to control mosquitoes that carry human diseases, including four cities in the United States. The technique uses lab-raised male mosquitoes which carry a select strain of *Wolbachia*, a bacterium that naturally occurs in up to 70% of insects. When male mosquitoes, which do not bite or transmit diseases, with this select strain of *Wolbachia* are released into a target habitat and mate with wild female mosquitoes that either contain different strains of *Wolbachia* or no strains, the eggs fail to develop due to the cytoplasmic incompatibility of the *Wolbachia* strains of the male and female mosquitoes. The mosquito species targeted for control in this process are also a vector of human diseases, such as West Nile Virus and lymphatic filariasis, and can transmit heartworm to pets. The development of IIT for mosquito-borne diseases that affect humans presents a unique opportunity to use the technique to control mosquitoes that spread avian diseases to native forest bird species in Hawai‘i. This approach does not employ genetic engineering and does not involve or result in either mosquitoes or bacteria being genetically modified organisms.

The DLNR proposes to employ IIT to reduce mosquito populations within the Kōke‘e and Alaka‘i areas of Kaua‘i (figures 1 and 2 below). This effort is consistent with the agency’s statutory missions and responsibilities. The project would involve mass-rearing and releasing of male mosquitoes that carry a strain of *Wolbachia* that is incompatible with existing wild female mosquitoes in the area. The male mosquitoes would be released from the ground, along established roads and trails. Additionally, release mechanisms are currently being developed which could enable the use of helicopters or drones to release mosquitoes from the air. Only existing routes of travel will be used, and no new roads, trails, helicopter or drone landing zones will be constructed to support this effort.

The release of incompatible male mosquitoes would take place within 59,204 acres (23,959 hectares) of northwestern Kaua‘i. This area includes portions of the Kōke‘e State Park, Hono o Nā Pali Natural Area Reserve, Ku‘ia Natural Area Reserve, Nā Pali Coast State Wilderness Park, Nā Pali-Kona Forest Reserve, the Alaka‘i Wilderness Preserve, as well as privately owned lands. The Kōke‘e State Park, Nā Pali-Kona Forest Reserve, and the Alaka‘i Wilderness Preserve overlap with the extant native forest habitat, including critical habitat for ‘akeke‘e (*Loxops caeruleirostris*) and ‘akikiki (*Oreomystis bairdi*), on the island. Extensive pre- and post-release monitoring would be implemented to determine the impacts of releasing the incompatible male mosquitoes on the local mosquito population.

It is anticipated that the Service will provide federal funding for the implementation of this action through congressionally allocated funds for the conservation and recovery of federally threatened and endangered species and/or the control of invasive species, including but not limited to potential funding through Recovery Challenge grants, Section 6 funds, State Wildlife Grants, funds awarded via the Pacific Island Fish and Wildlife Office or the Science Applications program, or other similar funding programs. The Service’s purpose and need for the project is to provide aid for the implementation of activities that would contribute to the recovery and conservation of several federally listed species, including the ‘akeke‘e, ‘akikiki, puaiohi

(*Myadestes palmeri*), and ʻiʻiwi (*Drepanis coccinea*), as well as other avian species showing concerning declines in population and range.

Transmitted for your review and comment is information on the above-referenced project. Please see enclosed maps of the project area and submit any comments to Cynthia King at cynthia.b.king@hawaii.gov by the internal deadline of October 24, 2022 to November 22, 2022. If no response is received by the indicated due date, we will assume your agency has no comments at this time. Should you have any questions about this request, please contact Cynthia King at cynthia.b.king@hawaii.gov. General information regarding the project can also be found on the www.birdsnotmosquitoes.org website. Information on the HEPA process can be found at https://planning.hawaii.gov/erp/

Sincerely,

Earl Campbell, Ph.D.
Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service

David G. Smith
Forestry and Wildlife Administrator
Division of Forestry and Wildlife
State of Hawaii Department of Land and Natural Resources

enclosures

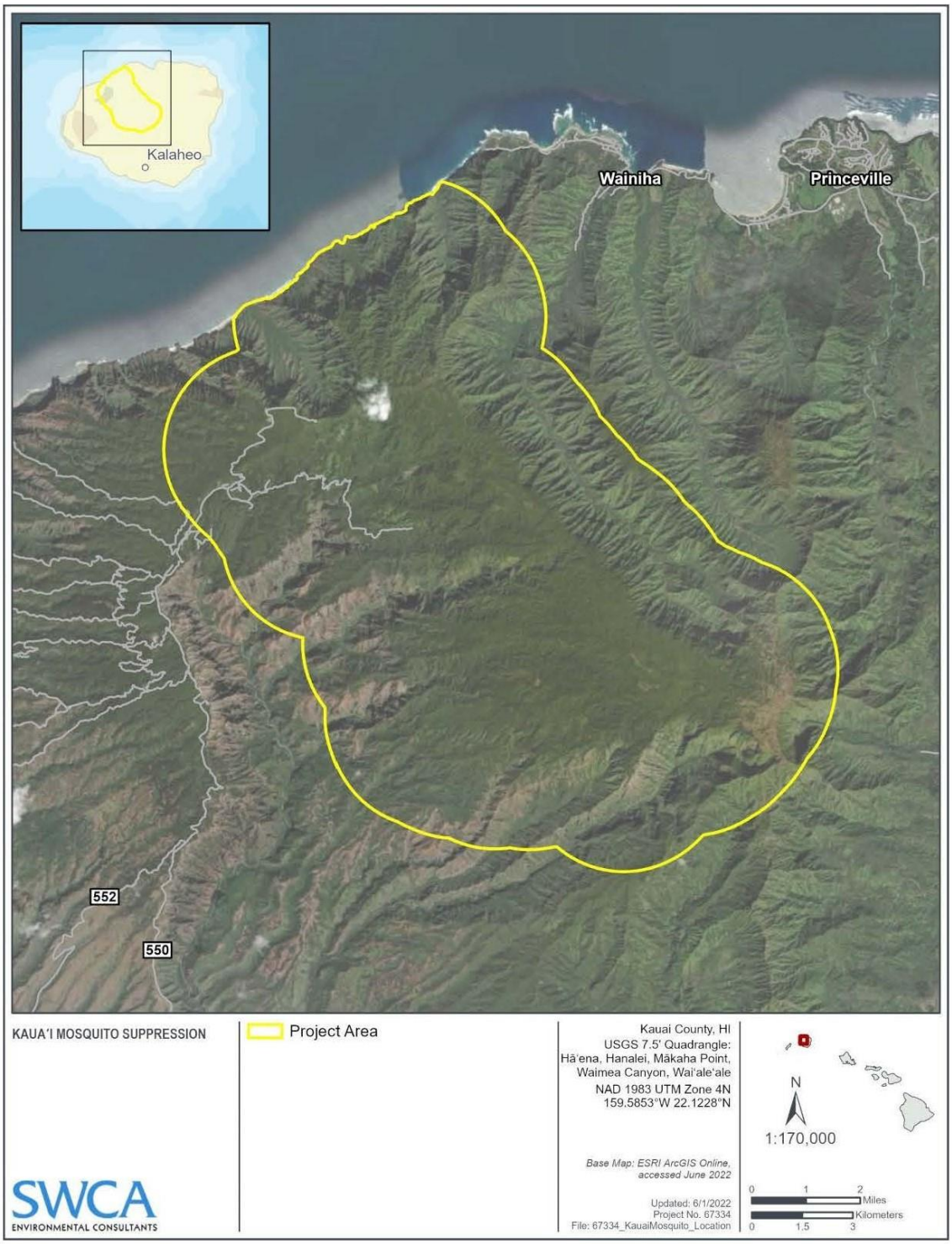

Figure 1. Boundaries of the project area.

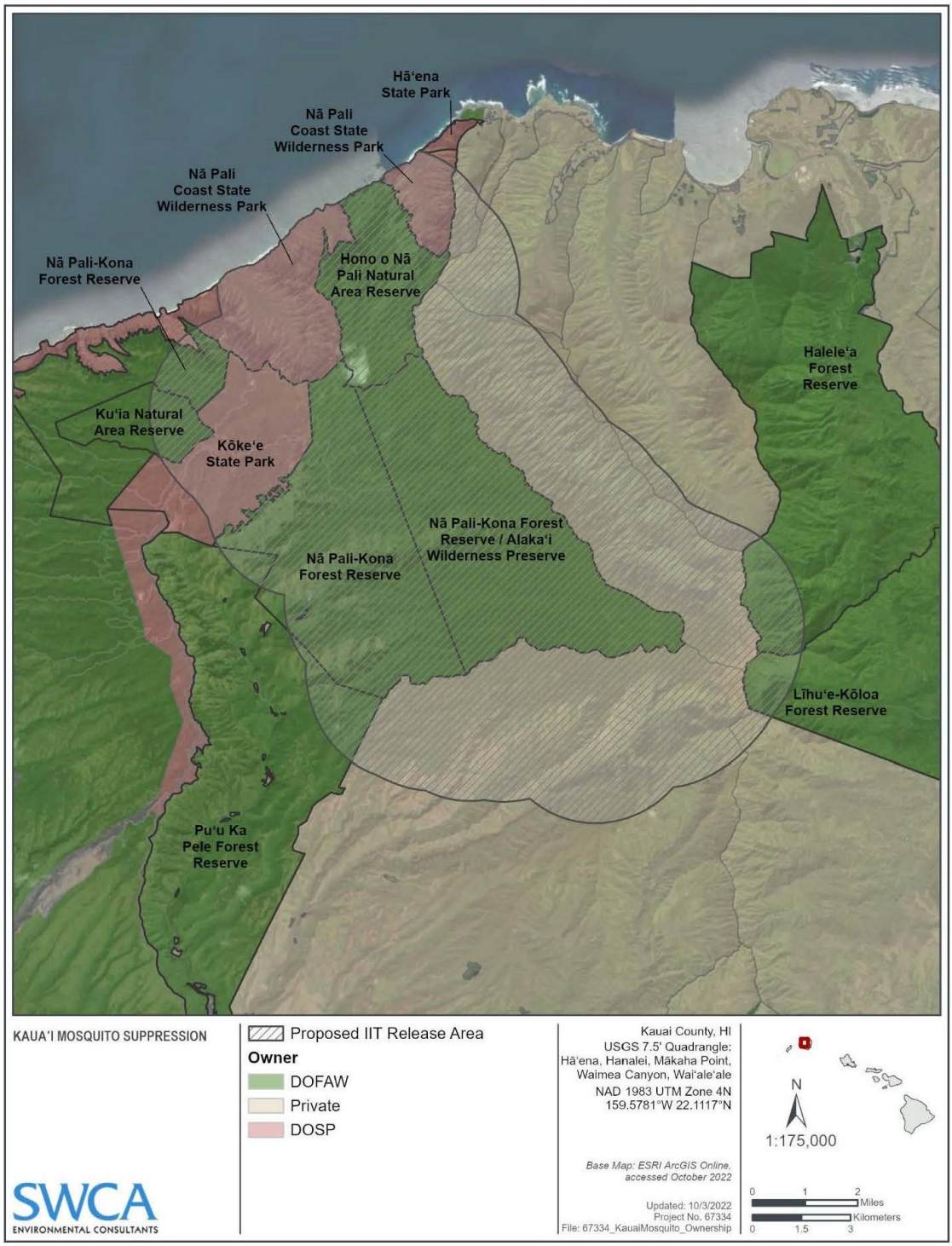

Figure 2. State Parks, Forest Reserves, Natural Area Reserves and private lands within and overlapping the project area.

Table H1. List of offices and/or people contacted with Federal and State preparatory notice of Draft Environmental Assessment.

Office or Entity Contacted	Contact Name	Title	Island
ʻAha Mālama, Corp.	ʻĀnela Jackson	President	
Alexander & Baldwin Properties, Inc.	Sean O'Keefe		Kauai
Alexander and Baldwin	Chad Brue		
American Bird Conservancy	Steve Holmer		—
Association of Hawaiian Civic Clubs	Mr. Hailama Farden	President	
Board of Land and Natural Resources, Kauai member	Karen Ono		Kauai
Cattlemen's Association	Nicole Galase		
Center for Biological Diversity	Amy Atwood	Legal Director	—
Council for Native Hawaiian Advancement	Mr. Joseph Kūhiō Lewis	CEO	
Department of Hawaiian Homelands	Andrew Choy		Oahu
Department of Hawaiian Homelands, Kaua`i Office	Erna Kamabayashi		Kaua'i
Department of Interior, Office of Native Hawaiian Relations	Lisa C. Oshiro-Saganuma		Oahu
Department of Land and Natural Resources - CWRM			
Department of Land and Natural Resources - DAR	Brian Neilson		
Department of Land and Natural Resources - Engineering Division			
Department of Land and Natural Resources - Land Division	Russell Tsuji		
Department of Transportation	Jade Butay		Oahu
Earthjustice	David L. Henkin		Oahu
Garden Island Resource, Conservation, and Development Inc.	Gilbert P. Kea		Kauai
Grove Farm	Casey Watabu		Kauai
Hālau Ka Lei Mokihana O Leināʻala	Leināʻala Jardin	Kuma Hula	

Office or Entity Contacted	Contact Name	Title	Island
Halau member	Sally Jo Manea		
Hanalei Watershed Hui	Makaala Kaaumoana		Kauai
Hanalei Watershed Hui; Kauai Wildlife Coalition; Hui Hoʻomalu i ka ʻāina	Makaʻala Kaʻaumoana		
Hanapepe salt pans	Malia Nobrega-Olivera		
Hawaii Audubon Society	John Harrison		Oahu
Hawaii Cattleman's Association	Nicole Galase		Hawaii
Hawaii Conservation Alliance	Emma Anders		Oahu
Hawaii State Government	Dee Morikawa	Representative	
Hawaii State Government	James Kunane Tokioka	Representative	
Hawaii State Government	Mayor of Kauai		
Hawaii State Government	Nadine K. Nakamura	Representative	
Hawaii State Government	Ronald D. Kouchi	Senator	
Hoʻokipa Network	Puanani Rogers		
Homestead Community Development Corporation	Robin Danner		
Hui Huliau Inc.	Adrian Nakea Silva	Chairman	
Hui o Laka - Kokeʻe Natural History Museum	Chris Faye		
Imua Hawaii	Dreanalee Kalili	Treasurer	
"KAHEA			
The Hawaiian-Environmental Alliance"	Miwa Tamanaha		Oahu
Kamehameha Schools	Mililani Browning		
Kamehameha Schools	Namaka Whitehead		Hawaii
Kamehameha Schools - Community Relations and Communications Group, Government Relations	Piilani Hanohano	Coordinator, Government Relations	
Kanu o ka ʻĀina Learning ʻOhana	Taffi Wise	Executive Director	
Kaua`i Aha Moku			
Kauai Albatross Network; Kauai Wildlife Coalition	Hob Osterlund		
Kauai Chamber of Commerce	Mark Perriello	Director	
Kauaʻi County Council			

Office or Entity Contacted	Contact Name	Title	Island
Kauaʻi Cultural Center	Leilani Darryl		
Kauai Historic Preservation Review Commission			
Kauaʻi Historical Society	Randy Wichman	Interim President	
Kauaʻi Museum			
Kawaileo Law A Limited Liability Law Company	Naʻunanikinau Kamaliʻi		
Ke Kula Niʻihau o Kekaha			
Kekaha Hawaiian Homestead Association	Liberta Hussey-Albao		
Makaweli Poi Mill	John Aʻana		
Malama Anahola	Sherri Cummings	President	
Malama Huleiʻa			
Na Koa Ikaika Ka Lahui Hawaii	Mililani Trask	Convenor	
Nā Kuleana o Kānaka ʻŌiwi	Donna Kaliko Santos		
Na Pali Coast ʻOhana	Sabra Kauka		
National Park Service, Pacific Island Support Office	Melia Lane-Kamahele		Oahu
National Tropical Botanical Gardens	Charles R. Wichman, Jr.		Kauai
NAVFAC Pacific	Norma Creps		Oahu
Niʻihauan Ranch	Mary Sue Matter		
NTBG, Kokeʻe lessees	Chipper & Hauʻoli Wichman		
Office of Conservation and Coastal Lands	Michael Cain		Oahu
Office of Hawaiian Affairs	Dan Ahuna		
Office of Hawaiian Affairs	Sylvia M. Hussey Ed.D.	CEO	
Office of Hawaiian Affairs	Kuulei Stockman	CEO	Oahu
Office of Planning, State of Hawaii	Mary Alice Evans	Director	Oahu
Office of the CEO, The Nature Conservancy	Mark Tercek		—
Office of the Chairperson, Hawaii Department of Agriculture	Phyllis Shimabukuro-Geiser		Oahu
Office of the Coordinator, Kauai Watershed Alliance, The Nature Conservancy, Kauai Program	Melissa Fisher		Kauai

Office or Entity Contacted	Contact Name	Title	Island
"Office of the Director			
US Forest Service, Institute of Pacific Islands Forestry, Pacific Southwest Research Station"	Susan Cordell		Hawaii
Office of the Director, Department of Hawaiian Homelands	William Aila, Jr.		Oahu
Office of the Director, Kauai Chamber of Commerce	Mark Perriello		Kauai
Office of the Director, Kauai County Council	Luke Evslin		Kauai
Office of the Director, National Fish and Wildlife Foundation	Amanda Bassow		—
Office of the Executive Director, Conservation Council for Hawaii	Les welsh		Oahu
Office of the Governor, State of Hawaii, Executive Chambers, State Capital	David Ige	The Honorable	Oahu
Office of the Mayor, Kauai County	Derek Kawakami	The Honorable	Kauai
Office of the President and CEO, National Audubon Society	David Yarnold		—
Office of the Program Manager, Garden Isle Resource, Conservation and Development Council			Kauai
Office of the Representative	Ed Case	Representative	Oahu
Office of the Representative	Kai Kahele	Representative	Oahu
Office of the Representative, Hawaii State Capital	Chris Todd	Representative	Oahu
Office of the Representative, Hawaii State Capital	Joy A. Sue Buenaventura	Representative	Oahu
Office of the Representative, Hawaii State Capital	Mark M. Nakashima	Representative	Oahu
Office of the Representative, Hawaii State Capital	Richard H.K. Onishi	Representative	Oahu
Office of the Senator	Brian Schatz	Senator	Oahu
Office of the Senator	Mazie Hirono	Senator	Oahu
Office of the Senator, Hawaii State Capital	Kaialii Kahele	Senator	Oahu

Office or Entity Contacted	Contact Name	Title	Island
Office of the Senator, Hawaii State Capital	Lorraine R. Inouye	Senator	Oahu
Office of the Senator, Hawaii State Capital	Russel E. Ruderman	Senator	Oahu
OHA, Community Outreach Coordinator, Kaua`i	Kaliko Santos		
Pacific Islands Refuges and Monuments Office			
US Fish and Wildlife Service			
	Ricardo Lopez		Oahu
Pacific Missile Range Facility	Jessi Hallman Behnke		
Pacific Rim Conservation	Eric VanderWerf	Dr.	Oahu
Pacific Rim Conservation	Lindsay Young	Dr.	
Robinson family			
San Diego Zoo, Conservation Program	Ron Swaisgood		—
Senior Vice President, Conservation Policy National Audubon Society	Sarah Greenberger		—
Sierra Club, Hawaii Chapter	Robert D. Harrix, Esq.		Oahu
State Historic Preservation Division			
Kakuhihewa Building	Alan Downer		Oahu
Supervising Deputy Attorney General			
Land and Transportation Division	Julie China		Oahu
The Nature Conservancy of Hawaii	Ulalia Woodside	Executive Director	Oahu
The Nature Conservancy of Hawaii, Cultural Practitioner, BLNR, etc.	Sam ‘Ohu Gon		
The Wildlife Society, Hawaii Chapter	Caroline Thow		Oahu
U.S. Geological Survey, Pacific Islands Ecosystem Research Center	Bob Reed	Director	Hawaii
USDA - Natural Resources Conservation Service	Jennifer Higashino		Oahu

Appendix I:

Responses to Substantive Public Comments on Environmental Assessment