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IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAI‘I

HAWAII UNITES, a 501(c)(3) nonprofit corporation; Tina Lia, an individual,

Plaintiffs,

vs.

BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAI‘I, and DEPARTMENT OF LAND AND NATURAL RESOURCES, STATE OF HAWAI‘I,

Defendants,

and

AMERICAN BIRD CONSERVANCY,

Defendant-Intervenor.

CIVIL NO. 1CCV-23-0000594

DEFENDANT STATE OF HAWAII'S MOTION FOR SUMMARY JUDGMENT; MEMORANDUM IN SUPPORT OF MOTION; DECLARATION OF MIRANDA C. STEED; EXHIBITS "1" – "2"; NOTICE OF HEARING MOTION; CERTIFICATE OF SERVICE

Hearing
Date: January 17, 2024
Time: 9:00 a.m.
Judge: Honorable John M. Tonaki

DEFENDANT STATE OF HAWAII'S MOTION FOR SUMMARY JUDGMENT

The Board of Land and Natural Resources, State of Hawai'i ("Board" or "BLNR") and Department of Land and Natural Resources, State of Hawai'i ("DLNR") (collectively the "State") move for summary judgment on the remaining claim in the Complaint filed on May 8, 2023. JEFS 1. There is no genuine issue of any material fact, and the State is entitled to judgment as a matter of law.

This Motion is based upon Rules 7 and 56 of the Hawai'i Rules of Civil Procedure and is supported by the Memorandum in Support of Motion, the attached Declaration and Exhibits, the records and files in this matter, and anything else that may be adduced at a hearing on this Motion or any other hearing in this matter.

DATED: Honolulu, Hawai'i, December 22, 2023.

/s/ Miranda C. Steed .
JULIE H. CHINA
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BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAI'I AND DEPARTMENT OF LAND AND NATURAL RESOURCES, STATE OF HAWAI'I

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MEMORANDUM IN SUPPORT OF MOTION

I. INTRODUCTION

The time for action to save native Hawaiian birds is now. Hawaiian honeycreepers sit at the precipice of extinction. Decades of scientifically sound research proffer a solution to saving the remaining Hawaiian honeycreepers from their greatest threat: avian malaria. Plaintiffs challenge the thoroughness of the environmental review of a project that aims to suppress mosquito populations carrying avian malaria through incompatible insect technology ("IIT"). Plaintiffs try to sound the alarm on decades of principled scientific research and previous peer-reviewed studies on the effectiveness and safety of using IIT. In short, Plaintiffs challenge the only viable option for saving Hawaiʻi's cherished native birds.

Only seventeen Hawaiian honeycreeper species are left. Ex. 1 (part 1) at 12.[1] Avian malaria threatens imminent extinction for many of those seventeen. *Id.* The Board of Land and Natural Resources ("BLNR" or "Board") approved a final environmental assessment ("EA") and finding of no significant impact ("FONSI") on March 24, 2023, which was published in the Environmental Notice on April 8, 2023. *Id.* at 2-3. The EA assesses a United States National Park Service ("NPS") and Department of Land and Natural Resources ("DLNR") project designed to reduce native bird mortality from avian malaria in East Maui by suppressing southern house mosquito (*Culex quincquefasciatus*) populations ("Project"). Non-native, invasive southern house mosquitos are the only host that transmits avian malaria in East Maui. *Id.*

The Project is designed to suppress southern house mosquito populations in East Maui by repeatedly releasing sterile male southern house mosquitos into the Project area, where there is a southern house mosquito population, which will prevent mosquitos within the Project area from reproducing. The Project uses IIT to inject lab-bred male mosquitoes with an artificial strain of stable bacteria—*Wolbachia*, which naturally occurs and is present in many insect species on Maui. *Id.* at 13. This makes them sterile and unable to mate with wild females. *Id.* The Project proposes releasing these sterile males in forested regions of Haleakalā. *Id.* at 12. Because female *Culex quincquefasciatus* mosquitoes only mate once, the influx of sterile males would cause the females to not reproduce, reducing population size. *Id.* at 13. *Wolbachia* is already naturally

[1] Exhibit 1 is broken up into two documents to accommodate size requirements for e-filing. The citation indicates whether the information is in part 1 or 2 and references the PDF page number of that document.

present in *Culex quincquefasciatus* mosquitoes in Hawai‘i. *Id.* And it cannot be transferred to humans. *Id.*

In other words, the Project aims to save native Hawaiian forest birds from extinction by releasing male mosquitoes that do not bite and are injected with bacteria already present in the wild that makes them sterile to prevent reproduction. This technique is not new and this is not the first time it has been used for control of mosquitoes as disease vectors.

Plaintiffs filed the instant case to challenge the Board's decision to approve the EA and determination that the Project will not have an adverse environmental impact. Compl. ¶¶ 47-48.

Plaintiffs' Complaint has two claims for relief. The first claim is that the Board erroneously issued a Finding of No Significant Impact and erroneously accepted the Final Environmental Assessment. The second claim was an alleged violation of HRS Chapter 91 for denying Plaintiffs' contested case hearing request. On June 26, 2023, the State filed a Partial Motion to Dismiss Complaint (JEFS 54). After briefing from all parties and a hearing on the matter on July 19, 2023, this Court granted the State's Partial Motion to Dismiss Complaint and dismissed Plaintiffs' second claim for relief. *See* JEFS 151.

Plaintiffs filed a Motion for Preliminary Injunction (JEFS 37). The parties briefed the matter and a hearing on Plaintiffs' Motion for Preliminary Injunction started on July 21, 2023. Plaintiffs' presented testimony from two live witnesses, Dr. Lorrin Pang ("Dr. Pang") and Plaintiff Tina Lia ("Plaintiff Lia"), then rested. The State and American Bird Conservancy began the presentation of their defense with a live witness, but due to time constraints, was unable to finish its case. The hearing on Plaintiffs' Motion for Preliminary Injunction has been continued to February 7-8, 2023.

Plaintiffs contend that the EA should have been an EIS because they disagree with BLNR's conclusion that the project will not have a significant impact. There are no disputed material facts in the instant matter and the State is entitled to summary judgment as a matter of law. The State brings this motion for summary judgment as to the remaining count against them and respectfully asks this Court to grant judgment in favor of the State.

II. LEGAL STANDARDS

Summary Judgment

Summary judgment is appropriate where "the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law." *Haw. Cmty. Fed. Credit Union v. Keka*, 94 Hawai'i 213, 221, 11 P.3d 1, 9 (2000). A given fact is material "if proof of that fact would have the effect of establishing or refuting one of the essential elements of a cause of action or defense asserted by the parties." *Querubin v. Thronas*, 107 Hawai'i 48, 56, 109 P.3d 689, 697 (2005) (citation omitted). "A party opposing a motion for summary judgment cannot discharge his or her burden by alleging conclusions, 'nor is he entitled to a trial on the basis of a hope that he can produce some evidence at that time.'" *Henderson v. Pro. Coatings Corp.*, 72 Haw. 387, 401, 819 P.2d 84, 92 (1991) (citing 10A Wright, Miller & Kane, Federal Practice and Procedure, Civil 2d § 2727 (1983)).

HRS Chapter 343

HRS Chapter 343 "establish[es] a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making." HRS § 343-1. When applicable, the agency proposing an action must "assess the significance of the potential impacts of the action to determine the level of environmental review necessary." HAR § 11-

200.1-14(a). If the agency anticipates that a proposed action will not have a significant effect on the environment, a draft environmental assessment ("EA") may be prepared and submitted for public review and comment. *See* HAR §§ 11-200.1-2 (defining draft environmental assessment); -14(d), -19. Based on the analysis in the EA, a full environmental impact statement ("EIS") is required if the action "may have a significant effect on the environment." HRS § 343-5(c). Chapter 343's administrative rules enumerate various "significance criteria" to determine whether the action "may" have a significant effect. HAR § 11-200.1-13. If the agency determines that the proposed action "is not likely to have a significant effect," the agency issues a finding of no significant impact ("FONSI") and publishes a final EA. *See* HRS § 343-5(c); *see also* HAR § 11-200.1-22(b).

III. DISCUSSION

The BLNR properly accepted the EA and FONSI for the Project. Whether an EA is sufficient under HRS chapter 343 is a question of law, which is properly addressed through summary judgment. *Price v. Obayashi Hawaii Corp.*, 81 Hawai'i 171, 182, 914 P.2d 1364, 1375 (1996) (sufficiency of an EIS under Chapter 343 and its implementing rules is a question of law).

To determine if an EA is appropriate, an agency must determine whether the project may have a significant impact. HRS § 343-5. The agency makes this determination by evaluating significance criteria. HAR § 11-200.1-13. Here, the significance criteria analysis demonstrated that the project would not have a significant impact. Ex. 1 (part 2) at 99-100. Thus, a FONSI was issued.

Despite the length of the Complaint, Plaintiffs fail (or do not even attempt) to identify which significance criteria they allege the agency incorrectly applied. This alone is insufficient to establish a legitimate challenge to the agency's issuance of a FONSI. The sole question for this

Court is whether the agency met the requirements to determine that no significant impact would occur under the significance criteria.

A. The FEA was sufficient under HRS Chapter 343.

HRS Chapter 343 ("HEPA") is modeled after the National Environmental Protection Act ("NEPA"). *Sierra Club v. Dep't of Transp.*, 115 Hawai'i 299, 306, 167 P.3d 292, 299 (2007). Federal courts' interpretation of NEPA are thus persuasive when analyzing Chapter 343. *See e.g. id.* at 334, 167 P.3d at 341; *Kilakila 'O Haleakala v. Univ. of Hawai'i & David Lassner*, 138 Hawai'i 364, 378, 382 P.3d 176, 190 (2016).

Like an EA under Chapter 343, an EA under NEPA is merely an informational document.[2] *Native Ecosystems Council v. Weldon*, 697 F.3d 1043, 1053 (9th Cir. 2012); *Kahana Sunset Owners Ass'n v. Cty. of Maui*, 86 Hawai'i 66, 70, 947 P.2d 378, 382 (1997). The purpose of an EA "is simply to create a workable public document that briefly provides evidence and analysis for an agency's finding regarding an environmental impact." *Weldon*, 697 F.3d at 1053 (internal quotation marks and citations omitted). An EA is intended to be concise and less comprehensive than an EIS. *Malama Makua v. Rumsfeld*, 136 F. Supp. 2d 1155, 1160 (D. Haw. 2001).

An EA is required in specific circumstances set forth in HRS § 343-5. The instant project required a HEPA because the project proposes a use within areas designated as "conservation district" lands and State-owned lands. *See* HRS §§ 343-5(a)(1), -(a)(2).

Under Chapter 343, an EA must include the following:

> An environmental assessment is "an informational document prepared by either the agency proposing an action or a private applicant, which is used to evaluate the possible environmental effects of a proposed action." An environmental assessment must

[2] Plaintiffs agree that an EA or EIS is merely an informational document. Complaint at 14, ¶35.

> include the following: (1) a detailed description of the proposed action or project; (2) an evaluation of the direct, indirect, and cumulative impacts; (3) a discussion of alternatives to the proposed project or action; and (4) a description of any measures proposed to minimize potential impacts.

Kilakila, 138 Hawai‘i at 370, 382 P.3d at 182 (citations omitted). These four essential requirements, and other necessary content, are also listed in HAR § 11-200.1-13.

If, after the preparation of a draft EA, comments from the public, and the preparation of a final EA, the accepting agency may determine that the proposed action will not have a significant impact on the environment or that the proposed action requires further analysis through an environmental impact statement ("EIS"). If the agency anticipates that a proposed action will not have a significant impact on the environment, it must publish the FONSI with the Office of Planning and Sustainable Development. HRS § 343-5(c). On the other hand, if the agency anticipates that the proposed action may have a significant impact, it must prepare an environmental impact statement ("EIS"). *Id.*

Whether an EA is sufficient under Chapter 343 is a question of law which is properly addressed through summary judgment. *Price v. Obayashi Hawaii Corp.*, 81 Hawai‘i 171, 182, 914 P.2d 1364, 1375 (1996) (sufficiency of an EIS under Chapter 343 and its implementing rules is a question of law). Like an EIS, courts apply the "rule of reason" to determine whether an EA is sufficient. *Wild Wilderness v. Allen*, 12 F. Supp. 3d 1309, 1317 (D. Or. 2014), *aff'd*, 871 F.3d 719 (9th Cir. 2017); *see also Kaleikini v. Yoshioka*, 128 Hawai‘i 53, 82, 283 P.3d 60, 89 (2012) (the sufficiency of an EIS is evaluated under the "rule of reason"). Under the rule of reason, the court "ensure[s] that the agency has taken a 'hard look' at the potential environmental consequences of the proposed action." *Allen*, 12 F. Supp. 3d at 1317, *see also Sierra Club*, 115 Hawai‘i at 342, 167 P.3d at 335.

Here, Plaintiffs challenge only the determination that the project will not have a significant impact based on the significance criteria and that the agency reached this conclusion because it failed to address impacts, alternatives, and mitigation measures.

i. The FEA Sufficiently Evaluated the Impacts of the Project.

An EA is required to include "an evaluation of the direct, indirect, and cumulative impacts" of the proposed action. *Kilakila*, 138 Hawai'i at 370, 382 P.3d at 182. An EA is not required "to compile an exhaustive examination of each and every tangential event that potentially could impact the local environment. Such a task is impossible, and never-ending." *Weldon*, 697 F.3d at 1053 (citation and internal quotation marks omitted). "The EA is not an exhaustive examination of every possible environmental event, but must provide sufficient evidence and analysis to determine the reasonableness of the decision not to prepare an EIS." *Friends of the Wild Swan v. Weber*, 767 F.3d 936, 942 (9th Cir. 2014).

Potential impacts of the Project are discussed in Section 3 of the FEA. Ex. 1 (part 1) at 33-84. The significance of the potential impacts of the Project are discussed in Appendix G of the FEA. Ex. 1 (part 2) at 99-100. Plaintiffs' Complaint alleges a litany of unfounded potentially significant impacts of the Project that Plaintiffs believe were not contemplated in the FEA. Plaintiffs assert that the FEA failed to evaluate certain impacts of the Project.[3] However, during

[3] Plaintiffs allege that certain potential significant impacts of the Project were not considered in the FEA. The potential significant impacts identified by Plaintiffs include: horizontal transmission, Complaint at ¶¶ 86-88, 98-99; increase in pathogen infection, causing mosquitoes to become more capable of spreading avian malaria and west nile virus, *id.* at ¶ 89; *Wolbachia* is a parasitic host, *Id.* at ¶ 90; possible release of lab-reared female mosquitoes, *Id.* at ¶¶91, 127; the causation of an evolutionary event and population replacement, *Id.* at ¶ 93; biopesticide drift, *Id.* at ¶94; horizontal gene transfer, *Id.* at ¶95; lack of biosecurity protocols and pathogen screenings, *Id.* at ¶¶97, 129; effects on poultry and egg farms, *Id.* at ¶100; lack of analysis of impacts of mitigation measures, *Id.* at ¶101; the impacts of drone flights, *Id.* at ¶¶102-103, 128; modeling issues, *Id.* at ¶104; invasive species, *Id.* at ¶105; impacts on other endangered species, *Id.* at ¶130; and environmental justice issues, *Id.* at ¶¶115, 117, 130.

cross-examination of Plaintiff Lia during the hearing on Plaintiffs' Motion for Preliminary Injunction, Plaintiff Lia admitted that the FEA did in fact evaluate the impacts she was concerned about. For example:

Concern	The concern was addressed in the EA
Horizontal transmission. Compl. ¶¶ 86-89, 98-99; Ex. 2 (Transcript) at 134:5-7.[4]	Ex. 1 (part 2) (App. H) at 111-112; Ex. 2 (Transcript) at 175:13-16 (Plaintiff Lia stating the concern was addressed).
Increase in pathogen infection, causing mosquitoes to become more capable of spreading avian malaria and west nile virus. Compl. at ¶ 89; Ex. 2 (Transcript) at 134:12-17.	Ex. 1 (part 2) (App. H) at 102, 110-111; Ex. 2 (Transcript) at 172:4-7, 175:8-11 (Plaintiff Lia stating the concern was addressed).
Effects of *Wolbachia* introduction. Compl. ¶ 90; Ex. 2 (Transcript) at 139:3-9, 19.	Ex. 1 (part 2) (App. H) at 108; Ex. 2 (Transcript) at 174:6-11 (Plaintiff Lia stating the concern was addressed).
Accidental release of female mosquitoes. Compl. ¶¶ 91, 127; Ex. 2 (Transcript) at 137:25, 138:1.	Ex. 1 (part 2) (App. H) at 109-110; Ex. 2 (Transcript) at 175:3-7 (Plaintiff Lia stating the concern was addressed).
Evolutionary event and population replacement. Compl. ¶ 93; Ex. 2 (Transcript) at 135:10-11, 14-15.	Ex. 1 (part 2) (App. H) at 112-115; Ex. 2 (Transcript) at 176:1-6 (Plaintiff Lia stating the concern was addressed).

The allegations that the FEA did not consider the above-listed impacts is not only demonstrably false but also fail to identify any deficiencies that would make the FEA insufficient. Further, Plaintiffs' allegations regarding potential impacts of the Project are supported by only conjecture.

Plaintiffs have not put forth any argument that Defendants misapplied the significance criteria. *See generally* Compl. Although Plaintiffs list the significance criteria in the Complaint, the Complaint does not actually allege that any of the criteria were met or that the DLNR

[4] Exhibit 2 contains excerpts from the transcript from the preliminary injunction hearing on July 21, 2023. Page numbers are to the page number listed on the bottom righthand corner of the document.

improperly analyzed the criteria. Compl. ¶34. Defendants provided a full explanation of the application of each of the significance criteria required by HAR § 11-200.1-19(a). Ex. 1 (part 2) at 99-100. This alone is a failure by the Plaintiffs to meet their burden under HRS § 343-7. It is well-recognized that "agencies possess and exercise subject-matter expertise and experience the courts generally lack. These qualities place agencies in a better position than the courts to evaluate scientific investigations and research." *Keep the N. Shore Country v. Bd. of Land & Nat. Res.*, 150 Hawai'i 486, 504, 506 P.3d 150, 168 (2022) (internal citations omitted). The agency is entitled to deference on its evaluation of the significance criteria.

Additionally, the project has not been segmented. Plaintiffs point to an exemption the DLNR received to begin testing ("Mark Release Recapture") prior to receiving the EA and FONSI. Compl. at ¶ 80. In addition to having no evidence that testing began prior to the EA, Plaintiffs also failed to challenge that exemption within 120-days of the notice of exemption. They cannot skirt the time constraints of HRS § 343-7 by including that claim in this lawsuit.

In short, the FEA contains sufficient information to allow the approving agency, DLNR, to take a "hard look" at the potential environmental consequences of the Project. *Allen*, 12 F. Supp. 3d at 1317.

ii. The FEA Sufficiently Discussed Alternatives.

As opposed to an EIS, an agency preparing an EA does not need to "engage in a full blown detailed analysis of all potential alternatives[.]" *Coal. to Pres. McIntire Park v. Mendez*, 862 F. Supp. 2d 499, 530–31 (W.D. Va. 2012) (internal quotation marks omitted) (quoting *Friends of Congaree Swamp v. Fed. Highway Admin.*, 786 F.Supp.2d 1054, 1073 (D.S.C.2011)).Instead, "an agency only is required to include a brief discussion of reasonable alternatives." *Id*.

Plaintiffs argue the EA did not consider the full range of alternatives but do not identify any they think the agency failed to address. Compl. ¶ 134. However, an agency "has wide discretion to choose the alternatives to evaluate in light of the project's purpose and environmental impacts." *Klein v. U.S. Dep't of Energy*, 753 F.3d 576, 582 (6th Cir. 2014) (citation omitted). An agency ***does not*** need to consider alternatives which are not "significantly distinguishable from alternatives already considered, or which have substantially similar consequences[.]" *Wild Fish Conservancy v. Nat'l Park Serv.*, 8 F. Supp. 3d 1289, 1299 (W.D. Wash. 2014), *aff'd*, 687 F. App'x 554 (9th Cir. 2017).

The only alternative is no action, which will result in extinction. Ex. 1 (part 1) at 12-13. DLNR considered and dismissed without further analysis other alternatives because they were not viable. *Id.* at 112-117. Avian malaria is the preeminent threat to Hawaiian honeycreepers. *Id.* The only course of action is to suppress and eliminate mosquito populations carrying avian malaria. *Id.* The agency is given wide latitude to exercise its discretion in determining which alternatives need to be fully analyzed. *Klein*, 753 F.3d at 582. Defendant DLNR initially considered and dismissed:

Sterile Insect Technique	Males are less competitive than IIT. Ex. 1 (part 1) at 113.
Introducing Self-Limiting Male Mosquitoes with Edited Genes	Technology not presently available for *Culex quinquefasciatus*. *Id.*
Gene Drive	Technology still ten to twenty years away from viability. *Id.* at 113-14.
Mosquito Habitat Source Reduction	Involves alteration of natural hydrology which would likely have a significant impact. *Id.* at 114.
Biological Larvicide Controls	Logistically difficult to ensure all breeding cites are treated in a large forest reserve. *Id.*
Chemical Controls	Likely to harm non-target native and listed insects and arthropods. *Id.* at 115.

Translocation of Birds to Mosquito-free Areas	High likelihood of failure based on previous attempts, concerns from cultural practitioners about losing cultural and familial connection to avifauna, and decreasing available habitat from climate change. *Id.*
Treatment of Birds with Acute Infections using Anti-malarial Drugs	Not feasible considering the population size and range of Hawaiian honeycreepers and likely to have significant impact because of capture and transportation requirements. *Id.* at 116.
Genetic Modification of Forest Birds	Technology not available for near-term implementation. *Id.*
Ground Release of Mosquitoes using Cars, Trucks, or ATVs	Impracticable because habitat is nearly roadless and difficult to reach. *Id.*
Pedestrian Release of Mosquitoes Without the Use of Helicopters	Similarly impracticable considering the vast size of habitat range and lack of roads. *Id.* at 117.

An EA only needs to contain "brief discussions" of alternatives, not "full blown" analyses. *Friends of Animals v. Silvey*, 353 F. Supp. 3d 991, 1014 (D. Nev. 2018), *aff'd*, 820 F. App'x 513 (9th Cir. 2020); *see also Soda Mountain Wilderness Council v. Norton*, 424 F. Supp. 2d 1241, 1267 (E.D. Cal. 2006) ("The cases do not appear to require a cumulative impacts discussion for each alternative."). The EA goes so far as to even include brief discussions of each alternative and why it was dismissed. Ex. 1 (part 1) at 112-117. Plaintiffs have again failed to identify any legal deficiencies in the EA.

iii. The FEA Sufficiently Described Proposed Mitigation Measures.

All that is required is that the EA describe "[p]roposed mitigation measures." HAR § 11-200.1-21(7); *Kilakila*, 138 Hawai'i at 370, 382 P.3d at 182. Compliance does not require that the harms actually be mitigated, but only that there is a discussion with sufficient detail to ensure that environmental consequences have been fairly evaluated. *S. Fork Band Council Of W. Shoshone*

Of Nevada v. U.S. Dep't of Interior, 588 F.3d 718, 727 (9th Cir. 2009) (citing *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 353 (1989)).

The proposed mitigation measures of this Project are discussed in Chapter 2 of the FEA. Ex. 1 (part 1) at 28-32. The proposed mitigation measures of this Project include both the general best management practices and the USFWS-recommended mitigation measures. *Id.* The best management practices that will be implemented for this Project are designed to avoid and minimize potential impacts to wildland fire, vegetation, wildlife, special status plant species, special status wildlife species, special status species habitat, invasive species, human health and safety, acoustic environment, visitor experience, cultural/historic/ethnographic resources, and wilderness preservation. *Id.* The USFWS-recommended mitigation measures that will be implemented for the Project are designed to avoid and minimize potential impacts on federally listed wildlife species, including nēnē (Hawaiian goose), Hawaiian forest birds, Hawaiian seabirds, Hawaiian waterbirds, and ʻōpeʻapeʻa (Hawaiian hoary bat). *Id.*

Plaintiffs challenge the acoustic impacts from using drones and helicopters to release mosquitoes and the impact of the biodegradable containers used to house mosquitoes. Compl. ¶¶ 53, 101-103. The EA discusses how the effect on the acoustic environment will be mitigated and minimized by careful planning of flight paths and timing of mosquito releases. Ex. 1 (part 1) at 33-45. The EA addressed concerns about the biodegradable packaging, noting that it will have a quick decomposition rate. Ex. 1 (part 2) at 116. Moreover, the Project complies with all applicable regulatory laws. "[A]n agency may properly base its evaluation of environmental impacts on the assumption that other specialized agencies with jurisdiction will enforce permits and related mitigation measures according to the law." *Gulf Restoration Network v. Bernhardt*, 456 F. Supp. 3d 81, 101 (D.D.C. 2020); *see also Friends of the Earth, Inc. v. U.S. Army Corps of*

Engineers, 109 F. Supp. 2d 30, 37 (D.D.C. 2000) (it can be assumed that an action that complies with state regulations will not have significant impact on the environment).

B. <u>The Issuance of the FONSI was not Clearly Erroneous.</u>

An agency's determination that a proposed action will likely have no significant impact on the environment is reviewed under the clearly erroneous standard. *Kilakila*, 138 Hawai'i at 375-76, 383-83, 382 P.3d at 187-88, 194-95. In reviewing an agency's decision not to prepare an EIS, the Ninth Circuit explained:

> [W]e ask whether the [agency's] decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment. But we must keep in mind that we are not a panel of scientists that instructs the agency how to validate its hypotheses . . . , chooses among scientific studies . . . , or orders the agency to explain every possible scientific uncertainty.

Bair v. California Dep't of Transportation, 982 F.3d 569, 578 (9th Cir. 2020) (internal quotation marks, citations, and brackets omitted). The court may not merely substitute its judgment for that of the agency. *Id.*

HAR § 11-200.1-13 describes the criteria that an agency needs to consider to determine whether an action may have a significant effect on the environment. In this case, the FEA discusses each of the HAR § 11-200.1-13 criteria and provides the reasons supporting the determination that the Project will have no significant impact. Ex. 1 (part 1) at 104-112. The DLNR reviewed and agreed with this reasoning, as indicated in its filed notice of determination with the OEQC. *Id.* at 3. The record shows that all significance criteria under HAR § 11-200.1-13 were considered by the DLNR in issuing its FONSI. Ex 1 (part 2) at 99-100.

To show that the FONSI was clearly erroneous, Plaintiffs must point to evidence that the Project *would* have a *significant* effect on the environment, not merely speculate that some tangential effects could occur. *See Bair*, 982 F.3d at 580-81 (agency is not required to "anticipate

conclusory supposition about speculative and tangential effects that are not supported by evidence in the record."). The word "significant" is key here. "It does not follow that the presence of some negative effects necessarily rises to the level of demonstrating a significant effect on the environment." *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1240 (9th Cir. 2005).

Again, Plaintiffs do not actually challenge Defendant DLNR's application of each significance criteria required by HAR § 11-200.1-13. That reason alone entitles Defendants to judgment in their favor. And Plaintiff Lia has admitted that the EA addressed every substantive concern that she raised in her comments.[5] Ex. 2 at 171:22-178:7.

In summary, the record shows that the FONSI was based on a consideration of the relevant factors and Plaintiffs have failed to identify any concerns or impacts not addressed in the EA that would constitute "a clear error of judgment." For those reasons, the FONSI must be upheld.

IV. CONCLUSION

For the aforementioned reasons and authorities, and any that may be adduced at a hearing on this Motion, the Board respectfully requests that the judgment be entered in favor of State.

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[5] Plaintiff Lia agreed that the EA responded to comments regarding: whether an EIS should have been prepared; concerns about potential impacts to public health and safety; concerns about genetically modified organisms or bio-engineered organisms; whether alternatives were adequately addressed; whether there was sufficient study of the Project; concerns raised that *Wolbachia* bacteria would be a foreign introduction into the environment; concerns that the Project is an experiment; concerns about female mosquitoes being released; concerns about the risk of increasing transmission of certain diseases; concerns that *Wolbachia* would infect other insect species via horizontal transfer; concerns about horizontal gene transfer from the mosquitoes being released; Native Hawaiian concerns; environmental effects of dropping mosquito packaging into the project area; additional literature to be reviewed; wildland fires potentially ignited by drones and helicopters; and unanticipated outcomes and that a monitoring and response plan will be implemented. *See generally* Exhibit 2.

DATED: Honolulu, Hawai‘i, December 22, 2023.

/s/ Miranda C. Steed .
JULIE H. CHINA
DANICA L. SWENSON
MIRANDA C. STEED
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BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAI‘I AND DEPARTMENT OF LAND AND NATURAL RESOURCES, STATE OF HAWAI‘I

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

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HAWAII UNITES, a 501(c)(3) nonprofit corporation; Tina Lia, an individual,

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AMERICAN BIRD CONSERVANCY,

Defendant-Intervenor.

CIVIL NO. 1CCV-23-0000594

DECLARATION OF MIRANDA C. STEED

DECLARATION OF MIRANDA C. STEED

I, MIRANDA C. STEED, hereby declare as follows:

1. I am one of the Deputy Attorneys General representing the State of Hawaiʻi in the above-captioned lawsuit.

2. I make this Declaration based on personal knowledge, and I am competent to testify to matters set forth herein.

3. Attached hereto as Exhibit "1" is a true and correct copy of the Final Environmental Assessment at issue in the Complaint.

4. Exhibit "1" was stipulated to and entered into evidence during the preliminary injunction hearing as Plaintiffs' "Exhibit P-1" and State's "Exhibit D-17." JEFS 126.

5. Attached hereto as Exhibit "2" is a true and correct copy of the portions of the cited-transcript from the Preliminary Injunction Hearing on July 21, 2023.

6. I hereby declare under the penalty of perjury that the foregoing is true and correct to the best of my knowledge.

DATED: Honolulu, Hawai'i, December 22, 2023.

/s/ Miranda C. Steed .
MIRANDA C. STEED

EXHIBIT 1
(Part 1 of 2)

JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

P.O. BOX 621
HONOLULU, HAWAII 96809

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
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LAURA H.E. KAAKUA
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M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

March 28, 2023

Director
State of Hawai'i
Office of Planning and Sustainable Development
Environmental Review Program
235 South Beretania Street, Room 702
Honolulu, HI 96813

RE: ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT FOR SUPPRESSION OF NON-NATIVE WILD MOSQUITO POPULATIONS TO REDUCE TRANSMISSION OF AVIAN MALARIA TO THREATENED AND ENDANGERED FOREST BIRDS ON EAST MAUI

Dear Director:

With this letter, the State of Hawai'i Department of Land and Natural Resources hereby transmits the final Environmental Assessment and Finding of No Significant Impact (EA-FONSI) for "Suppression of Non-native Wild Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui" for publication in the next available edition of The Environmental Notice.

In addition to this letter, the online Environmental Review Program (ERP) Publication Form has been submitted through the ERP website.

Should you have any questions, please contact Cynthia King of the Division of Forestry and Wildlife at (808) 587-0019 or cynthia.b.king@hawaii.gov.

Sincerely,

DGS

Dawn N. S. Chang
Chairperson

Signature:

Email: david.g.smith@hawaii.gov

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Wednesday, March 29, 2023 11:16:53 AM

Action Name

Suppression of Invasive Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district

Maui - multiple districts

Tax Map Key(s) (TMK(s))

2-1-6-999:999; 2-2-4-016:999; 2-2-4-013:999; 2-2-4-016:004; 2-1-3-001:002; 2-1-4-001:003; 2-1-5-001:001; 2-1-5-001:002; 2-1-5-011-002; 2-1-5-011:007; 2-1-5-011:008; 2-1-6-001:001; 2-1-6-001:002; 2-1-6-001:003; 2-1-6-001:004; 2-1-6-001:005; 2-1-6-001:007; 2-1-6-001:009; 2-1-6-002:001; 2-1-6-002:002; 2-1-6-002:003; 2-1-6-002-004; 2-1-6-002:005; 2-1-6-002:006; 2-1-6-002:007; 2-1-6-002:008; 2-1-6-002:009; 2-1-6-002:010; 2-1-6-002:011; 2-1-6-002:012; 2-1-6-003:001; 2-1-6-003:002; 2-1-6-003:003; 2-1-6-003:007; 2-1-6-003:008; 2-1-6-003:009; 2-1-6-003:010; 2-1-6-003:013; 2-1-6-003:015; 2-1-6-003:016; 2-1-6-003:017; 2-1-6-003:021; 2-1-6-003:022; 2-1-6-003:023; 2-1-6-003:025; 2-1-6-003:026; 2-1-6-003:027; 2-1-6-003:028; 2-1-6-003:029; 2-1-6-004:001; 2-1-6-004:002; 2-1-6-004:006; 2-1-6-004:007; 2-1-6-004:008; 2-1-6-004:020; 2-1-6-005:013; 2-1-6-005:016; 2-1-6-005:022; 2-1-6-005:024; 2-1-6-005:028; 2-1-6-005:035; 2-1-6-006:001; 2-1-6-006:002; 2-1-6-006:003; 2-1-6-006:004; 2-1-6-006:005; 2-1-6-006:006; 2-1-6-006:007; 2-1-6-006:012; 2-1-6-006:014; 2-1-6-006:015; 2-1-6-006:016; 2-1-6-006:020; 2-1-6-006:021; 2-1-6-006-023; 2-1-6-010:004; 2-1-6-010:006; 2-1-6-010:007; 2-1-7-001:001; 2-1-7-001:002; 2-1-7-001:033; 2-1-7-001:034; 2-1-7-004:016; 2-1-3-001:001; 2-1-7-001:003; 2-1-7-004:004; 2-1-6-005:007; 2-2-4-013:073; 2-2-4-013:185; 2-2-4-016:001; 2-2-4-016:003; 2-2-4-033:010; 2-2-4-033:013; 2-2-7-015:001; 2-2-8-008:001; 2-2-8-008:008; 2-2-8-008:009; 2-2-9-014:001; 2-1-2-004-013; 2-1-2-004:005; 2-1-1-002:002; 2-1-2-004:007; 2-1-3-001:003; 2-1-8-001:007; 2-2-3-005:001; 2-1-7-004:006; 2-1-7-002:073; 2-1-4-001:001; 2-1-1-001:050; 2-1-1-001:044; 2-2-3-005:004; 2-2-3-005:003; 2-1-6-001:006; 2-1-6-010:002; 2-2-8-008:007; 2-2-7-015:003; 2-1-6-010:001; 2-2-4-016:002; 2-1-6-010:008; 2-2-3-005:999;

Action type

Agency

Proposing/determining agency

Department of Land and Natural Resources

Agency contact name

Cynthia King

Agency contact email (for info about the action)

cynthia.b.king@hawaii.gov

Agency contact phone

(808) 587-0019

Agency address

1151 Punchbowl Street
Room 325
Honolulu, Hawaii 96813
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Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Tetra Tech

Consultant contact name

Keith Pohs

Consultant contact email

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Consultant address

350 Indiana Street
Golden, Colorado 80401
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Map It

Action summary

Populations of endangered Hawaiian forest birds have decreased substantially over the last 20 years, and it is predicted that at least two more species could be extinct in the next 2 to 10 years. The primary cause of declines in native forest birds is avian malaria, which is spread by non-native mosquitoes. The purpose of the project is to substantially suppress or eliminate non-native mosquitoes in threated and endangered forest bird habitat on East Maui, thereby reducing the risk of their extinction and contributing to the recovery of these species. The approved action consists of repeatedly releasing incompatible male mosquitoes, which will reduce the reproductive potential of wild mosquitoes. When conducted repeatedly over time, releases of incompatible mosquitoes will suppress the wild mosquito population by at least 90%. The primary tool used to release mosquitoes on the landscape will be drones and, to a lesser extent, helicopters and ground-based methods.

Reasons supporting determination

See Appendix G – DLNR HEPA Significance Criteria Analysis

Attached documents (signed agency letter & EA/EIS)

- ERP-letter_East-Maui-EA-FONSI_03282023-part-1-signed.pdf
- DLNR-Mosquito-Suppression_EA_Main-Body_Final_Complete_03242023.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- East_Maui_MosquitoEA_Project_Area.zip

Authorized individual

Cynthia King

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Suppression of Invasive Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui

Final Environmental Assessment

Hawai‘i Department of Land and Natural Resources

March 24, 2023

STATEMENT OF COMPLIANCE

This Environmental Assessment (EA), titled "Suppression of Invasive Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui", was produced through a cooperative effort between the National Park Service (NPS) and the Hawai‘i Department of Land and Natural Resources (DLNR). The NPS served as lead for drafting this EA for National Environmental Policy Act (NEPA) compliance, and DLNR served as the cooperating agency. The document attached here serves as the DLNR's final EA and has been revised and adjusted as needed to meet Hawai‘i Revised Statutes (HAR) Chapter 343 compliance.

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APPENDICES

ACRONYMS AND ABBREVIATIONS

AGL	above ground level
CEQ	Council on Environmental Quality
dBA	A-weighted decibel
DLNR	Hawai‘i Department of Land and Natural Resources
DOFAW	Hawai‘i Division of Forestry and Wildlife
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
HEPA	Hawai‘i Environmental Policy Act
IIT	Incompatible Insect Technique
IVUMC	Interagency Visitor Use Management Council
LOS	line of sight
LZ	landing zone
MFBRP	Maui Forest Bird Recovery Project
NEPA	National Environmental Policy Act
NPS	National Park Service
OGG	Helibase - Kahului Airport
OSHA	Occupational Safety and Health Administration
PEPC	Planning, Environment, and Public Comment
TNC	The Nature Conservancy
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

This environmental assessment (EA) analyzes the impacts of the proposed action to suppress invasive mosquito populations with the goal of addressing the effects of avian malaria on threatened and endangered forest birds on Maui, Hawai‘i versus a no-action alternative. The project area primarily consists of Haleakalā National Park and adjacent properties managed by the State of Hawai‘i, The Nature Conservancy (TNC), and other private conservation lands. This EA has been prepared consistent with the National Environmental Policy Act (NEPA) and the Hawai‘i Environmental Policy Act (HEPA) and provides compliance for project implementation on both federal and state lands.

Haleakalā National Park (the park) was established in 1916 and manages over 33,000 acres of federal land on the island of Maui. There are two districts in the park: the Summit District and the Kīpahulu District. The Summit District includes a portion of Haleakalā Highway (known as Crater Road within the park), Haleakalā Crater, Kaupō Gap, and Nu‘u. The Kīpahulu District includes ‘Ohe‘o Gulch, Kīpahulu Valley, Manawainui, and Ka‘āpahu. Recognized as an International Biosphere Reserve, the park’s stated purpose is: *"For the inspiration of current and future generations, [the park] protects a wild volcanic landscape with a wild array of fragile and diverse native ecosystems, including plant and animal species found nowhere else on Earth. Our stewardship perpetuates the unique and continuing connections between Hawaiian culture and this sacred and evolving land"* (NPS 2015; see Appendix A: References). The National Park Service (NPS) is the lead agency for this EA.

The State of Hawai‘i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) manages forest and wildlife resources, including plant and wildlife habitats and native ecosystems, lands designated as forest reserves, natural area reserves, wildlife sanctuaries, and game management areas, and partners broadly for the protection and management of natural resources on agency and private land throughout the state. DOFAW reserves on East Maui include the Ko‘olau Forest Reserve, Hāna Forest Reserve, Hanawī Natural Area Reserve, Kīpahulu Forest Reserve, and Makawao Forest Reserve. DLNR is serving as a cooperating agency for this project.

TNC manages lands in the Waikamoi Preserve, while several private partners, including East Maui Irrigation, Mahi Pono, LLC., and Haleakala Ranch, manage adjacent properties on East Maui to protect native ecosystems and watersheds. TNC, NPS, DLNR, and partners would work together to implement this mosquito suppression project on these lands. These cooperative actions do not alter the jurisdiction of each agency, organization, or private landowner; rather, this collaboration is the most efficient way to achieve the goals of the project.

PROJECT BACKGROUND

More than 30 species of forest birds known as Hawaiian honeycreepers have gone extinct over the last 20–200 years (Banko and Banko 2009, Elphick et al. 2010, USFWS 2021). Many of the remaining 17 species are considered at risk, with some populations exhibiting rapid and recent declines (Paxton et al. 2016, Judge et al. 2021). The primary cause of these declines is avian malaria, a non-native disease that is caused by a parasite (*Plasmodium relictum*) spread by the invasive southern house mosquito (*Culex quinquefasciatus*). Hawaiian honeycreepers have little resistance to avian malaria, and most cannot survive infection (Atkinson et al. 1995, LaPointe and Atkinson 2009). Until recently, honeycreepers were able to persist in high elevation forests where it is too cold for mosquitoes and the avian malaria parasite to reproduce. Recent climate changes have allowed mosquitoes and associated avian malaria to start invading these upper elevation forests on Maui, killing native forest birds in their last remaining locations. At least two endangered bird species on East Maui, kiwikiu (Maui Parrotbill, *Pseudonestor xanthophrys*) and ‘ākohekohe (*Palmeria dolei*), are expected to become extinct within two to fifteen years if avian malaria is left unchecked (Mounce et al. 2018, Paxton et al. 2022). There are currently fewer than 200 kiwikiu and fewer than 2,000 ‘ākohekohe persisting in the wild, all of which are located within the project area of this EA on East Maui (Judge et al. 2021). Both species have declined by more than 70 percent over the last two decades. Four additional Hawaiian honeycreepers also reside on

East Maui: the threatened ʻiʻiwi (*Drepanis coccinea*), Maui ʻalauahio (only lives on Maui; *Paroreomyza montana*), Hawaiʻi ʻamakihi (*Chlorodrepanis virens*), and ʻapapane (*Himatione sanguinea*). These species are also affected by avian malaria and addressed in this EA.

The NPS and DLNR propose to reduce native forest bird mortality from avian malaria by suppressing southern house mosquito populations on East Maui. These non-native invasive mosquitoes are the only insect that transmits avian malaria in this area. The proposed action consists of repeatedly releasing incompatible male southern house mosquitoes (hereafter "incompatible mosquitoes"), which would prevent mosquitoes within the project area from being able to reproduce. This approach employs the incompatible insect technique (IIT), which uses a naturally occurring bacteria called *Wolbachia* that is present in many insect species on Maui. When male mosquitoes with an incompatible strain of *Wolbachia* are introduced to a population of female mosquitoes, mating is unproductive, thereby suppressing mosquito populations (Atyame et al 2015). When releases are done repeatedly over time, they further suppress the mosquito population and, in turn, would suppress transmission of avian malaria.

In response to comments received during public scoping, the following are key points regarding mosquitoes and the proposed action:

1. Male mosquitoes do not bite animals or humans. This project would only release male mosquitoes.
2. *Wolbachia* is already present in many insects in Hawaiʻi, including the southern house mosquito populations present on Maui. This project would release only male mosquitoes with a different strain of *Wolbachia* bacteria to that occurring in southern house mosquitoes in East Maui.
3. *Wolbachia* bacteria cannot transfer between animal species or to humans. Similarly, it cannot transfer between male mosquitoes and female mosquitoes; mosquitoes can only inherit *Wolbachia* from their mother.
4. The southern house mosquito, like all mosquitoes in Hawaiʻi, is an invasive species on Maui. It occupies higher elevations and cooler environments than other species of mosquitoes found on Maui. Other mosquito species would not expand their ranges in response to elimination of southern house mosquitoes.
5. Southern house mosquitoes are not an important source of food for native bats, birds, or other insects in Hawaiʻi.
6. Neither southern house mosquitoes nor *Wolbachia* bacteria are new organisms to Maui; this project would not result in introduction of any new species to the island.
7. The proposed use of IIT does not include genetic engineering techniques that result in genetically modified organisms (GMOs).

PURPOSE OF AND NEED FOR ACTION

The purpose of the project is to substantially suppress or eliminate southern house mosquitoes and, thus, avian malaria in threatened and endangered forest bird populations on East Maui, thereby reducing extinction risks and contributing to the recovery of these species. To prevent the extinction of threatened and endangered forest birds on East Maui, timely management action needs to be taken to control avian malaria. The populations of two endangered Hawaiian forest birds, kiwikiu and ʻākohekohe, have decreased by more than 70 percent over the last 20 years, and population projections predict their extinction in the next two to ten years (Mounce et al. 2018, Paxton et al. 2022). The avian malaria parasite and the mosquitoes that spread avian malaria are unable to successfully reproduce in cold environments, thus these two honeycreepers have been able to persist in high elevation native forest habitat on East Maui. Recently, increasing temperatures associated with climate change are allowing mosquito populations and avian malaria to expand into these high elevation native forests where some of the last populations of these forest birds remain. This expansion is the primary cause of these endangered species' rapid decline and threat of extinction (Fortini et al. 2015, Mounce et al. 2018, Judge et al. 2021, Paxton et al. 2022).

PROJECT AREA

The NPS and DLNR identified the project area through a collaborative process, during which all public lands within much of the current and historic ranges of threatened and endangered forest birds on East Maui were evaluated for inclusion. The project area (**Figure 1**) includes areas downslope from many birds' current ranges that may serve as high-density mosquito breeding grounds from which mosquitoes may move upward in elevation into native forest bird habitat. The upper elevation limit of the project area was defined by the boundary of the park along the north slope and Palikū Ridge between Pōhaku Pālaha and Kuiki, separating native forest from Haleakalā Crater. The lower limit of the project area, 1,969 feet above sea level, is the low elevation range of vulnerable native forest birds, such as the ʻapapane and ʻiʻiwi (Judge et al. 2019) except within the boundaries of the park in the lower Kīpahulu Valley and Kaʻapahu where the project area extends to sea level.The project area includes approximately 64,666 acres, including NPS land (12,042 acres), DLNR lands in forest reserves and natural area reserves (37,989 acres), adjacent lands privately managed in a conservation easement by TNC (8,606 acres), East Maui Irrigation Company, LLC (4,409 acres), Haleakala Ranch (393 acres), and Mahi Pono (1,227 acres) lands managed for conservation (**Table 1** and **Figure 1**).

TABLE 1: PROJECT AREA ACREAGE AND MANAGEMENT

Name	Management	Acres
Haleakalā National Park	NPS	12,042
Koʻolau Forest Reserve	DLNR/DOFAW	15,179
Hāna Forest Reserve	DLNR/DOFAW	10,679
Hanawī Natural Area Reserve	DLNR/DOFAW	7,713
Kīpahulu Forest Reserve	DLNR/DOFAW	2,318
Makawao Forest Reserve	DLNR/DOFAW	2,100
Waikamoi Preserve (TNC)	TNC	8,606
East Maui Irrigation Company, LLC	Private	4,409
Mahi Pono	Private	1,227
Haleakala Ranch	Private	393
TOTAL		**64,666**

ISSUES AND IMPACT TOPICS ANALYZED IN THIS ENVIRONMENTAL ASSESSMENT

This EA analyzes environmental consequences associated with the implementation of the proposed action or the no-action alternative. Issues and impact topics address the following resources and values: threatened and endangered wildlife species and wildlife species of concern, threatened and endangered plant species and state plant species at risk, wilderness character, acoustic environment, and visitor use and experience. Numerous other issues and impact topics were considered but dismissed from further analysis for reasons specified in "Appendix B: Issues, Impact Topics, and Alternatives Dismissed from Detailed Analysis."

The interdisciplinary team consulted with scientific experts and environmental planners from NPS, DLNR, U.S. Fish and Wildlife Service (USFWS), and U.S. Geological Survey (USGS) familiar with the native forest bird species and ecosystems of East Maui to determine which environmental issues would be carried forward for detailed analysis in the EA. The team also reviewed public scoping comments for additional insight on issues and impact topics relevant to this project. Details of the civic engagement and public scoping processes are available in Chapter 4 of this EA.

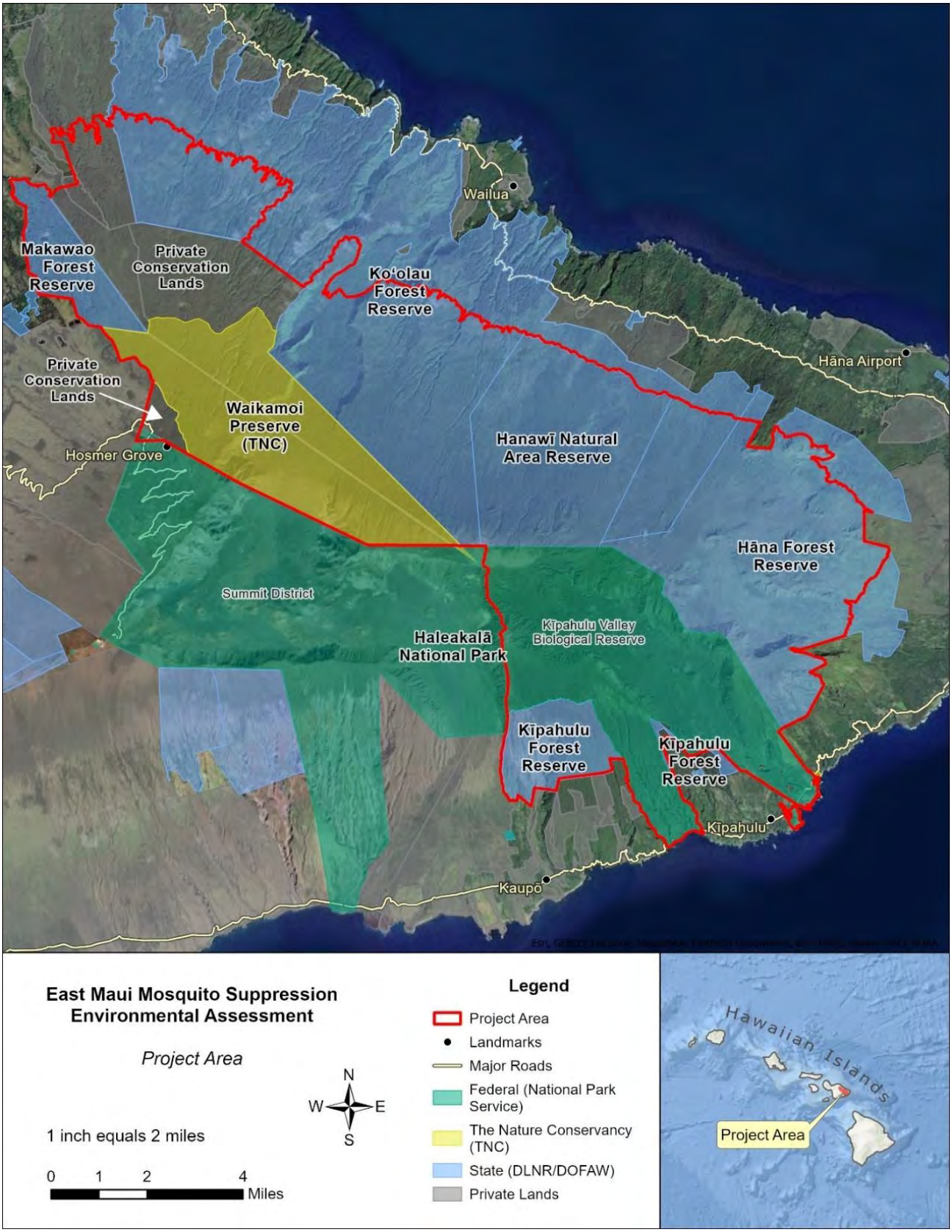

FIGURE 1: PROJECT AREA FOR RELEASE OF INCOMPATIBLE MOSQUITOES

CHAPTER 2: ALTERNATIVES

INTRODUCTION

This chapter describes alternatives for reducing mosquito populations and, thus, avian malaria transmission to threatened and endangered forest birds on East Maui, consistent with the purpose and need for action. Two alternatives are presented: the no-action alternative and the proposed action. Mitigation measures are included in the proposed action. Several other potential alternatives were considered and discussed during internal and public scoping but were dismissed from detailed analysis in this EA as described in "Appendix B: Issues, Impact Topics, and Alternatives Dismissed from Detailed Analysis."

NO-ACTION

Under the no-action alternative, release of incompatible mosquitoes would not occur. Although ongoing conservation and other management activities would continue on East Maui (e.g., fencing, removal of non-native ungulates and predators, 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.

PROPOSED ACTION

The NPS and DLNR propose to reduce threatened and endangered forest bird mortality from avian malaria by suppressing mosquito populations on East Maui. The proposed action was developed in consideration of park and state statutory missions and responsibilities; environmental factors; preliminary impact analysis; Native Hawaiian consultation and public input; existing infrastructure (such as helibases, landing zones [LZs], camps, trails, fence lines, and roads); and input from agency personnel, technical experts, and the public. The proposed action consists of repeatedly releasing incompatible male mosquitoes to reduce the reproductive potential of mosquitoes in the project area. This approach employs IIT, which as described in Chapter 1, uses a naturally occurring bacteria called *Wolbachia* that is present in the eggs and sperm of many insect species, including the southern house mosquito (Hilgenboecker et al. 2008, Bennett et al. 2012). When male mosquitoes with an incompatible strain of *Wolbachia* are introduced to a population of female mosquitoes, mating is unproductive, thereby suppressing mosquito populations (Atyame et al 2015). Releases under the proposed action must be conducted repeatedly over time to achieve and maintain significant suppression of the mosquito population, and like other similar mosquito suppression projects, this project has the potential to suppress the mosquito population by 90 percent or more (Beebe et al. 2021, Crawford et al. 2020, and Zheng et al. 2019). Monitoring mosquito populations would guide the frequency, number, and location of releases, and would need to continue for as long as the proposed action is implemented. The park would oversee implementation on federal lands and DLNR on state and private conservation lands or those managed by TNC.

Effective implementation of the proposed action would be dependent on the numbers and availability of lab-reared southern house mosquitoes that carry incompatible strains of *Wolbachia*. The proposed action would start with small scale on-the-ground or aerial releases of incompatible mosquitoes within the project area, where field teams would be able to monitor effectiveness of IIT implementation. The majority of the project area is inaccessible by ground, and thus would require uncrewed aircraft systems (i.e., drones) to implement large-scale mosquito releases throughout the project area. Releases via helicopter may be required as a short-term (up to two months), temporary release method if drones are not available. Mosquito release technologies would resemble those established for IIT (or related techniques) suppression projects of the yellow fever mosquito (*Aedes aegypti*), which have been successfully implemented in the United States and other parts of the world (Mains et al. 2016, Bouyer et al. 2020, Crawford et al. 2020, Moreira et al. 2009, Hoffman et al. 2011, Ritchie et al. 2014, Dutra et al. 2016). Releases would be expected to continue until southern house mosquito populations are significantly reduced and the status of threatened and endangered forest birds stabilizes, or until new mosquito population suppression techniques are developed. Releases

may be conducted in a piecemeal fashion over the project area because of limitations in resources (e.g., availability of drones, personnel, or incompatible mosquitoes). The details of the proposed action are described below and include descriptions of the project area, frequency, timing, mosquito release methodology, and monitoring techniques.

Mosquito Transport and Storage

Under the proposed action, incompatible mosquitoes would be reared under sterile conditions in a laboratory environment to ensure that they are free from invasive organisms, parasites, and diseases. The lab-reared incompatible mosquitoes would be derived from southern house mosquito eggs initially collected in Hawai‘i. The *Wolbachia* strain transinfected into the southern house mosquitoes is also found in Hawai‘i, including on Maui. As such, no foreign organisms would be introduced to Maui via the proposed action. The lab would likely be located at a U.S. mainland facility, at least at the outset of this project, and incompatible mosquitoes would be transported to Maui from the rearing facility in containers designed for transport and/or field release. After arriving on Maui and following agricultural inspection, the incompatible mosquitoes would be held by a permitted importer in a climate-controlled environment, then promptly distributed by NPS or DLNR staff and designated agents. The timing of release following shipment is critical for success as the survivorship, and thus time to find a mate, of the incompatible mosquitoes is influenced by the length of time held in transport containers. During implementation, mosquitoes may be released directly from drones or handheld containers, or from small biodegradable packages that could be dispersed by drones or helicopters (as discussed in the following sections).

Number of Mosquitoes to be Released

As previously mentioned, the goal of the proposed action is to dramatically reduce the distribution and abundance of the mosquito population within the project area. Many previous successful IIT projects resulted in mosquito population declines of 90 percent 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. The number of incompatible mosquitoes per release would be based on the local population densities of wild mosquitoes. 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 Hawai‘i 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, Giambelluca 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). Based on current estimates, we expect to release between 50 and 6,000 incompatible mosquitoes per acre per treatment (which would occur up to twice per week) depending on elevation and local temperature and capture data gathered during monitoring. 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 in East Maui 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.

Release Locations and Spacing

The project team used all available data to estimate the distribution of mosquitoes within the project area. The current range of kiwikiu and ‘ākohekohe (Judge et al. 2021) and mosquito movements were applied to identify areas where

mosquitoes might occur and spread disease. This information was also used to determine the locations to release mosquitoes. Based on past research, southern house mosquitoes are estimated to travel (disperse) approximately 650 feet in a 24-hour period (LaPointe 2008); thus, incompatible males would have the highest probability of finding a female and mating during the first day of release when locations are spaced 1,300 feet apart. Based on the estimated dispersal of mosquitoes into the range of threatened and endangered birds, a total of 1,389 proposed release locations were identified within the center of the project area (**Figure 2**). The area encompassing these 1,389 release locations is hereafter referred to as the "core area." The number of release locations, based on 1300-foot spacing within the core area, within each land management area are included in **Table 2**. The core area may expand, contract, or shift within the project area. Release spacing would be determined through a series of trials within the core area and may differ from those estimated here. This spacing would dictate the total number of release locations. Releases would be conducted systematically within each management area (the park, state forest and natural area reserves, TNC's Waikamoi Preserve, and private conservation lands), potentially by a variety of tools simultaneously (release methods are described in the following sections).

TABLE 2: MOSQUITO RELEASE LOCATIONS PER MANAGEMENT UNIT IN THE PROPOSED PROJECT AREA.

Land Manager and Reserve	Area (acres)	% Of Project Area	Release Locations
Hawai'i Dept. of Land and Natural Resources			
Hāna Forest Reserve	9,117	14.1%	262
Hanawī Natural Area Reserve	6,072	9.4%	174
Kīpahulu Forest Reserve	1,953	3%	51
Ko'olau Forest Reserve	11,668	18%	340
Makawao Forest Reserve	1,986	3.1%	59
National Park Service			
Haleakalā National Park	7,099	11%	211
Private			
East Maui Irrigation, LLC	3,927	6%	112
Haleakala Ranch Company	15	<0.1%	0
Mahi Pono	1,226	1.9%	36
The Nature Conservancy			
Waikamoi Preserve	5,101	7.8%	144
Grand Total	**48,164**	**74.5%** *	**1,389**

Note: Release locations are spaced 1,300 feet apart. The core area is smaller than the project area because the distribution of mosquitoes and range of native forest birds do not overlap (in all months of the year) in some high-elevation areas.
* At this time, 74.5% of the project area represents the core area between 2,200 and 4,300 feet where incompatible mosquito releases would be most important (as described in earlier sections).

Frequency and Timing of Release

Incompatible mosquito releases could occur throughout the project area during all seasons. However, releases would likely occur across the largest portion of the project area in the summer and fall months when mosquito populations in Hawai'i peak (LaPointe 2000; Gaudioso-Levita et al. 2005; Warren et al. 2020). These are months when the temperatures are suitable for avian malaria transmission within the greatest elevation extent, including areas above 4,300 feet in elevation (where most threatened and endangered birds currently live and breed). Incompatible mosquito releases may be reduced during the cooler spring and winter months when the abundance of mosquitoes at high elevations is thought to be reduced. The breeding season of most native forest birds peaks during the colder months from December through April (Berlin and Vangelder 2020, Fancy and Ralph 2020a,b, Simon et al. 2020), when

incompatible mosquito releases may be curtailed at higher elevations due to temperature (and low mosquito density). Limited disturbance from release efforts to breeding forest birds is expected during this time. Concurrent monitoring would help identify seasonal fluctuations in mosquito populations and help guide the release strategy. Implementation may also be limited by inclement weather conditions and availability of mosquitoes.

To achieve the greatest possible reduction in the mosquito population, incompatible mosquitoes would be released at a maximum of twice per week per release location and potentially less frequently as wild mosquito population suppression is achieved over time. Release frequency would be determined by initial trials to determine longevity and dispersal of the incompatible males. The rate of release would be determined by the length of time the incompatible males survive at sufficient densities after release. The frequency of releases may also be reduced if there are advances in technologies for transporting mosquitoes (including lab-rearing in Hawai‘i) or releases, both of which could reduce mortality and improve longevity and competitiveness (the ability of incompatible male mosquitoes to compete with wild male mosquitoes for breeding). The release locations shown in **Figure 2**, each spaced 1,300 feet apart, have distinct temperature and precipitation characteristics because of elevation, topography, and aspect. Low elevation areas (red release locations) would require releases throughout the year, while high elevation areas (blue release locations) may require less frequent releases primarily during summer months. Higher frequency release locations (red) are in areas with temperatures that are conducive to year-round reproduction of mosquitoes and the avian malaria parasite (in infected mosquitoes). Medium frequency (orange) and low frequency (blue) release locations correspond to areas with lower average monthly temperatures and reduced distribution of mosquitoes and avian malaria during cooler months, typically from December through April. The frequency and number of incompatible mosquitoes released could decrease over time depending on the project's success in suppressing the mosquito population.

Release Methods

Mosquito releases would be primarily conducted via drones. If there are obstacles to using drones for aerial releases in the core area, NPS and DLNR would release incompatible mosquitoes from helicopters over the short term (up to two months), either from a release device attached to the belly of a helicopter or from a long cable affixed with a device that could allow release of mosquitoes closer to the forest canopy or floor (described below). It is expected that limited pedestrian releases and monitoring would be conducted simultaneously with broadscale aerial releases.

Drone Release

Drones would allow for efficient incompatible mosquito releases throughout the core area and are considerably safer, less expensive, and quieter than helicopters. This method has been successfully used elsewhere for other mosquito control projects (Virginio et al. 2018, Bouyer et al. 2020). Although the specific mosquito release mechanism is still under development, it is expected that it will be available by the time the project is ready for implementation. It has also been assumed that drones would be flown from "front country" locations accessible by major roads and that no helicopter use would be required to transport drone operation crews into the remote or ground-inaccessible "backcountry" areas.

Drones would operate somewhat automatically (monitored by an operator), flying a prescribed route and releasing incompatible mosquitoes at the pre-determined release locations in the core area (**Figure 2**). It is estimated that drones would fly approximately 50–100 feet above the tree canopy during mosquito releases but no higher than 500 feet above ground level (AGL) when ferrying between release locations and the operator. Larger areas would require multiple days to conduct releases (e.g., Koʻolau Forest Reserve), while smaller areas (e.g., Kīpahulu Forest Reserve) may only require a few hours for each aerial release. The drone operator would ensure that the drone and release mechanism are operating correctly and safely during each flight. Incompatible mosquitoes would likely be released in small biodegradable packages designed to open on contact with the canopy or forest floor.

The drone model(s) to be used has yet to be determined and would depend on a host of factors including environmental conditions and agency approvals. 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). The flight speeds possible during releases of incompatible mosquitoes are also dependent on drone model and weather conditions (e.g., wind speed) as well as optimal speeds for the release mechanism, which are still to be determined. Estimates provided are based on a 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.

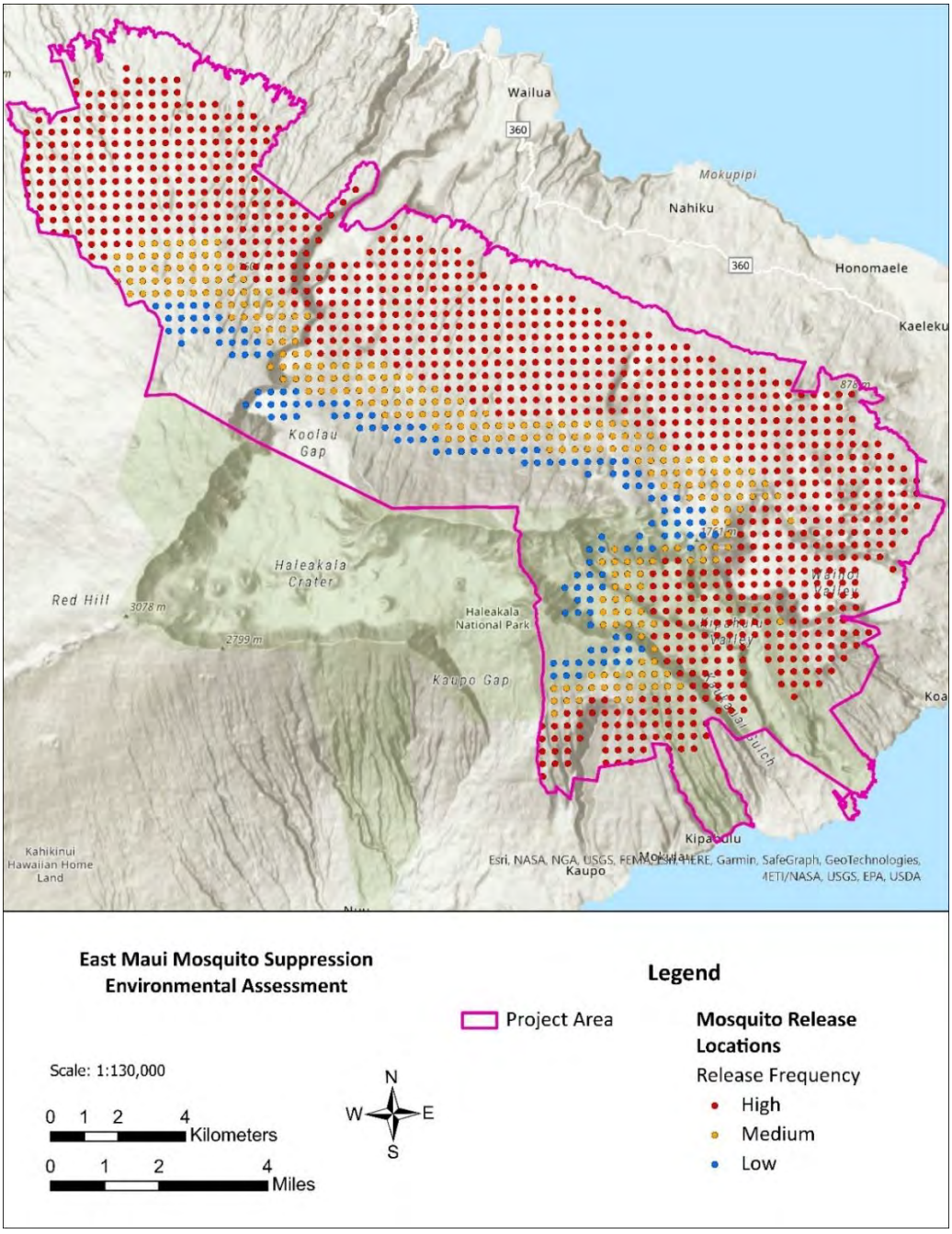

FIGURE 2: RELEASE LOCATIONS[1], SPACED 1,300 FEET APART, WITHIN THE PROJECT AREA BETWEEN 2,300 AND 6,000 FEET IN ELEVATION.

[1] Release frequency was determined by seasonal temperature patterns where warmer low elevation areas (red) may require releases throughout the year, while high elevation areas (blue) would only require releases during warmer summer months.

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 Makawao Forest Reserve but would need more than 5 minutes to reach certain areas of Hanawī Natural Area Reserve and Hāna Forest Reserve from a drone operator located in the front country. **Figure 3** provides a depiction of the drone launch locations (temporary helibases) and the general directions that the drones could fly into the core area to reach release locations. With an estimated maximum of 6 hours of release time possible per day, 576 release locations could be reached per day by one drone, based on the flight assumptions (e.g., speed, battery life) described above. The drone would likely spend 15 seconds or less hovering over each mosquito release location; it may be possible that drones would be able to release without pausing. A "treatment" is defined as releasing incompatible mosquitoes at all release locations within the entire core area. At least two drones would need to be working simultaneously each week to achieve two complete treatments per week in the core area. As described in the previous sections, however, the number of release locations could vary based on release location spacing and/or because of seasonal temperature trends, which can be simplified into "warm months" and "cold months." Additionally, the number of release locations planned for a given treatment may be less than what is estimated for the entire core area based on limited available resources.

Table 3 illustrates the expected number of drone flight hours and total flights, both per week and for the entire core area, in both cold (December–April) and warm months (May–November). Note that the number of release locations during cold months is a minimum estimate and numbers of locations could increase incrementally over the course of each year to include the entire core area under unusually warm climatic conditions. The estimates presented in **Table 3** are for the entire core area. Multiple drones operating simultaneously would greatly decrease the number of total flying days. The estimates in **Table 3** are based on a convertible fixed wing/multicopter drone type and other drone models may be available that have increased speed, payload, and battery capacity that would alter flight estimates provided in the table.

TABLE 3. ESTIMATED NUMBER OF DRONE FLIGHT HOURS AND ROUND-TRIP FLIGHTS PER TREATMENT (RELEASING MOSQUITOES AT EACH LOCATION) AND PER WEEK (ASSUMING 2 TREATMENTS PER WEEK) PER LAND MANAGER.

Land Manager	Per Treatment				Per Week			
	warm months		cold months		warm months		cold months	
	hrs	flights	hrs	flights	hrs	flights	hrs	flights
Hawai'i Dept. of Land and Natural Resources	23.2	43	18.2	35	46.5	87	36.4	70
National Park Service	5.5	10	2.9	6	11.0	21	5.9	11
Private	3.4	7	3.0	6	6.7	14	6.1	12
The Nature Conservancy	3.6	7	0.3	1	7.3	14	0.6	1
TOTAL	**36**	**67**	**24**	**48**	**72**	**134**	**49**	**94**

Note: Presented in this table are estimated flight information for lower elevations only (2000–4300 ft) during colder months (December–April) when releases at higher elevations are not expected to be needed ("cold months") and all elevations (2000–5600 ft) within the core area where releases are expected to be needed during warmer months. These elevations are based on thermal limits of the malaria parasite (>55° F) below which transmission from mosquitoes is limited (Ahumada et al. 2004).

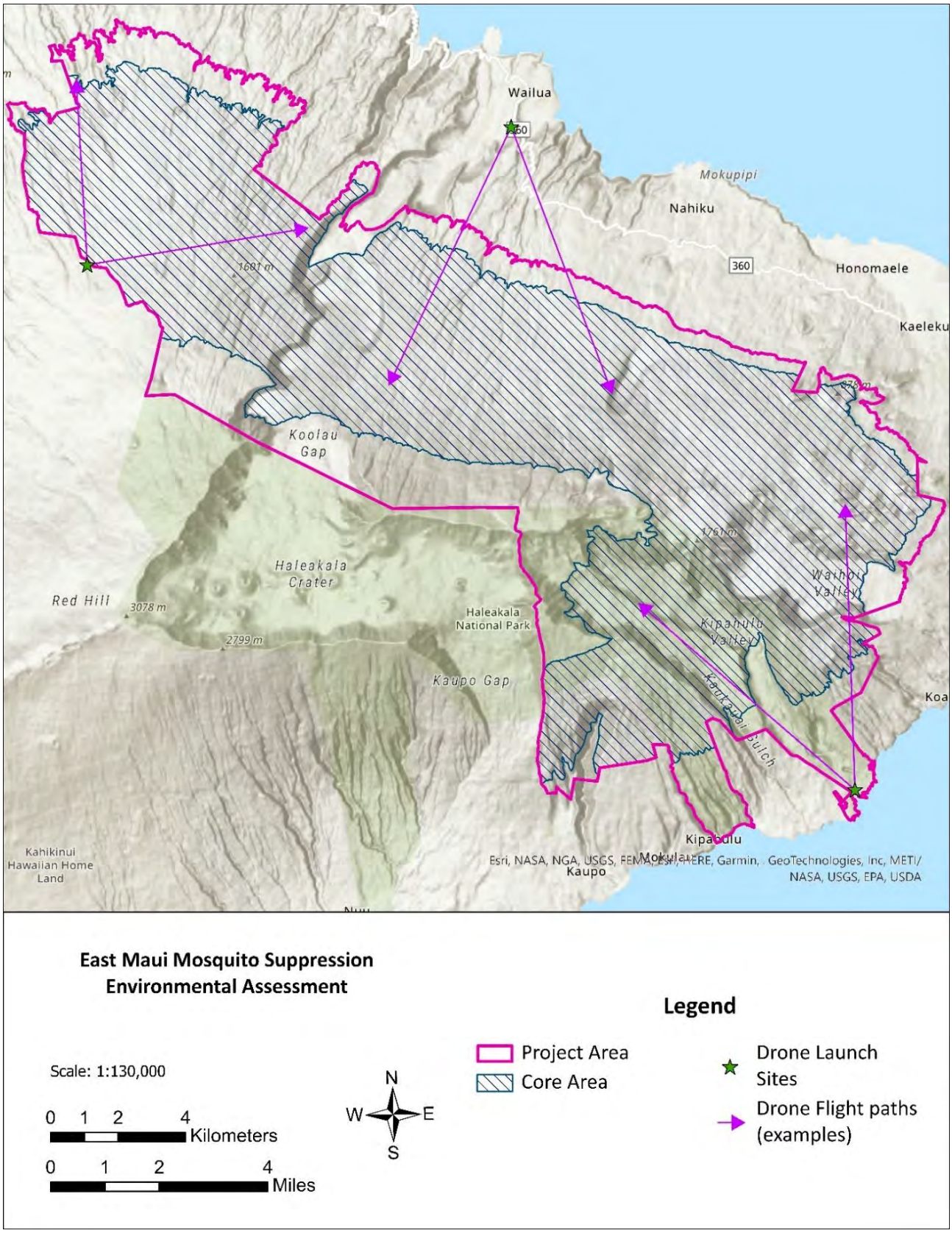

FIGURE 3: EXAMPLE DRONE FLIGHT PATHS FROM POSSIBLE LAUNCH LOCATIONS INTO THE CORE AREA.

Helicopter Longline Release

Helicopters are an essential tool for natural resource management on East Maui. Because of the steep topography and dense vegetation in the project area, helicopters are invaluable for transporting personnel and equipment to remote areas. Given the noise and visual impacts, logistics, and financial requirements of helicopters, the use of helicopters for releasing incompatible mosquitoes is proposed as a short-term (up to two months), temporary release method if drone releases are unavailable. In that event, helicopters could release incompatible mosquitoes for up to two months in management units where population suppression can be sustained.

Several projects worldwide have used helicopters to release sterile insects to control or eradicate agricultural pests (Dyck et al. 2021), and several projects on Maui have had success controlling pests and weeds from devices attached to longlines (Tuttle et al. 2008). The helicopter, operated by a pilot and carrying one spotter (unless the load calculation precludes the weight of a passenger), would be equipped with an approximately 50–100-foot longline attached to the belly hook of the helicopter. Longlines are heavy-duty steel cables that can be attached to the underside of a helicopter. This type of cable allows the helicopter to place loads in areas where the helicopter could not safely land or distribute a load while hovering above the surface.

With an approximately 50-foot tree canopy, a 50–100-foot longline, and a 50-foot buffer for safety, the helicopter would fly approximately 150–200 feet AGL while releasing mosquitoes above the tree canopy. A release mechanism would be attached to the end of the longline, and mosquito releases may be triggered remotely by the pilot or spotter. While the detailed design for longline release of mosquitoes is not yet known, the method is considered feasible based on current longline operations on federal and state lands in Hawai‘i. On East Maui, the NPS and DLNR regularly conduct helicopter herbicide applications using longlines to control high priority invasive plants and animals. These methods would be adapted to mosquito releases within the core area, and have been used to estimate flight speed, flight times, and specific logistics for suppression of mosquito populations on East Maui.

During a typical operation, it is expected that the helicopter would fly at a speed of 69 miles per hour and approximately 500–2000 feet AGL from the main heliport (Kahului Airport, OGG) to a designated temporary helibase (20–90 miles; 10–25 minutes) where the longline and release mechanism would be attached by ground teams. The helicopter would then fly at a slower speed with the longline to the core area (approximately 22 miles per hour) for releases. The helicopter could complete 68–74 release locations per hour and 137–148 release locations per flight before refueling (based on the spacing assumptions previously described for drones). The helicopter could complete three flights per day. Thus, one day of helicopter flights could consist of six hours of flying covering 412–443 release locations. The helicopter would likely spend 15 seconds or less hovering over each mosquito release location. Here we assume repeat visits to any given area would not likely occur more than twice per week, based on logistic constraints, but would be refined over time based on monitoring of mosquito populations.

Table 4 describes the estimated number of helicopter flights (including round trip to and from the main heliport [OGG] and round trip from a front country launch location and release area) and number of flight hours required to release mosquitoes via helicopter longline throughout the entire core area. These estimates are further broken down into warm and cold months.

Pedestrian Mosquito Release

Pedestrian release is not expected to be a primarily release method as it is much less efficient than aerial release methods and it is only possible in limited areas within the project area. Under this method, pedestrian teams would receive helicopter deliveries and then distribute mosquitoes to the release locations and conduct concurrent mosquito monitoring. Pedestrian releases would involve field teams walking the terrain on foot, using existing management trails and fence lines, as well as camping at established remote camps or helicopter LZs if necessary. Teams may spend several days hiking and releasing mosquitoes at designated release locations every 1,300 feet along existing management trails. The number of release locations that can be accessed would be determined by the terrain and availability of management trails at each location. Some non-mechanized trail clearing and re-flagging would be required by NPS or DLNR staff in some areas, with generally more effort required at the lower elevation locations

TABLE 4. ESTIMATED NUMBER OF HELICOPTER FLIGHT HOURS AND ROUND-TRIP FLIGHTS PER TREATMENT (RELEASING MOSQUITOES AT EACH LOCATION) AND PER MONTH (ASSUMING 2 TREATMENTS PER MONTH) PER LAND MANAGER AS A SHORT-TERM, TEMPORARY MEASURE.

Land Manager	Per Treatment				Per Month			
	warm months		cold months		warm months		cold months	
	hrs	flights	hrs	flights	hrs	flights	hrs	flights
Hawai'i Dept. of Land and Natural Resources	12.4	6.2	10.1	5.0	24.9	12.4	20.2	10.1
National Park Service	3.1	1.5	1.7	0.9	6.1	3.1	3.4	1.7
Private	2.0	1.0	1.8	0.9	4.0	2.0	3.6	1.8
The Nature Conservancy	2.0	1.0	0.2	0.1	3.9	2.0	0.4	0.2
TOTAL	**20**	**10**	**14**	**7**	**39**	**20**	**28**	**14**

Note: Presented in the above table are estimated flight information for lower elevations only (2000–4300 ft) during colder months (December–April) when releases at higher elevations are not expected to be needed ("cold months") and all elevations (2000–5600 ft) within the core where releases are expected to be needed during warmer months. These elevations are based on thermal limits of the malaria parasite (>55° F) below which transmission from mosquitoes is limited.

where brushy vegetation is thicker and encroaches on trails and fence lines more frequently. As such, trail maintenance may take more effort per release location at the lower elevation locations. Protocols would be followed to prevent invasive weed dispersal, particularly from lower elevation areas to higher-elevation areas, including sanitation procedures and limiting all movement between camps (either hiking or successive trips) from only higher to lower elevations.

Pedestrian mosquito release, especially at remote sites, would likely be primarily for necessary field trials because it can be implemented immediately and would allow for simultaneous monitoring. Consistent pedestrian release is only possible in portions of Makawao Forest Reserve and Waikamoi Preserve. Although pedestrian releases could occur throughout the year in Makawao Forest Reserve and Waikamoi Preserve, pedestrian releases may only be possible within Haleakalā National Park, Hanawī Natural Area Reserve, and other remote sites on a quarterly basis simultaneous with ground-based mosquito monitoring. A helicopter would be required to transport crews into the field to reach LZs near monitoring and release locations in Haleakalā National Park and Hanawī Natural Area Reserve, and the frequency and duration of these helicopter flights is described in the following section, "Mosquito Monitoring."

Mosquito Monitoring

DLNR will work with State and Federal partners to prepare a detailed monitoring plan. Field teams would conduct a variety of monitoring activities to measure the effectiveness of the proposed action. Field teams would trap mosquitoes in release areas to determine relative abundance of the mosquito population, dispersal distance of incompatible mosquitoes, and estimated hatch success. Field teams would place traps along existing trails and fence lines, collect mosquitoes from traps, and preserve the captured mosquitoes for additional testing, e.g., for absence or presence of avian malaria. As a result of monitoring, the NPS and DLNR would be able to prioritize future releases, optimize the number and location of incompatible mosquitoes, improve mosquito release methods, and minimize costs for project implementation. Sustained and regular mosquito trapping would be necessary to understand the proposed action's effectiveness and track seasonal fluctuations in population densities.

Monitoring would likely occur quarterly (four times/year). Baseline monitoring data are available from areas of Kīpahulu Valley, TNC's Waikamoi Preserve, and Hanawī Natural Area Reserve (Aruch et al. 2007, MFBRP unpublished), and monitoring would be continued at these locations. Monitoring would be more frequent at the start of the project and would vary depending on the availability of incompatible mosquitoes and personnel. It is assumed that

four locations would be selected on state lands (e.g., two within Hanawī Natural Area Reserve and two within Forest Reserves), two locations within the park (within the Kīpahulu Valley Biological Reserve), and two locations within TNC's Waikamoi Preserve.

A total of five sites within Haleakalā National Park, TNC's Waikamoi Preserve, and Hanawī Natural Area Reserve are helicopter access only, where mosquito monitoring field teams would camp at established remote shelters or helicopter LZs. Crews would conduct monitoring activities remotely for approximately one week at a time and would need to use portable generators to charge mosquito trap batteries, GPS units, and field radios. **Table 5** estimates helicopter flight hours required to transport teams in and out of the field for necessary mosquito population monitoring. **Figure 4** shows existing helicopter infrastructure that includes the main heliport at Kahului Airport (OGG) and several LZs throughout the project area. Three other sites within the analysis area are accessible by vehicle, where field teams could commute from management offices daily for monitoring activities.

TABLE 5. ESTIMATED HELICOPTER FLIGHT HOURS TO TRANSPORT MONITORING TEAMS

Land Manager	Helicopter Flight Hours	
	per quarter	per year
	hrs	hrs
Hawai'i Dept. of Land and Natural Resources	7	28
National Park Service	7	28
The Nature Conservancy	3.5	14
TOTAL	**17.5**	**70**

Note: The flight estimates in this table are based on the need to reach 2 monitoring locations within DLNR, 2 within the park, and 1 within TNC Waikamoi Preserve with a helicopter. Additional monitoring may be conducted but helicopter assistance may not be required. Flights hours are estimated for one visit per location quarterly (4 × per year).

Vehicle Support

Where access roads exist (shown in **Figure 5**), motorized vehicles (trucks or SUVs) would be used to transport field teams and equipment for ground-based monitoring and pedestrian releases. Vehicles would be used in the project area on a quarterly basis to support monitoring and likely more frequently to support pedestrian mosquito releases. Vehicles would be used on existing roads that are currently used and maintained by their respective landowners for maintenance, management, and public recreation. None of these existing roads are within designated wilderness. During monitoring, vehicles would drive along the Flume Road shown (in brown) on **Figure 5** for up to 4 hours per day for 7 consecutive days on a quarterly basis to reach three monitoring locations in Makawao Forest Reserve and TNC's Waikamoi Preserve. Vehicles would drive along the same road once or twice weekly for up to 2 hours per day when or if pedestrian mosquito releases are occurring (for perhaps 50-100 locations in Makawao Forest Reserve and TNC's Waikamoi Preserve). This road crosses Makawao Forest Reserve and private conservation lands but provides pedestrian access to TNC's Waikamoi Preserve.

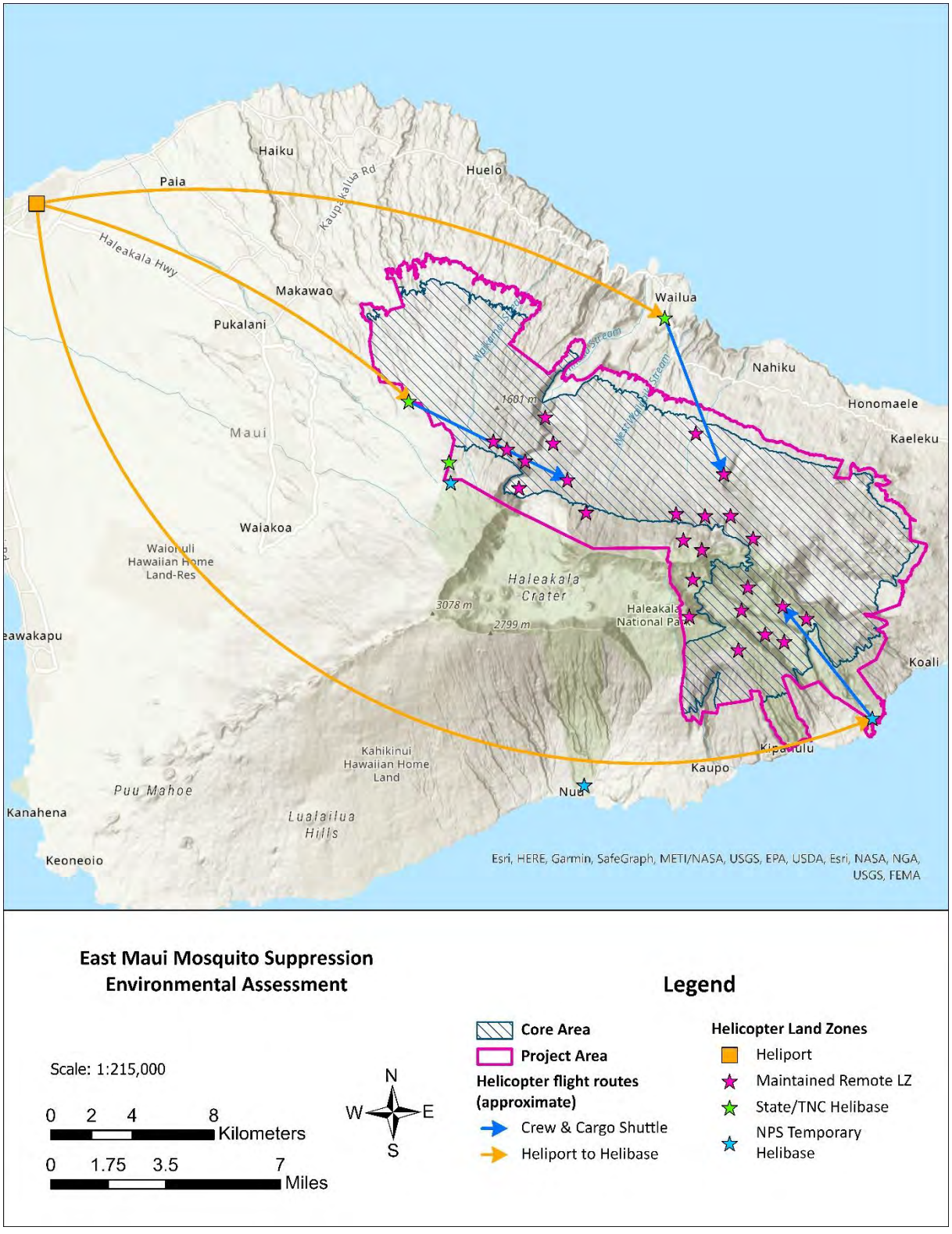

FIGURE 4: EXAMPLE FLIGHT PATHS[1] FROM THE HELIPORT TO HELIBASES (ORANGE) AND THEN ON TO REMOTE LANDING ZONES (BLUE).

[1] Many of the landing zones without arrows would also be used during project implementation but this map has been provided to show several example scenarios for various flight paths from the heliport to helibases and then to remote landing zones.

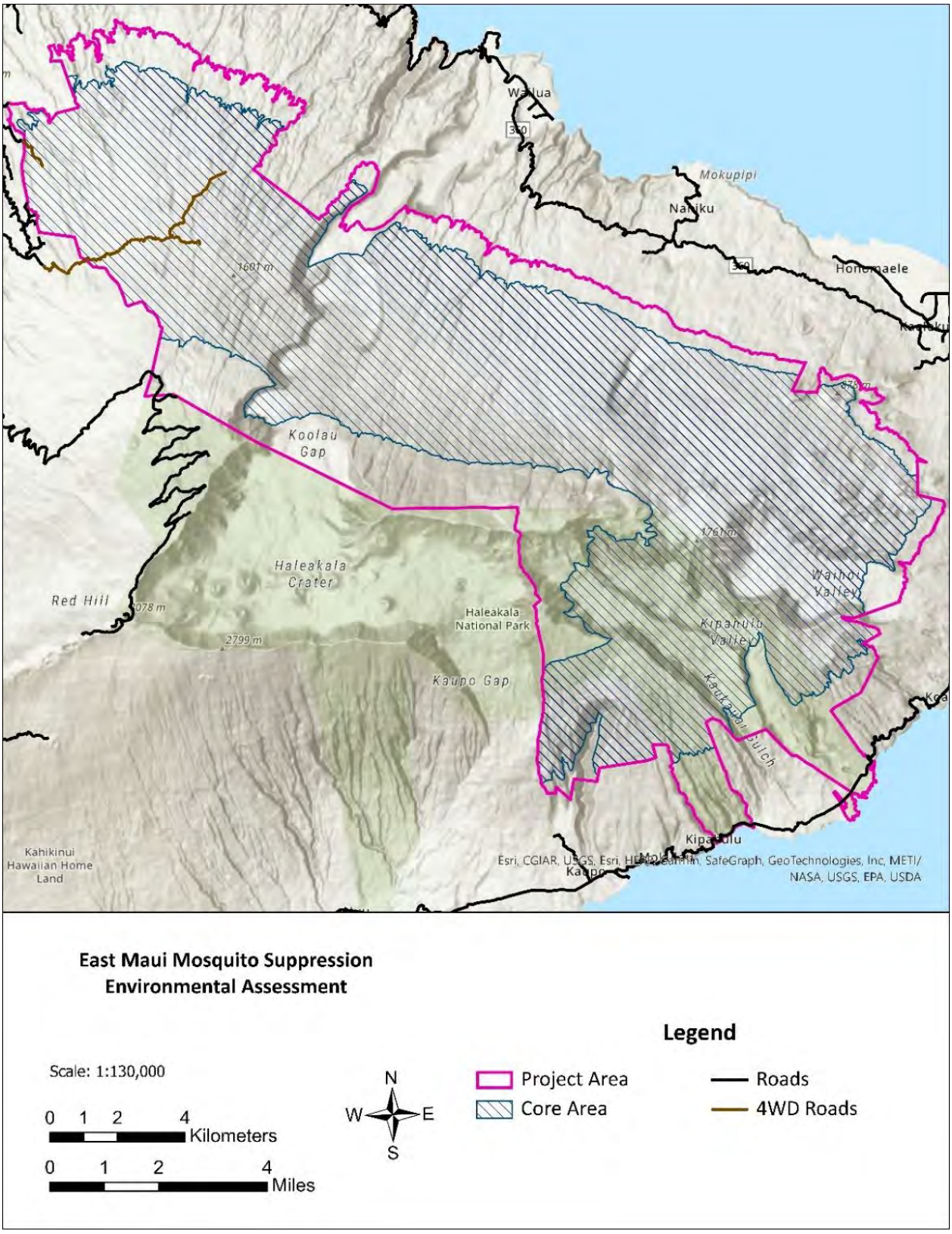

FIGURE 5: ROAD ACCESS TO THE PROJECT AREA

Required Permits and Approvals

To implement the proposed action as described, the NPS expects to obtain approval from the Department of the Interior to operate drones in the park. Currently, the state can use drones on state Forest and Natural Area Reserves and TNC within Waikamoi Preserve if compliant with the Federal Aviation Administration (FAA) regulations. Certification by the FAA would be required for drone use in all areas, and all drone and helicopter flights would comply with all FAA rules and regulations.

In June 2022, the State of Hawai‘i Board of Agriculture approved the addition of the southern house mosquito to the Chapter 4-71, Hawai‘i 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 inoculated with incompatible strains of *Wolbachia* bacteria. In October 2022, the Hawai‘i Department of Agriculture (HDOA), Plant Quarantine Branch issued a permit to DLNR to allow for the import of southern house mosquitoes for mosquito control projects; however, the permit would need to be amended for broad-scale implementation of releases as part of this project. The Environmental Protection Agency (EPA) regulates incompatible mosquitoes as biopesticide products. An EPA Section 18 application has been prepared for submittal by the HDOA, in collaboration with 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. If approved, the Section 18 process would result in temporary product registration and a label that identifies appropriate product use, application rates, restrictions, safety, and quality control requirements. If 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.

The release of incompatible mosquitoes for landscape scale control of the southern house mosquito on state lands is contingent on the results of the impact analysis in this EA. However, in June 2022, DLNR filed an exemption notice regarding the preparation of an environmental assessment under the authority of Chapter 343, Hawai‘i Revised Statutes (HRS) and Section 11-200.1-17, HAR, to conduct limited import of male mosquitoes for preliminary transport trials and mark release recapture studies. The Chairperson of the DLNR has the authority to declare exempt from the preparation of an environmental assessment those department actions that are included in the DLNR exemption list when the Board of Land and Natural Resources has delegated authority to conduct those actions. The exemption notice cited General Exemption Type 5 “Basic data collection, research, experimental management and resource and infrastructure testing and evaluation activities that do not result in a serious or major disturbance to an environmental resource” (DLNR exemption list November 10, 2020).

Mitigation Measures and Best Management Practices

Table 6 summarizes general best management practices that would be implemented for this project to avoid and minimize potential impacts.

TABLE 6: GENERAL BEST MANAGEMENT PRACTICES INCLUDED IN THE PROPOSED ACTION

Resource Mitigation Measures	
Wildland Fire	Especially in dry areas, personnel would take all precautions to avoid igniting wildland fires. Vehicles would not be left to idle, especially in tall grass. Vegetation within LZs would be maintained to avoid possible ignition by helicopters. Personnel would follow all applicable DLNR and NPS regulations in the project area that includes but is not limited to no open fires and closed cooking devices.
	Helicopters would use appropriate mufflers to minimize fire potential.

Resource Mitigation Measures	
	NPS and DLNR staff regularly conduct on-site measurements of temperature, humidity, and wind to determine fire risk. If the level is moderate-high, fire teams would warn staff and restrict or eliminate activity in high-fire risk areas. Water tanks would be maintained and could provide a water source for suppression if needed.
	Although not anticipated, the local fire department, in coordination with NPS and DLNR, would respond to and extinguish potential fires ignited by project activities as soon as possible.
	All uncrewed aircraft systems (UAS) will be closely monitored by the operator and field teams while adhering to guidance developed by the NPS Natural Resource Stewardship and Science Directorate and policies established by Federal Aviation Administration. The DLNR Division of Forestry and Wildlife (DOFAW) is mandated under the Land Fire Protection Law, Chapter 185, Hawai‘i Revised Statute to take measures for the prevention, control, and extinguishment of wildland fires within all forest reserves and natural area reserves on East Maui (DLNR, DOFAW 2018). DOFAW is statutorily required to cooperate with county and federal government fire control agencies to develop plans for wildfire prevention. UAS operators under NPS or DOFAW operational control will be required to have an up-to-date FAA 14 CFR Part 107 Remote Pilot Certificate and FAA Certificate of Waiver or Authorization. UAS operations will follow best practice protocols established by the National Wildfire Coordinating Group, which provides guidance detailed in the Interagency Helicopter Operation Guide. NPS law enforcement will monitor UAS operations and approve flight plans and thus will be able to respond immediately to UAS mishaps. The Maui Fire Department, in coordination with NPS Fire Management officers and the DOFAW Fire Management Program, will respond to any on-site emergency, including downed UAS vehicles to assure that there is no risk of wildfire.
Vegetation	Transport of weeds by equipment, including helicopters, would be mitigated by strictly following NPS and DLNR sanitation protocols. Specifically, concerns regarding the spread of invasive weeds would dictate the order of which LZs are accessed, who is sent to each LZ and when. Project personnel would implement and follow the USFWS “*Avoidance, Minimization, and Conservation Measures for listed plants in the Pacific Islands*” (revised September 2020; Appendix D), the USFWS January 20, 2022, letter addressed to the park regarding this project (Appendix D), and the [*Pacific Islands Fish and Wildlife Office] PIFWO Invasive Species Biosecurity Protocol* (USFWS 2022a; Appendix D). Personnel would follow DLNR and NPS Rapid ‘Ōhi‘a Death sanitation protocols.
Wildlife	NPS and DLNR staff would observe native wildlife while conducting mosquito suppression and monitoring activities. If noise-producing activities appear to be adversely affecting native wildlife, the park or DLNR wildlife biologists would be consulted as to what, if any, restrictions would be implemented. Restrictions could include re-routing, delaying, or modifying flight times or motor vehicle use. No flights (either drone or helicopter) would occur between “civil sunset” and “civil sunrise.”

Resource Mitigation Measures	
Special Status Plant Species	NPS and DLNR personnel and contractors working in the area would be required to demonstrate the ability to identify special status plants (i.e. federally- and state-listed plants and plant species at risk) and would be trained on how to avoid adverse impacts to them. Project personnel would implement and follow the USFWS "*Avoidance, Minimization, and Conservation Measures for listed plants in the Pacific Islands*" (revised September 2020; Appendix D), the *PIFWO Invasive Species Biosecurity Protocol* (USFWS 2022a; Appendix D), and the mitigation measures provided in the USFWS January 20, 2022, letter addressed to the park regarding this project (Appendix D). The boundary of the area occupied by listed plants and plant species at risk would be marked with flagging by a surveyor and these areas would be avoided. All project personnel would be provided with maps showing the locations of designated critical habitat areas and trained on how to avoid unnecessary adverse impacts within designated critical habitat, including disturbance to native and special status plant species and activities that could accelerate erosion. This sensitive information (i.e. localities of listed plants) would be protected and not shared outside of the personnel assigned to this project.
Special Status Wildlife Species	All team members working on the project would be trained in special status wildlife species identification and ways to minimize impacts to listed species. This information would include maps showing locations of all known nesting or roosting sites. This sensitive information would be protected and not shared outside of the personnel assigned to this project. Project personnel would implement and follow the USFWS "*Animal Avoidance and Minimization Measures"* for listed wildlife in the Pacific Islands (February 2022; summarized in **Table 7**; Appendix D), the "*PIFWO Invasive Species Biosecurity Protocol*" (Appendix D), and the mitigation measures provided in the USFWS January 20, 2022, letter addressed to the park regarding this project (Appendix D). Additionally, the park does not fly out of ʻOheʻo/Kīpahulu temporary helibase until after 8 am to prevent early morning noise disturbance, which would double as a mitigation for birds that are active at dawn. No flights (either drone or helicopter) would occur between "civil sunset" and "civil sunrise."
Special Status Species Habitat	Personnel tasked with working in or traversing across designated critical habitat would be trained and evaluated in plant identification (especially listed plant identification). Disturbance to special status species would be avoided. Avoidance measures would include confining pedestrian travel to existing trails and camps and restricting project activities for a certain period of time or in a certain area. If deemed necessary by park or DLNR wildlife biologists, noise-producing activities may be prohibited near breeding or nesting habitat of endangered or threatened wildlife. All project personnel would be provided with maps showing the locations of critical habitat areas and trained in biosecurity (see Invasive Species below) and on how to avoid adverse impacts within critical habitat.
Invasive Species	All vehicles, equipment, clothes, and footwear would be inspected and cleaned to prevent transport and establishment of introduced species including weeds and diseases/pathogens before and after field deployments.
Cultural, Historic, and Ethnographic Resources	Archaeological features would be avoided during all ground-based activities. Staff would be provided with maps depicting the locations of cultural and historic resources and buffer zones and trained in best practices for avoiding adverse impacts. This sensitive information would be protected and not shared outside of the personnel assigned to this project.

Resource Mitigation Measures	
	Project-related helicopter and drone flights would be avoided on park's six (6) designated commercial free days (calendar dates vary slightly from year to year) to avoid disturbance of traditional cultural practices (see Appendix C for more information): • End of Makahiki (January) • Zenith Noon (May) • Summer Solstice (June) • Zenith Noon (July) • Start of Makahiki (October) • Winter Solstice (December)
Human Health and Safety	All appropriate precautions and safety measures would be taken when operating helicopters and drones and conducting release activities to avoid threats to human health and safety. Specifically, regulations for safe operation of helicopters/drones, camping, and hiking during release activities would be strictly enforced.
Acoustic Environment	LZs, camps, helibases, flight paths, timing of flights, and height above ground level would be selected to minimize noise impacts on visitors, nearby landowners or communities, wilderness, and sensitive environmental resources. Helicopter flights out of the ʻOheʻo/Kīpahulu temporary helibase would not occur until after 8 am to prevent early morning noise disturbance. A communication plan would be developed to include coordination with interpretation staff to avoid conducting flights when an interpretive program is scheduled or when Native Hawaiian ceremonies, plant collecting, or other traditional activities would be conducted.
Visitor Experience	There would be no flights or operations conducted after dark, before civil sunrise, or on weekends. When flights are conducted near areas open to public access, flight path and timing would be selected to minimize noise and viewscape impacts on visitor experience.
Wilderness Preservation	All actions taken that involve a prohibited use pursuant to Section 4(c) of the Wilderness Act would be subject to a Minimum Requirements Analysis and would strive to minimize the impacts to wilderness character.

Table 7 summarizes USFWS-recommended mitigation measures (Appendix D) that would be implemented to avoid and minimize potential impacts on federally listed wildlife species.

TABLE 7. USFWS-RECOMMENDED MITIGATION MEASURES

Resource Mitigation Measures	
Nēnē (Hawaiian Goose)	• Personnel would not approach, feed, or disturb nēnē. • If nēnē are observed resting or foraging within a particular release location or helicopter/drone launch location during the breeding season (October through May), a biologist familiar with nēnē nesting behavior would survey for nests in and around the launch site prior to the resumption of work. Repeat surveys after any subsequent delay of work of three or more days (during which the birds may attempt to nest). • If a nest is discovered within 150 feet of a proposed worksite, all work within 150 feet would cease and USFWS would be contacted for guidance before resuming work within this area proximate to the nest. • In areas where nēnē are known to be present, personnel would post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.
Hawaiian Forest Birds	• Personnel would avoid activities that may increase the wildfire threat to montane forest habitats. • Personnel would avoid removing tree cover during the typical breeding season between November 1 and June 30. • Personnel would prevent the spread of invasive species. • Personnel would avoid increasing stagnant water habitat. • To the extent possible, personnel would conduct mosquito suppression in threatened and endangered forest bird habitat outside the peak of the breeding season (January-March). Where breeding seasons cannot be avoided, drone operations would occur only above tree height level, and hovering in one place would be minimized to limit the risk that breeding birds would flush from active nests. Helicopters would avoid flying low near forest bird habitats to avoid rotor wash and disturbing nesting forest birds.
Hawaiian Seabirds	• During the seabird breeding season (February 1 to November 15), NPS and DLNR would avoid flights between dusk and dawn to protect night-flying seabirds.
Hawaiian Waterbirds	• Endangered waterbirds do not occupy, or breed within the project area. If waterbirds were to be detected, personnel would post and implement reduced speed limits and inform project personnel and contractors about the presence of endangered species on-site.
ʻŌpeʻapeʻa (Hawaiian Hoary Bat)	• 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). • NPS and DLNR would avoid drone and helicopter flights between dusk and dawn to protect flying bats. • During the breeding season, drone operations would occur only 50-150 feet above tree height level, and hovering in one place would be minimized to limit the risk of disturbing pup rearing. Helicopters would avoid flying low near ʻŌpeʻapeʻa habitats to avoid rotor wash and disturbing day roosting bats.

CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes both the affected environment (the existing conditions of resources, including trends and ongoing and planned actions) and environmental consequences (impacts) of the proposed action on each resource. The affected environment and environmental consequences if no action is taken are described in each "Current and Expected Future Condition of the [Resource] if No Action is Taken" section. This is consistent with direction from the Council on Environmental Quality (CEQ), which states 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 environmental consequences of the proposed action are described in the "Effects of the Proposed Action on [Resource]" section for each resource. For the purposes of describing the affected environment and resource trends, past, present, and reasonably foreseeable future actions on NPS, DLNR, and TNC lands were assessed and are further described in Appendix E.

Methods and Assumptions

The following analysis evaluates direct, indirect, and cumulative impacts that would result from the implementation of the alternatives. A factual description of the direct and indirect impacts provides the reader with an understanding of how the current condition of a resource would likely change as a result of implementing the alternatives. The approach includes the following elements:

- The analysis is focused, to the greatest extent possible, on management changes and associated issues that could have meaningful impacts on the resources being evaluated.
- The description of the affected environment and analysis of impacts follow the CEQ NEPA regulations, as amended in May of 2022, the Department of the Interior NEPA regulations, and the 2015 NPS NEPA Handbook.
- As the proposed action is a joint NPS/DLNR project, the impact analysis in this EA is also in accordance with the Hawai‘i Environmental Policy Act (HEPA). According to HAR Chapter 11-200.1, Environmental Impact Statement Rules, "(a) In considering the significance of potential environmental effects, agencies shall consider the sum of effects on the quality of the environment and shall evaluate the overall and cumulative effects of an action. (b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action." HEPA Significance criteria are evaluated in Appendix G.
    - One of the specific considerations under HEPA is that the effects of a proposed action on the cultural practices of the community be analyzed. Impacts to cultural resources were considered and dismissed from detailed analysis, as described in Appendix B. However, a Cultural Impact Assessment was prepared for the project as required by HEPA and is included in Appendix C.

The NPS and DLNR interdisciplinary planning team reviewed a substantial body of scientific literature and studies applicable to the proposed mosquito release methods, project area, and associated resource issues and impact topics. This information augmented previous site-specific observations and documentation gathered by team personnel to support the qualitative and quantitative statements presented for each analyzed resource.

The following basic guiding assumptions were used to provide context for this analysis:

- *Mitigation.* All mitigations/best management practices included in Chapter 2 would be implemented for the proposed action.

- *Analysis Period.* The proposed action provides objectives and specific implementation actions needed to manage mosquito populations into the future. To understand the potential long-term impacts associated with mosquito population management, this document considers actions and effects over a 20-year period.
- *Overall Analysis Area.* The overall analysis area includes 64,666 acres of NPS, DLNR, and private lands managed for conservation. Haleakalā National Park lands within the analysis area include the Kīpahulu District and small portions of the northern edge of the Summit District. State lands within the analysis area include the Koʻolau, Hāna, Kīpahulu, and Makawao Forest Reserves and Hanawī Natural Area Reserve. Private lands managed by TNC, East Maui Irrigation, and Mahi Pono are also within the analysis area. Based on proposed ground activities under the proposed action or a more limited extent of a resource within the analysis area, a smaller area was analyzed (such as for threatened and endangered plants, which would only potentially be impacted by pedestrian teams, and wilderness character, which is only applicable to the designated Haleakalā Wilderness within Haleakalā National Park).

Cumulative Impacts

The CEQ regulations for implementing NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "effects on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.1(g)(3)).

Cumulative impacts were determined for each impact topic by combining the impacts of other past, present, and reasonably foreseeable future actions that also would result in beneficial or adverse impacts. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the park, on adjacent DLNR and TNC-managed lands in the project area, and, if applicable, the surrounding region. Past projects or plans with ongoing effects and reasonably foreseeable future projects or plans on NPS, DLNR, and TNC-managed lands are identified in Appendix E). Cumulative impacts of past, present, and reasonably foreseeable actions are included in the "Current and Expected Future Condition of the [Resource] if No Action is Taken" section of each resource, and the cumulative impacts of the proposed action are included under the "Effects of the Proposed Action on [Resource]" section of each resource.

ACOUSTIC ENVIRONMENT

The acoustic environment is the combination of all the acoustic resources and sounds within a given area as modified by the environment (such as meteorological conditions, absorption, reverberation, reflection, and diffraction). Acoustic resources are the individual types of sounds, including both natural sounds (for example, wind, water, wildlife, weather) and cultural sounds (for example, Native Hawaiian ceremonies). The natural soundscape of a park, according to the NPS soundscape management policy (Section 4.9 in NPS 2006), refers to the combination of all the natural sounds occurring in the park, absent the human-induced sounds, as well as the physical capacity for transmitting those natural sounds that can be perceived and comprehended by humans. Natural sounds include those within and beyond the range that humans can perceive and can be transmitted through air, water, or solid materials (NPS 2006b). The character and quality of the acoustic environment influence human perceptions of an area, providing a sense of place that differentiates it from other regions. In addition, the acoustic environment is a critical component of wilderness character and plays an important role in wildlife communication, behavior, and other ecological processes (Wood 2015).

Noise generally refers to sounds that are unwanted or intrusive, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds (Section 4.9 in NPS 2006; Lee et al. 2016). Primary sources of human-caused noise can include cars, aircraft, buses, and other motorized vehicles and equipment. Sound levels can vary greatly, depending on location, topography, vegetation, biological activity, weather conditions, and other factors. The magnitude of sound levels is usually described by its sound pressure. The A-weighted decibel (dBA) scale is commonly used to describe sound levels because it reflects the frequency range to which the human ear is most sensitive.

Current and Expected Future Condition of the Acoustic Environment if No Action is Taken

The current condition of the acoustic environment is described below. A detailed discussion of past, present, and reasonably foreseeable future projects within the park contributing to the existing conditions and current trends of the acoustic environment are described in more detail in Appendix E. The description below includes an overview of how these ongoing and future actions would affect the acoustic environment. Details regarding impacts of noise from the no-action alternative on wildlife, visitors, and wilderness are discussed further in the "Federally Listed Wildlife Species and Wildlife Species of Concern," "Visitor Use and Experience," and "Wilderness" sections of this chapter.

Under the no-action alternative, the acoustic environment would remain the same or similar to existing conditions, including trends and impacts from past, present, and foreseeable planned actions. Therefore, the affected environment and impacts of no-action are the same and discussed only once here.

Haleakalā National Park

NPS *Management Policies 2006* and Director's Order 47 require the agency to manage, preserve, and restore park acoustical environments and soundscapes. These policies require the NPS to protect and restore the natural soundscapes of parks, including those that have been affected by unnatural and unacceptable noise. In addition to these policies, the park's Foundation Document (NPS 2015b) identifies natural sounds as one of the fundamental resources and values of the park. As discussed in the Foundation Document, natural soundscapes are vital components of a healthy, intact, biological community, that play an important role in wildlife communication and behavior and are critical to effective wilderness management. In addition, natural soundscapes are highly desired by park visitors. As a fundamental resource and value, natural soundscapes are "*warranted primary consideration during planning and management processes"* (NPS 2015b).

The natural acoustic environment of the park is a key fundamental resource and value (NPS 2015b), and is important for wildlife, visitors, and native Hawaiian ceremonies. Because of this importance, the park has invested in over three decades of extensive acoustic monitoring, scientifically documenting the acoustic environment and where human caused noise may impact key resources. Overall, the findings of these studies revealed that across the park, the acoustic environment is generally in good condition, while aircraft are documented as the most prevalent noise source affecting the soundscape (Wood 2015, Lee et al. 2016). Helicopters are most common during the daytime and high-altitude jets are most common at night (Wood 2015). Further, the crater of Haleakalā National Park boasts intensely quiet sound pressure levels, around 10 dBA (Wood 2015). It is necessary to note that the intent of these acoustic monitoring reports is to identify the general acoustic conditions of the park. Sampling locations are generally chosen to represent larger areas of the park based on considerations such as vegetation cover and topography. The acoustic monitoring in these reports was not intended to measure any specific noise, including aircraft or air tour noise. Further, what is mostly reported below are median sound pressure levels during the day from 6am to 6pm ($L_{A50,\ 12hr,\ daytime}$). Like any median measure, this metric does not drastically change if only a few loud events per day occur. Additionally for reference, because decibels are measured on a logarithmic scale, an increase in 3 dB represents a doubling of sound pressure level.

Most of the project area within park lands is in the Kīpahulu District. Common natural sounds in that portion of the project area include weather-related sounds (wind in the forest canopy, thunder, and rain), water flowing, waterfalls rushing, bird calls, insects buzzing, and other animal calls or communications (Lynch 2012, Lee et al. 2016, Job et al. 2018). **Table 8** presents the results of acoustical monitoring conducted for the park within or near the project area and **Figure 6** depicts noise monitoring locations identified in the table. The project area includes the entire Kīpahulu District and a small portion of the Summit District of the park.

The baseline acoustic measurement of natural ambient sound levels for upper Kīpahulu Valley (ST9) is approximately 30 dB ($L_{A50,\ 12hr,\ daytime}$) and the measurement of existing ambient sound levels is approximately 35 dB ($L_{A50,\ 12hr,\ daytime}$) (Lee et al. 2016). Natural ambient in upper Kīpahulu Valley is 30 dB ($L_{A50,\ 12hr,\ daytime}$) due to more vegetation, rain and streams, birds, and insects. The existing ambient of 35 dB ($L_{A50,\ 12hr,\ daytime}$) includes the noise of aviation, which is the dominant (and possibly the only) non-natural sound that could be heard in the area. Visitors are not allowed in Kīpahulu Valley Biological Reserve (see **Figure 6**).

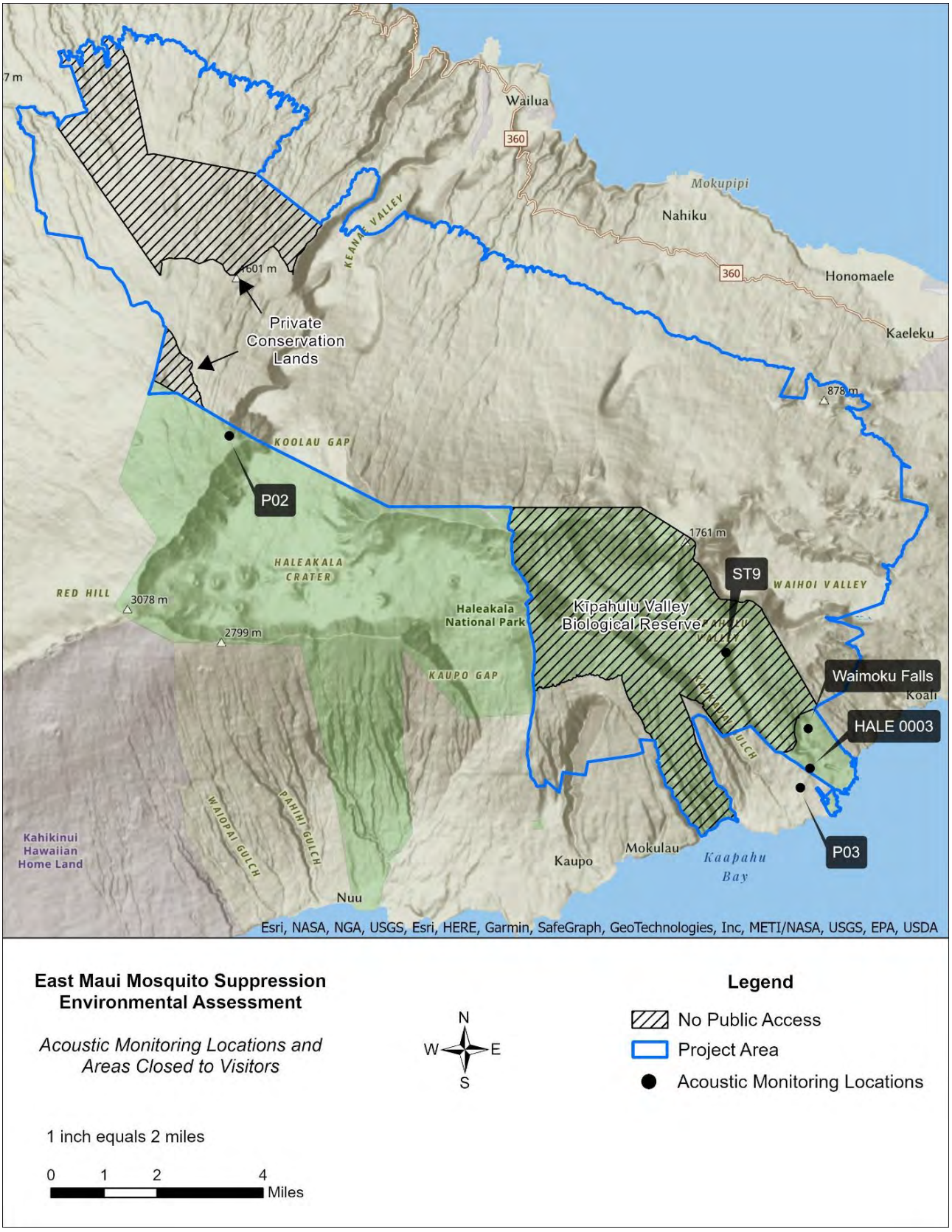

FIGURE 6: AREAS CLOSED TO PUBLIC ENTRY AND ACOUSTIC MONITORING LOCATIONS WITHIN HALEAKALĀ NATIONAL PARK

Commercial air tours, commercial flights, private aviation, and other administrative flights contribute noise to this area. The difference between the natural and existing ambient, as measured in 2003 for upper Kīpahulu Valley, represents a meaningful change. In other words, the natural ambient is noticeably quieter than the existing ambient due to the factors described earlier in this section.

The lower-elevation portion of the Kīpahulu District acoustic measures are represented by Kīpahulu Coastal (P03) measured in 2003 and Kīpahulu (HALE003) measured in 2008 (Lee et al. 2016, Lynch 2012). Natural ambient sound levels for these areas were 45.3 dB ($L_{A50, 12hr, daytime}$) for P03 and 38.0 dB ($L_{A50, 12hr, daytime}$) for HALE003. The existing ambient sounds levels were 43.5 dB ($L_{A50, 12hr, daytime}$) for P03 and 38.9 dB ($L_{A50, 12hr, daytime}$). These sound pressure levels (both natural and existing) are much higher due to the proximity to the coast and more natural sound activity; however, the small differences between natural and existing ambient here suggest lower levels of noise than the upper portion of the valley. The higher natural and existing ambient sound pressure levels do allow for masking of anthropogenic or unwanted noise in these areas.

A small portion of the project area occurs within the Summit District of the park. **Table 8** includes the results of acoustical monitoring conducted along the Supply Trail within the Summit District (P02) with the natural ambient at approximately 27.2 dB ($L_{A50, 12hr, daytime}$) and the measurement of existing ambient sound levels is approximately 27.7 dB ($L_{A50, 12hr, daytime}$) (Lee et al. 2016). These measures indicate a relatively quiet acoustic environment, dominant in natural sounds such as the sound of wind, rain, and the occasional animal noise (Lee et al. 2016). In addition to sounds of hikers, day-use visitors, campers, and human-generated noises that are part of the soundscape on a regular to intermittent basis, there is also noise generated by park management activities, vehicles along the small portion of Crater Road within the project area, and administrative and commercial aircraft flying overhead (primarily helicopter flights).

TABLE 8: SUMMARY OF SOUNDSCAPE DATA COLLECTED WITHIN THE PARK PORTIONS OF THE PROJECT AREA

Site Name (Site Number)	Vegetation Type	Year Data Collected[1]	$L_{Anat,12hr, daytime}$[2]	$L_{A50, 12hr, daytime}$[3]	$L_{A90, 12hr, daytime}$[3]
Kīpahulu (HALE003) *	Grassland; coastal	2008	38.0	38.9	35.1
Upper Kīpahulu Valley / Kīpahulu Scientific Reserve (ST9) *	Evergreen forest	2003	30.7	34.9	30.0
Kīpahulu Coastal (P03) *	Forested upland	2003	45.3	43.5	38.2
West Rim Crater / Supply Trail (P02)	Shrubland	2003	27.7	27.2	21.5

Sources: Lee et al. 2016 Lynch 2012.
[1] Different techniques were used to calculate natural ambient sound in 2003 versus 2008. See Lee et al. 2016 for data collection protocol in 2003 and see Lynch 2012 for data collection protocol for data collected in 2008
[2] L_{nat} = natural ambient sound level and is the natural sound conditions in national parks, which exist in the absence of any human-produced noise.
[3] L_{50} and L_{90} = metric used to describe existing sound pressure level (L) in decibels, exceeded 50 and 90 percent of the time respectively; in other words, half the time the measured levels of sound are greater than the L_{50} value, while 90 percent of the time the measured levels are higher than the L_{90} value.
* Located in lower Kīpahulu Valley.

Helicopters are used for transporting park personnel to various park locations for resource monitoring, rescue actions, and maintenance activities. These flights contribute noise to the park's acoustic environment. Park staff conduct management and resource monitoring activities in remote areas of the park and fieldwork may last a few hours to a week at a time. Ongoing activities that use mechanized tools include fencing to exclude ungulates and facilities maintenance for existing cabins within wilderness enclaves. Helicopter use for these administrative activities averaged approximately 200 hours/year (approximately 100 operations) between 2011 and 2022 (T. Bailey, *pers. comm. 5/26/2022*) and would likely continue at current levels into the future. Approximately 30 percent of current administrative flights travel within the Summit District and 70 percent (140 hours/year or 12 hours/month) travel within the Kīpahulu District including many areas where incompatible mosquito releases would occur under this project. The

park would continue current management actions and respond to future needs and conditions without major changes in the present course.

Unlike administrative flights, commercial air tours in the park occur seven days a week year-round except during inclement weather and on the following commercial-free days (end of Makahiki [January], Zenith Noon [May], Summer Solstice [June], Zenith Noon [July], start of Makahiki [October], and Winter Solstice [December]). Between 2013 and 2019, the number of commercial air tours in the park ranged between 4,543 and 4,932 per year (Lignell 2020). From 2013 through 2018, the number of commercial air tours averaged approximately 13 air tours per day (an estimated 2.05 hours per day or 750 hours per year). In 2019, a study identified a total of 321 helicopter air tours between March 15–April 15, with an average of 10 flights per day over this period (Beeco et al. 2020). **Figure 7** displays the travel patterns and helicopter model of these flights (figure from Beeco et al. 2020). These flights intersect the project area in the southernmost reaches, primarily around Kīpahulu Valley, Kaʻāpahu, and Kaupō Gap. Based on acoustical monitoring in 2003, commercial aircraft were audible 10.2 percent of the time at the Supply Trail (P02) monitoring station (in the Summit District) and 27.8 percent of the time at the monitoring station located in the highest monitoring station in upper Kīpahulu Valley (ST9), Kīpahulu District (Lee et al. 2016). The park is developing an Air Tour Management Plan (ATMP) with the FAA to mitigate or prevent substantial adverse impacts of commercial air tour operations on the park's natural and cultural landscapes and resources, areas of historic and spiritual significance to Native Hawaiians, wilderness character, and visitor experience. A decision is expected in 2023.

The impacts of these ongoing and future actions (Appendix E) have been considered. Under the no-action alternative, the acoustic environment would remain the same or similar to existing conditions, including trends and impacts from past, present, and foreseeable planned actions. Because these actions are part of the existing acoustic environment conditions, the no-action alternative would not result in any indirect or direct impacts to the acoustic environment on NPS lands. In turn, because there are no direct or indirect effects of the no-action alternative, there would be no cumulative effects associated with the no-action alternative.

State Lands

The State of Hawaiʻi regulates noise through the HAR, Title 11, Chapter 46 (HAR 11-46), "Community Noise Control." The purpose of these rules is to *"provide for the prevention, control, and abatement of noise pollution in the State from the following noise sources: stationary noise sources; and equipment related to agricultural, construction, and industrial activities"* (HAR 11-46). Community Noise Control Regulations are not applicable to most moving sources, i.e., transportation and vehicular movements.

State lands within the project area are depicted in **Figure 1**. Other than administrative and commercial helicopter flights and the occasional noise from hunters and management activities on state forest reserves (e.g., invasive animal and plant control, habitat restoration, resource monitoring, rare species protection and research, fire management, and infrastructure maintenance), the state forest and natural area reserves are extremely quiet (based on anecdotal experience of state staff working in the project area). Although the state has no acoustic monitoring data in the project area, the soundscape likely consists primarily of natural sounds coming from wind, rain, animal noises, and waterfalls, based on NPS acoustic monitoring results as the baseline for the entire project area. Most state forest reserves within the project area are open to the public, however, visitor use is very low due to the difficult terrain and limited roads and trails. State natural area reserves within the project area (such as Hanawī Natural Area Reserve) are open to the public, but access is extremely difficult, and permits may be required for access and certain activities. Therefore, visitor use in these areas is extremely limited.

On state lands, DOFAW oversees fence construction and maintenance, control of ungulates, control of invasive plants, and predator control to preserve native ecosystems and species. The Maui Forest Bird Recovery Project (MFBRP) conducts mosquito and avian malaria monitoring. Mechanized equipment and ground teams would generate noise during fencing activities and regular planned maintenance of trails and LZs. Approximately 165 helicopter operations are conducted per year for management activities within the reserves. These flights are typically quick trips to drop off field staff and supplies. Over the past 12 years, DOFAW used helicopters for approximately 208 hours/year (4 hours/week) to conduct natural resource management activities (Safecom 2022). It is unknown how many commercial or tour flights fly over the state forest reserves within the project area, and site-specific acoustic data have

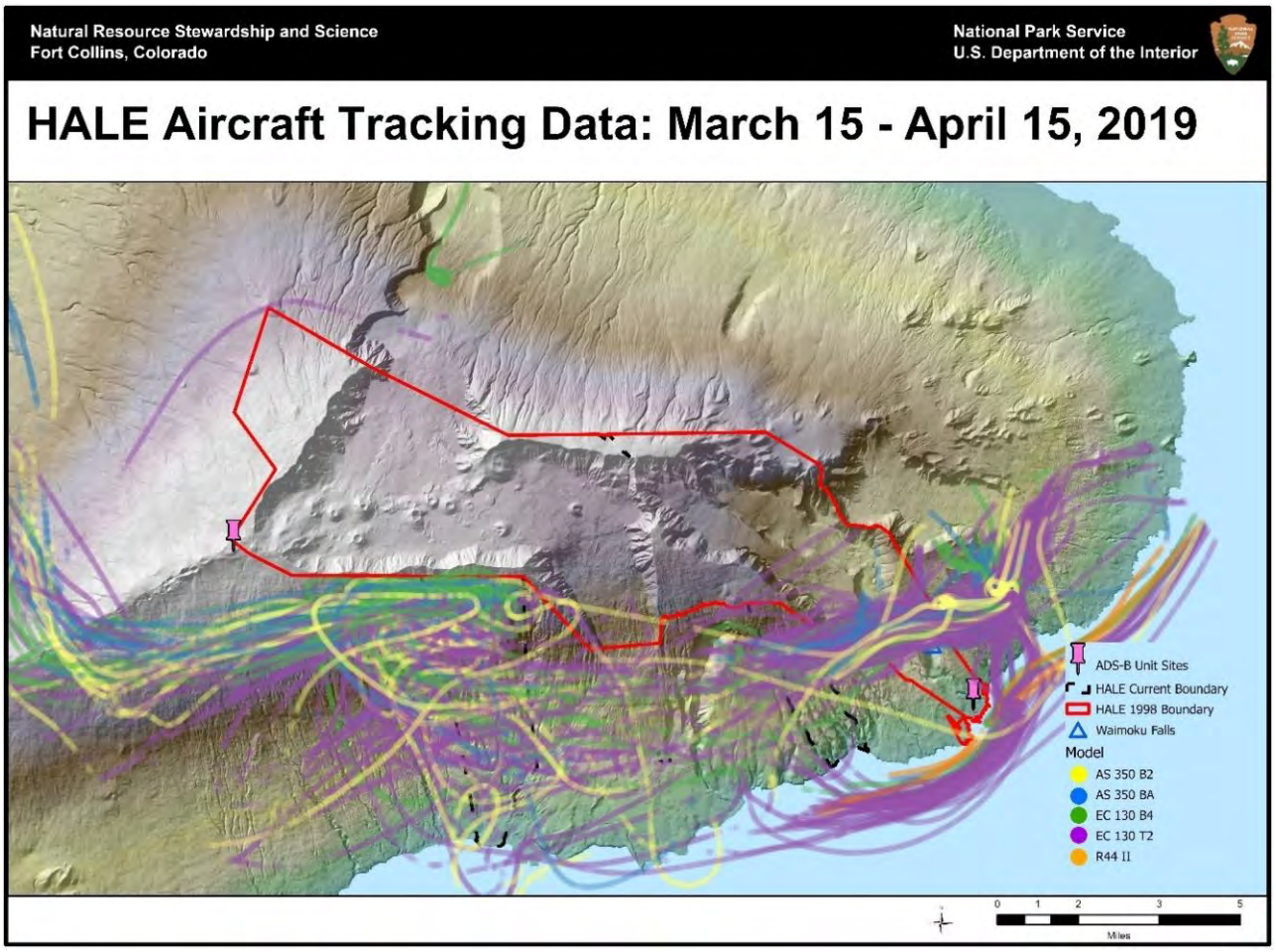

FIGURE 7: COMMERCIAL HELICOPTER FLIGHTS OVER THE PROJECT AREA (BEECO ET AL. 2020).

not been collected within the state forest reserves. However, for analysis purposes and because the majority of state forest reserves occur within the project area, it has been assumed that approximately 200 hours/year of administrative helicopter flights occur within or immediately near the project area. As in the park, the number of state administrative helicopter flights and associated noise levels would likely continue at current levels within the project area. There are no anticipated changes to public access within the project area, so ongoing noise impacts to visitors would remain unchanged in the foreseeable future.

The impacts of these ongoing and future actions (as listed in Appendix E) have been considered as part of the affected environment as described above. Under the no-action alternative, the acoustic environment would remain the same or similar to existing conditions, including trends and impacts from past, present, and foreseeable planned actions. Because these actions are part of the existing acoustic environment conditions, the no-action alternative would not result in any indirect or direct impacts to the acoustic environment on state lands. In turn, because there are no direct or indirect effects of the no-action alternative, there would be no cumulative effects associated with the no-action alternative.

The Nature Conservancy and Other Private Conservation Lands

Other than the noise associated with occasional commercial air tours and helicopter administrative flights, as well as the sounds of human visitors and employees, TNC's Waikamoi Preserve is extremely quiet, with natural sounds coming from wind, rain, vegetation, and animals (assuming conditions are similar to those within the park). Because acoustic data has not been collected within the preserve (other than bird recordings), the NPS acoustic monitoring

results were used as a baseline for the entire project area. However, within the other private conservation lands adjacent to the park and Waikamoi Preserve, human-caused noise is likely lower than in the park, state, and TNC-managed lands because there is no public access allowed within these areas. Noises in the private conservation lands primarily consist of occasional commercial overflights, and vehicle use for management activities and landowner/manager/employee recreational hunting.

Public access to the Waikamoi Preserve is limited to guided hikes, educational and service trips, and scientific research. TNC staff typically lead public hikes into the preserve three times per month with a maximum of 15 participants per hike. In addition, approximately one volunteer work trip is conducted per month and TNC typically provides trips into the preserve twice a month (once for local groups, and once for donors or other special guests). Research projects typically occur for a period of one week a couple of times a year. In total, visitation to the preserve is approximately 1,000 people per year (A. Cohan, *pers. comm. 9/30/21*).

In addition to the sound of walking and talking by visitors, noises are generated by management activities including fence maintenance, ungulate control, treatment of non-native plant species, and resource monitoring within the preserve. Because much of Waikamoi Preserve is remote and relatively inaccessible by foot, many management activities are conducted by helicopter. Approximately 60 helicopter operations are conducted per year (estimated 75 flight hours/year) into and out of the preserve (A. Cohan, *pers. comm. 9/30/21*). These flights typically drop off employees and supplies. Management activities are expected to continue as described in this section on the private conservation and TNC-managed lands. In addition to helicopter flights to and from the preserve, commercial flights over the preserve also create intermittent noise.

The impacts of these ongoing and future actions (see Appendix E) have been considered. Under the no-action alternative, the acoustic environment would remain the same or similar to existing conditions, including trends and impacts from past, present, and foreseeable planned actions. Because these actions are part of the existing acoustic environment conditions, the no-action alternative would not result in any indirect or direct impacts to the acoustic environment of TNC and other private conservation lands. In turn, because there are no direct or indirect effects of the no-action alternative, there would be no cumulative effects associated with the no-action alternative.

Effects of the Proposed Action on the Acoustic Environment

Activities associated with the proposed action would result in noise that could impact the acoustic environment, visitor experience, sensitive wildlife, and wilderness character. Noise impacts would be mitigated through careful planning of flight paths and timing of mosquito releases (see mitigation measures in Chapter 2). Details regarding impacts of noise on wildlife, visitors, and wilderness are discussed further in the "Federally Listed Wildlife Species and Wildlife Species of Concern," "Visitor Use and Experience," and "Wilderness" sections of this chapter.

Methods and Assumptions

The baseline for evaluating potential impacts to the acoustic environment was developed using the available existing ambient sound measurements in the park (Lynch 2012, Lee et al. 2016). No baseline sound metrics are available for state, TNC, or privately managed conservation lands; however, given the similarity of conditions on state, TNC, and privately managed lands to park lands, existing sound levels in these areas are assumed to be similar to those within the park. The existing ambient sound measurements were then compared to the expected noise levels that would occur during incompatible mosquito releases, specifically the use of drones, and occasionally other mechanized equipment such as ground vehicles, generators, and helicopters, relative to the existing ambient sound levels. Impacts were evaluated based on the potential for mosquito release activities to create noise impacts over sustained periods of time that would surpass ambient existing sound levels and indicators for human and wildlife impacts. Notably, the attenuation (reduction) of noise depends on site-specific conditions such as the terrain conditions between the noise source and receiver (i.e. visitors and/or wildlife), vegetation, and meteorological conditions. A detailed analysis of mechanized noise (from drone, helicopter, ground vehicle, or other mechanized equipment) in specific locations that take these factors into account would be impracticable because impacts to the acoustic environment would be dispersed

over the entire core area; however, a general understanding of how the acoustic environment may be impacted is presented.

The acoustic environment analysis area includes not only the core area where most releases would occur, but also the area surrounding it where project-related noise could impact the acoustic environment. Specific locations included in the acoustic environment analysis area that lie outside of the project area include temporary helibases outside of the core area and drone or helicopter flight paths to and from the core area.

Sound pressure levels are often measured with the logarithmic decibel (dB) scale relative to a reference value. The relative loudness of sounds as perceived by the human ear is expressed in dBA (OSHA 2013). The following values illustrate some key sound level indicators and the effects that they have on humans:

- 35 dBA – This value is designed to address health effects of sleep interruption; noises at this loudness can have effects on blood pressure while sleeping (Harabaldis et al. 2008).
- 45 dBA – This value represents the recommendation from the World Health Organization that noise levels inside bedrooms remain below 45 dBA (Berglund, Lindvall, and Schwela 1999).
- 52 dBA – This value is based on the U.S. Environmental Protection Agency's level for speaking in a raised voice to an audience at 33 feet (EPA 1974). This represents the sound level at which an interpretive program would be affected.
- 60 dBA – This value is the sound level where normal communications with individuals standing 3.3 feet apart would be interrupted. This represents the sound level at which recreational visitors conversing would be affected, including hikers (EPA 1974).

Although noise levels are usually measured and expressed in dBA, which is based on the sensitivity of the human ear to different frequencies, this measurement may not reflect the noise sensitivity of birds or other wildlife (NPS 1995). For additional information regarding noise impacts to wildlife from the proposed action, refer to the "Noise Impacts on Wildlife" section within the Threatened and Endangered Wildlife Species and Wildlife Species of Concern impact analysis.

An increase of the existing ambient sound level affects the ability of humans and animals to perceive other sounds within a certain distance or area. In general, the higher the existing ambient sound level, the shorter the distance from which other sounds (for example, those of a forest bird) can be heard. This concept is expressed in terms of listening area (the area in which humans and wildlife can perceive sounds) and alerting distance (distance at which alerting communications can be heard). Reduction in listening area and altering distance is a way of quantifying degradation of hearing performance in humans and animals as a result of an increase in ambient noise level. **Table 9** shows the relationship between increases in ambient sound levels and percent reduction in listening area and alerting distance. The impact criteria are based on the distance at which project impacts would result in a 3 dBA increase over ambient conditions (EPA 1974). A 3 dBA increase above the existing ambient sound level is considered an important indicator of potential noise impact because it results in a 50 percent reduction in listening area for humans and animals and a 30 percent reduction in alerting distance, as shown in **Table 9** (NPS 2010).

TABLE 9: REDUCTION IN LISTENING AREA AND ALERTING DISTANCE DUE TO INCREASES IN AMBIENT SOUND LEVELS

50% dBA Ambient Increase	Percent Reduction in Listening Area	Percent Reduction in Alerting Distance
3	50%	30%
6	75%	50%
10	90%	70%
20	99%	90%

Drone Noise Levels

The primary method of incompatible mosquito release within the project area would be through the use of drones. The sound produced by a consumer-grade battery-powered rotary or fixed-wing drone at ground level is similar to loud highway noise (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 in close proximity. Therefore, it is not anticipated that noise impacts would be compounded by the use of 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 10** 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 10: DRONE NOISE LEVELS AT VARIOUS HEIGHTS

Drone Type	Height Above Ground Level (AGL) from Source (feet)			
	25 feet AGL	100 feet AGL	200 feet AGL	500 feet 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

Source: Airborne Drones (2020) and Schaffer et al. (2021)

Helicopter Noise Levels

Helicopter noise levels were estimated using the sliding scale approach presented in the Interagency Visitor Use Management Council Framework (IVUMC 2016) and the NPS Natural Sounds and Night Skies Division (NSNSD) developed Attenuation Calculator. The Attenuation Calculator maps and provides noise metric statistics for the attenuation (i.e. spread and reduction) of noise using the ISO 9613-2 (*Attenuation of sound during propagation outdoors — Part 2: General method of calculation*) standard. The main limitation of this tool is that terrain effects are not incorporated into the calculation; it is strictly the attenuation loss due to the atmosphere and distance. Practically, this means that the distances with associated noise metrics identified are a worst-case scenario. Further, the Attenuation Calculator only calculates a single operational mode (hover in ground effect) and cannot incorporate multiple operational parameters such as aircraft performance, thrust settings, directivity, and other operational modes. Despite these limitations, the tool provides valuable information regarding noise attenuation and is a means of comparison between different release methods for this project. For the purposes of this analysis, two primary approaches were taken. First, noise was calculated for the helicopter in transit and the other for the helicopter hovering.

For the transit analysis, it was assumed that:

- the park and state would be using a Hughes 500D helicopter for all flight operations, which is a typical aircraft used for park and state administrative flights;
- the analysis used the Hughes 500D in the 'hover in ground effect' operational mode;
- the speed was set to 57 mph, which is similar to the anticipated transiting flight speed (62 mph)
- altitude was set at 500 feet above the receiver (person on the ground).
- natural ambient and existing ambient sounds levels were set to 30 dB (A-weight) and 35 dB, respectively, which are consistent with the baseline acoustic measures of natural ambient for the upper Kīpahulu Valley (Lee et al. 2016).

For the hovering analysis, the assumptions were the same as for transit, except:

- the speed was set to stationary.
- altitude was set at 150 feet above the receiver (person on the ground).

As summarized in **Table 11**, results of the Attenuation Calculator under the worst-case scenario suggest that helicopter noise could be audible[1] up to 3.5 miles from a given flight path at 500 feet AGL, and noise could be above existing ambient levels (35 dB) up to1.8 miles from the flight path. Modeled flight paths were chosen as representative flight paths into and out of the Kīpahulu Valley portion of the project area for mosquito releases that would commonly be used for dropping off teams for monitoring or conducting helicopter longline releases. Speech or interpretive program interference (levels above 52 dB) could begin to occur at 0.47 miles from a flight path. Speech or interpretive program interference is based on the EPA's level for when speaking in a raised voice to an audience at 33 feet would begin to be affected (EPA 1974). Finally, when hovering within 50 lateral feet of a given location at 150 feet AGL, helicopter sound levels could reach a maximum of 82 dB (L_{AMax}) at ground level. The maximum sound pressure levels directly under the helicopter at 50 feet AGL are estimated to be 93 dB (L_{AMax}).

TABLE 11: ATTENUATION CALCULATOR HELICOPTER SOUND EXPOSURE LEVELS AT DIFFERENT DISTANCES

		Lateral Distance from Source (feet or miles)				
Aircraft Name	**Operational Mode**	**0 feet**	**50 feet**	**0.47 miles**	**1.8 miles**	**3.5 miles**
Hughes 500D	Hover in ground effect	93.1 dB (L_{AMax}) at 50 feet AGL	82.1 dB (L_{AMax}) at 150 feet AGL	Speech Interference (> 52 dB) at 500 feet AGL	Above Existing Ambient (> 35 dB) at 500 feet AGL	Audible (~27 dB) at 500 feet AGL

Source: NSNSD attenuation calculation for this project

Generators and Vehicle Noise Levels

The estimated noise levels of generators and vehicles proposed for use under the proposed action are included in **Table 12**. Trucks or SUVs would be used on existing roads (see **Figure 5**) to reach monitoring and pedestrian release sites in Makawao Forest Reserve, TNC's Waikamoi Preserve, Mahi Pono, and East Maui Irrigation lands and to reach drone launch sites at road-accessible helibases. Generators would only be used at up to four monitoring locations on state lands, two locations within the park, and two locations within TNC's Waikamoi Preserve. Notably, these noises would occur at ground level and would be substantially muffled by the surrounding dense vegetation.

TABLE 12: GROUND MECHANIZED EQUIPMENT PROPOSED FOR USE IN THE ANALYSIS AREA.

Type of Equipment	Estimated Maximum Noise Level (dBA)
Quiet Honda Generator	~ 52–58 dBA* at 23 feet from source
Truck or SUV	~75 dBA** at 50 feet from source

* Source: Honda (2022)
** Source: FHWA (2006)

Analysis

Drone Release

The park and state would use drones as the primary mosquito release method in the core area. Drone operators would be positioned at temporary helibases accessible by ground vehicles. Noise from vehicles would only occur when drone operators drive (outside the project area) to or from helibases at the beginning and end of each drone operation day

[1] Audibility was defined to be sounds levels that are 8 dB below existing ambient levels

(operation days could include five workdays per week) or if resupply trips are needed. As described in Chapter 2, it is conservatively estimated that this project would require up to 72 hours of drone flight time per week during warm months and up to 49 hours during cold months to achieve the desired mosquito release rate (**Table 3**). Of those hours, 37–47 flight hours per week would occur over state lands (approximately 64 percent of the core area or 30,796 acres), 6–11 hours per week would occur over NPS lands (approximately 15 percent of the core area or 7,099 acres), 6–7 hours per week would occur over private conservation lands (approximately 11 percent of the core area or 5,168 acres), and 1–7 hours per week would occur over TNC-managed lands (approximately 10 percent of the core area or 5,101 acres). Two or more drones would fly for up to five days per week between civil sunrise and civil sunset on weekdays. Drone flight paths would vary substantially depending on the release locations being treated each day, and drones would likely only pass over a specific location twice per week. Depending on the drone model in use, noise levels experienced by wildlife or a person on the ground during releases where the drone is flying at 100 feet AGL could range from 47 to 65 dBA and from 41 to 59 dBA at 200 feet AGL for less than 15 seconds because the drones would be moving swiftly through the core area during releases (up to 22 mph; see **Table 10**) (Airborne Drones 2020; Schaffer et al. 2021). For birds or other wildlife near the top of the tree canopy, drone noise levels could range from 47 to 71 dBA for less than 15 seconds again depending on the type of drone in use and the height above canopy. For reference, a Hughes 500D helicopter at 150 feet AGL would produce a maximum noise level of 82 dBA (**Table 11**). During ferrying flights at approximately 500 feet AGL, drone sound levels would range between less than existing ambient (~35 dBA in upper Kīpahulu Valley) to 53 dBA (see **Table 10**) for wildlife or a person on the ground or wildlife in the tree canopy. These noise levels are estimated to only last for less than 5 seconds at a time because the drones can travel up to 62 mph while ferrying.

Under the worst-case scenario, drone noise could potentially be heard (above approximately 27 dBA) up to 0.5 mile of the drone. Notably, the extensive tree canopy cover and rugged terrain can have a dampening effect on sound and may reduce the distance (likely by half or more based on anecdotal experience of park and state staff working in the project area) where sound is heard. The nearest recreational areas where people could experience drone noise are in Makawao Forest Reserve and lower Kīpahulu District. People in these areas could very briefly experience drone noise if drones pass within 0.5 mile of recreational trails or other public use areas, but these impacts could be reduced, for example, by conducting regular pedestrian releases in Makawao Forest Reserve, should that be deemed necessary. Most of the areas where drones would be conducting releases would be out of earshot for hikers along the Pīpīwai Trail to Waimoku Falls. Drone flight paths, timing of flights, and flight heights would be selected to reduce noise impacts on visitors, nearby landowners or communities, wilderness, and sensitive environmental resources. Mosquito releases would occur outside the breeding season of Hawaiian forest birds, to the extent possible. Where breeding seasons cannot be avoided, drone operations would occur above the tree canopy to limit the noise impact to nesting forest birds. It should also be noted that there would be no mosquito releases at night or on the weekends, so noise impacts from drones would only occur during daylight hours on weekdays.

Overall, people would not likely notice a noise difference at popular visitor use areas near the park and other publicly accessible areas during the anticipated 49–72 hours of drone flights per week. The anticipated drone use under the proposed action would require two or more drones flying simultaneously in different areas of the core area for a total of approximately 220–325 hours per month throughout the core area. The perceived drone noise levels (approximately 47–59 dBA at 100–200 feet AGL) experienced by wildlife or people on the ground in the core area would fluctuate rapidly because drones would be moving swiftly, and noises would be muffled by the tree canopy and rugged terrain. At the upper limit of the estimated decibel levels, drone noise could possibly be loud enough to disrupt conversations, but this disruption would be brief, due to the minimal time that a drone would be overhead in one location. With the exception of the Kīpahulu District of Haleakalā National Park and Makawao Forest Reserve, very little recreation or hunting occurs in the project area, so noise impacts to visitors or other users would be minimal. Noise from drones would be present in the project area during release operations until sufficient mosquito population suppression is achieved but would largely go unnoticed by humans and may only briefly cause annoyance to wildlife.

Helicopter Longline Release

The helicopter longline release method would only be used as a short-term (up to two months), temporary release method for intermittent time periods if drones are unavailable. Decibel levels directly under flight paths are expected to

be substantially higher than existing ambient levels based on the maximum sound levels produced by a helicopter. Notably, higher sound level estimates were used for a more conservative analysis. Under this worst-case scenario, helicopter noise could be audible up to 3.5 miles from a given flight path at 500 feet AGL, and noise could be above existing ambient levels up to 1.8 miles from the flight path. Speech interference could occur at 0.47 miles (the area within a 0.47 mile-radius is 448 acres; see **Table 11**). When a helicopter is hovering within 50 feet laterally of a given location at approximately 150 feet AGL (at which most helicopter longline releases would occur), helicopter sound levels at the ground could reach a maximum of 82 dBA for 15 seconds or less at any given location in the core area. Sound levels would decrease as the distance from a given flight path increases. Notably, actual distances and sound levels would likely be far lower than the modeled results provided in **Table 11** due to the rugged terrain and extensive tree canopy cover in the project area, which would block and absorb some of the helicopter noise. Additionally, the noise levels presented in this section are not actual measured noise levels; actual noise levels would vary during specific operations depending on the altitudes, types of maneuvers, speed, and power settings during helicopter flight. These factors also affect the intensity, duration, and spatial distribution of noise.

For purposes of estimating helicopter noise impacts during mosquito releases, it has been assumed that an average of two treatments of the entire core area could occur per month for up to two months per year. The average anticipated helicopter flight time would occur for up to 6 hours per day, 5–7 days per month for a total of 39 hours per month during warm months and 28 hours per month during cold months. Flight time would not exceed 56–78 flight hours/year. However, as stated in Chapter 2, this estimate is a maximum and the occasional helicopter longline releases would only be needed as a short-term (up to two months), temporary release method should drones become unavailable. For reference, this maximum estimate of helicopter flight hours for helicopter longline release (56–78 flight hours/year) is far less than the current estimate of annual administrative flight hours (approximately 415 hour/year) for park, state, and TNC-managed lands within the project area.

Helicopters would avoid flying low near forest bird breeding habitats to avoid rotor wash and excessive noise disturbance to nesting forest birds. There would be no mosquito releases at night or on the weekends, so noise impacts would only occur during daylight hours (between civil sunrise and civil sunset) on weekdays. During helicopter longline releases, adverse impacts on the acoustic environment would primarily occur along flight paths, at helibases, and when hovering over mosquito release locations. Helicopters would hover for less than 15 seconds over each mosquito release location. At any given location in the core area, the perceived noise levels from helicopter operations would fluctuate for humans or wildlife because helicopters would be moving through the area quickly (22 mph during releases and up to 115 mph during transit). Impacts from helicopter longline releases could occur anywhere within the core area but would be targeted depending on the need at the time. The core area contains many places where there is little to no public use. The most well-used areas with established public trails include Makawao Forest Reserve and the lower Kīpahulu District area where many people use the Pīpīwai Trail to access Waimoku Falls. **Table 13** provides estimates for the duration that helicopter noise along several example flight paths would be audible under the worst-case scenario provided by the Attenuation Calculator (above existing ambient) for a visitor at Waimoku Falls. As shown in the table, most flights to the Kīpahulu Valley and Manawainui locations of the core area would produce audible noise for less than 4 consecutive minutes. The flight paths included in **Table 13** are intended to provide a representative of potential flight paths and the times they would be audible in visitor use areas. Actual flight paths would vary and be determined by weather, and targeted release locations.

TABLE 13: COMMON FLIGHT PATHS IN KĪPAHULU VALLEY AREA

Flight Path	Path Distance (round trip)	Potential Speed of Travel	Travel Time (round trip)	Closest Point along Flight Path to Waimoku Falls	Time Noise above 35dB at Waimoku Falls
ʻOheʻo to Wing	13.0 miles	115 mph	6.8 min	0.7 mile	3.0 min
ʻOheʻo to Palikea	11.2 miles	115 mph	5.9 min	0.3 mile	3.5 min
ʻOheʻo to Charlie	10.6 miles	115 mph	5.6 min	0.4 mile	3.5 min
Nuʻu to Wing	12.0 miles	115 mph	6.3 min	~ 5.0 miles	0 min

Overall, adverse impacts on the acoustic environment from helicopter longline releases could occur anywhere in the core area (up to 48,164 total acres) but would be targeted depending on the need at the time. However, it should be noted that this method would only be used as a short-term (up to two months), temporary release method when drones are not available. Up to 28–39 hours of helicopter flight time could occur per month (up to 6 hours per day, 5–7 days per month) for up to two months per year. Because the helicopters would be flying or hovering well above the canopy, noise levels on the ground would not exceed 82 dBA for a person or wildlife on the ground. While noise levels immediately beneath flight paths would exceed levels that would be expected to disrupt human communication and potentially cause annoyance to wildlife, these noise levels would not be sustained at that level for more than 15 seconds at any given point. Impacts could potentially extend over thousands of acres at a given time, impacting wildlife habitat and visitor use areas within that range. However, little public use occurs in the very remote sections of the core area, and visitors would only experience intermittent noise if flights paths were near their location. Further, this short-term release method would only temporarily occur in necessary situations for less than 2 months per year and would therefore largely be unnoticed by people and would rarely cause annoyance to wildlife.

Pedestrian Release

As stated in Chapter 2, pedestrian release of mosquitoes may occur within an area of up to 5,000 acres in the western portion of the project area including portions of Makawao Forest Reserve (State land), TNC's Waikamoi Preserve, and other private lands. These locations are accessible for pedestrian release due to existing four-wheel-drive roads (shown in brown on **Figure 5**) and established trails with drive-up trailheads. Pedestrian releases may also occur within approximately 400 acres of the park and approximately 400 acres of Hanawī Natural Area Reserve but only on a quarterly basis simultaneous with ground-based mosquito monitoring (see analysis of impacts from pedestrian releases at these monitoring sites in the "Mosquito Monitoring" section below).

Motorized vehicles (SUVs or trucks) would assist in the transportation of field teams and gear for treatments in Makawao Forest Reserve, TNC's Waikamoi Preserve, and other private lands. Noise from vehicles is estimated to not exceed 2 hours per day up to 2 days per week along the Flume Road shown (in brown) on **Figure 5** during pedestrian releases. As previously mentioned, ground vehicles can reach 75 dBA at 50 feet from the source but would be muffled by the surrounding canopy and would not be expected to exceed 60 dBA at 50 feet from the source of noise. The noise produced by crews releasing mosquitoes would be similar to that produced by any other recreational visitor on the trails in Makawao Forest Reserve. Trails within TNC's Waikamoi Preserve are private and not regularly travelled by the public except during guided trips.

Overall, noise from this release method would be minimal and would include noise of up to 75 dBA at 50 feet from vehicles approaching and leaving trailheads up to 2 hours per day, 2 days per week. Noise impacts from vehicles would blend into the vehicle traffic/noise already occurring at trailheads and would largely be unnoticeable to wildlife and humans along the Flume Road.

Mosquito Monitoring

As described in Chapter 2, monitoring activities would consist of intermittent ground-based monitoring to trap and evaluate mosquito populations and would be conducted concurrently with ground-based pedestrian or aerial releases, on a quarterly basis (four times/year). Monitoring activities would continue indefinitely over the life of the project. Four monitoring locations would be selected on state lands, two locations within the park, and two locations within Waikamoi Preserve. It is anticipated that three of the locations (two on state lands and one in Waikamoi Preserve) would be accessible by ground vehicles and the other five locations (two on state lands, two within the park, and one within Waikamoi Preserve) would require helicopter access. Pedestrian releases may occur concurrently with monitoring and could potentially cover up to 1,000 acres within the core area (400 acres in the park, 400 acres on state lands, and 200 acres in Waikamoi Preserve), and potential impacts are discussed in the preceding section.

The estimated total required helicopter flight time for mosquito monitoring is 70 hours/year (approximately 17.5 hours per week for one week each quarter) and would include the time required to land and drop off or pick up crews and supplies at the LZs. For reference, the current estimate of park, state, and TNC administrative flights is 415 hours/year. Helicopters would fly 2–6 hours per day for pick-ups and drop offs at LZs during these quarterly trips. As listed in

Table 11, in the worst-case scenario, helicopter noise could be audible up to 3.5 miles from a given flight path at 500 feet AGL, and noise could be above existing ambient levels up to 1.8 miles from the flight path. Speech interference could occur when helicopters are operating 0.47 miles away. Finally, when hovering within 50 lateral feet of a given location at 150 feet AGL, helicopter sound levels could reach 82 dBA and grow louder (up to 93 dBA) as the helicopter descends below the canopy to land at LZs. As described previously, actual distances and sound levels would likely be far lower than the modeled results provided in **Table 11** due to the rugged terrain and extensive tree canopy cover in the project area, which would block and absorb some of the sound generated by helicopters. Additionally, the noise levels presented in this section are not actual measured noise levels; actual noise levels vary during specific operations depending on the altitudes, types of maneuvers, speed, and power settings during helicopter flight. These factors also affect the intensity, duration, and spatial distribution of noise.

Generators would be needed for monitoring trips and could produce intermittent noise at the five backcountry camps four times per year at each camp, for up to 3 hours per day for up to 7 consecutive days. As listed in **Table 11**, a quiet Honda generator can produce noise levels of up to 58 dBA at 23 feet from the source. However, due to the density of vegetation where generators would be used, this noise is expected to be lower, and generators would only be running in the evening when crews return to camp. While there would be no impact to public visitors from generator noise due to the remote location of these camps, there could be some mild annoyance to wildlife.

Motorized vehicles (SUVs or trucks) would assist in the transportation of field teams and gear to reach three ground-accessible monitoring sites in Makawao Forest Reserve and TNC's Waikamoi Preserve. Noise from vehicles used during monitoring would primarily occur along the Flume Road shown (in brown) on **Figure 5** and is not expected to exceed 4 hours per day for up to 7 days on a quarterly basis. It should be noted that vehicles would not be running constantly during that 4-hour time period because crews would be stopping periodically to check mosquito traps. As previously mentioned, ground vehicles can reach 75 dBA at 50 feet from the source but would be muffled by the surrounding canopy and would not be expected to exceed 60 dBA at 50 feet from the source of noise.

Overall, the noise from helicopters and generators would be primarily focused at the five helicopter-only accessible monitoring camps and LZs. Noise from approaching or departing vehicles would occur at trailheads in Makawao Forest Reserve and TNC's Waikamoi Preserve but would be minimal throughout the duration of the project and would blend into the vehicle traffic/noise already occurring at trailheads. Impacts from noise would be affected by topography, vegetation, distance to source, and in the case of helicopters, speed of travel. The duration and frequency of helicopter flights required for monitoring (2–6 hours per day for a total of approximately 17.5 hours per week for one week each quarter) and, therefore, the amount of time visitors or wildlife could experience helicopter noise impacts, would vary by distance from the source. Noise levels along helicopter flight paths would reach less than 72 dBA at 500 feet AGL during overflights at the beginning and end of each monitoring session. Adverse noise impacts from helicopter drop-offs and pick-ups would only occur at five helicopter-accessible only monitoring sites and could reach 82–93 dBA during pick-ups and drop-offs (less than 10 minutes each). During the 7-day quarterly monitoring sessions, adverse noise impacts from generators would be limited to less than 58 dBA at 23 feet for up to 3 hours per day at five monitoring camps, and noise from vehicles would be limited to 4 hours per day in Makawao Forest Reserve and TNC's Waikamoi Preserve to reach the three ground-accessible monitoring sites. Therefore, adverse impacts on the acoustic environment during monitoring activities from helicopters, generators, and vehicles would be highly variable and not sustained (would only occur every three months). In addition, it is unlikely that any visitors or recreationists would be aware of the helicopter landings or generator noise due to the remoteness of the LZs used during monitoring and the infrequency of trips required for quarterly monitoring.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable future actions (see Appendix E) and the no-action alternative are as described in the section titled "Current and Expected Future Condition of the Acoustic Environment if No Action is Taken". As past, present, and reasonably foreseeable future actions are part of the existing acoustic environmental conditions, and because the no-action alternative would result in no indirect or direct impacts to the acoustic environment, there would be no cumulative effects associated with the no-action alternative. When compared to the no-action alternative, mosquito release activities under the proposed action would contribute periodic adverse impacts on

the acoustic environment near LZs, helibases, flight paths, trails, trailheads, and roads from the use of drones, mechanized equipment, and helicopters.

Under the proposed action, noise from drones could occur throughout the 48,164-acre core area for 49–72 hours per week. Noise levels from drones could reach a maximum of 47–59 dBA at 100–200 feet AGL (the altitude where most releases would occur) for less than 15 seconds as the drone passes over any given location in the core area one to two times per week. Helicopter noise would only occur for 2–6 hours per day potentially spread over the course of 7 days for a total of approximately 17.5 hours per week for quarterly monitoring trips. Most helicopter flight noise would be highly variable depending on the flight altitude and lateral distance to a person or wildlife but could reach a maximum of 82–93 dBA during pick-ups and drop offs at LZs. Short-term, temporary helicopter longline releases (up to 6 hours of flight time per day, 5–7 days per month for up to two months per year) could produce a maximum of 82 dBA at 150 feet AGL for less than 15 seconds at any given release location in the core area. Generator noise (maximum of 52–58 dBA at 23 lateral feet) could occur for up to 3 hours per day for up to 7 consecutive days on a quarterly basis at the five backcountry monitoring locations. Noise from vehicles (maximum of 75 dBA at 50 feet from the source) would occur intermittently in Makawao Forest Reserve and TNC's Waikamoi Preserve for up to 4 hours per day for up to 7 days during quarterly monitoring and up to 2 hours per day, up to 2 times per week for pedestrian releases that are scheduled to occur in those areas.

As described above, the proposed action would contribute a measurable but largely unnoticeable adverse impact to the acoustic environment. Humans and animals would experience slight increases in perceptible sound/noise compared to the no-action alternative in certain areas at certain times, but in many cases, the project-related noises would be imperceptible due to remoteness of the project area. The locations affected by the proposed action are where most past, present, and reasonably foreseeable management actions are already occurring on park, state, and private conservation lands. When the impacts of the proposed action are added to the impacts of present and reasonably foreseeable actions, an overall adverse cumulative impact on the acoustic environment spread over the entire core area would last until sufficient mosquito population suppression is achieved.

Conclusion

Under the no-action alternative, conditions and trends would remain the same or similar as existing conditions. Compared to the no-action alternative, mosquito release activities under the proposed action would contribute periodic adverse impacts on the acoustic environment near LZs, helibases, flight paths, trails, trailheads, and roads from the use of drones, vehicles, mechanized equipment, and helicopters.

Noise from drones (the primary method for mosquito releases) could occur throughout the 48,164-acre core area (30,796 acres of state land, 7,099 acres of NPS land, 5,168 of private conservation land, and 5,101 acres of TNC-managed land) for 49–72 hours per week. Specifically, 37–47 flight hours per week would occur over state lands, 6–11 hours per week would occur of NPS lands, 6–7 hours per week would occur over private conservation lands, and 1–7 hours per week would occur over TNC-managed lands. Noise levels from drones could reach 47–59 dBA at 100–200 feet AGL (the altitude where most releases would occur) for less than 15 seconds as the drone passes over any given location in the core area one to two times per week.

Helicopter noise would only occur if a short-term (up to two months), temporary release method is needed for releases and when monitoring needs to occur in the backcountry (on a quarterly basis). Helicopter noise impacts would occur primarily at LZs, helibases, and along selected flight paths. To reach the five helicopter-only accessible monitoring sites, helicopter flights could occur for 2–6 hours per day potentially spread over the course of 7 days for a total of approximately 17.5 hours per week. Because monitoring would occur quarterly, the estimate of total annual helicopter flight time is 70 hours. Most helicopter flight noise would be highly variable depending on the flight altitude and lateral distance to a person or wildlife but could reach 82–93 dBA during pick-ups and drop offs at LZs. For short-term temporary helicopter longline releases, it is anticipated that up to 6 hours per day, 5–7 days per month for up to two months could occur and result in a total of up to 56–78 hours of flight time per year. Noise levels could reach a maximum 82 dBA at 150 AGL for up to 15 seconds while the helicopter hovers over release locations within targeted portions of the core area.

Noise from generators (maximum of 52–58 dBA at 23 lateral feet) would be highly variable and would be limited to the five helicopter-only accessible monitoring areas and camps for up 3 hours per day for up to 7 consecutive days on a quarterly basis during monitoring trips. Noise from vehicles (maximum of 75 dBA at 50 feet from the source) would occur intermittently in Makawao Forest Reserve and TNC's Waikamoi Preserve for up to 4 hours per day for up to 7 days during quarterly monitoring and up to 2 hours per day, up to 2 times per week for pedestrian releases that are scheduled to occur in those areas.

Noise from the drone and helicopter longline release methods and monitoring would be the most intense acoustic impacts to result from this project. However, the adverse impacts from the drone and helicopter longline release methods and monitoring would be confined largely to backcountry areas and would largely go unnoticed by humans and would only briefly disturb wildlife. Humans and animals would experience slight perceptible increases in sound/noise compared to the no-action alternative in certain areas at certain times resulting in fleeting disruption or annoyance. Though considerable analysis is presented here, the proposed action would contribute a measurable but largely unnoticeable adverse impact to the acoustic environment during mosquito release and monitoring activities.

WILDERNESS

The Wilderness Act of 1964 established the National Wilderness Preservation System, which is currently comprised of over 800 congressionally designated wilderness areas and over 111 million acres. Congress passed the Act in order to preserve and protect certain lands "in their natural condition" and "to secure for the present and future generations the benefits of wilderness." The Wilderness Act and NPS policy mandate preservation of wilderness character, which includes five tangible qualities (untrammeled, natural, undeveloped, outstanding opportunities for solitude or primitive and unconfined recreation, and other features of value). The Haleakalā Wilderness is designated by federal statue and there is no wilderness on state or private lands.

Analysis Area

The area of analysis for impacts on wilderness character includes the eastern portion of the Haleakalā Wilderness within the park focused on Kīpahulu Valley and Manawainui, where IIT mosquito releases would occur under the proposed action. The area of analysis for wilderness additionally includes locations outside of the mosquito release area where helicopters would travel from helibases outside of wilderness including the lower Kīpahulu Valley and the portion of the designated Haleakalā Wilderness in the park's Summit District.

Current and Expected Future Condition of Wilderness if No Action is Taken

The current condition of these wilderness character qualities is described below. A detailed discussion of past, present, and reasonably foreseeable future actions within the park contributing to the existing conditions and current trends within designated wilderness are located in Appendix E. The description below provides an overview of how these ongoing and future actions would affect wilderness character. Under the no-action alternative, the qualities of wilderness would remain the same or similar to existing conditions, including trends and impacts from past, present, and foreseeable planned actions. The affected environment and impacts of no-action are therefore the same and discussed here only once.

Qualities of Wilderness Character

Formal definitions of wilderness character were developed in 2006 by an interagency monitoring team, including NPS, using the five qualities of wilderness set forth in the Wilderness Act. These qualities are used nationwide to monitor the status and trends in wilderness (preservation or degradation) over time by accounting for stewardship actions as well as impacts from modernization, visitation, and changes occurring outside of the wilderness itself (NPS 2015a). All five qualities occur within the congressionally designated wilderness in Haleakalā National Park and are analyzed in detail: untrammeled, natural, undeveloped, solitude or primitive and unconfined recreation, and other features of value.

Haleakalā Wilderness

Approximately 24,719 acres, or 74 percent, of Haleakalā National Park is congressionally designated wilderness (**Figure 8**). Two distinct areas comprise the Haleakalā Wilderness: the Haleakalā Crater and Kīpahulu Valley above 2,000 feet in elevation, the adjacent Manawainui and Hāna Rainforest areas. Kīpahulu Valley and adjacent areas are a designated Biological Reserve and are closed to visitors. Approximately 14 percent of the project area is in wilderness.

Untrammeled

An untrammeled wilderness is one that is unhindered and free from the intentional actions of modern human control or manipulation. The untrammeled quality is preserved or sustained when actions to intentionally control or manipulate the components or processes of ecological systems inside wilderness (e.g., suppressing fire, stocking lakes with fish, installing water catchments, or removing predators) are not taken. Actions that intentionally manipulate the biophysical environment, such as the removal of nonnative species, intervention in the behavior or lives of native plants and animals, projects to restore the natural conditions of wilderness, and interference in natural processes and energy flows, degrade the untrammeled quality.

Several threats to Haleakalā National Park's unique natural environment have spurred management action to preserve the rare ecological communities and individual species of the park. The ongoing extreme degradation of wilderness ecosystems caused by invasion of non-native species has led the park to take management actions (trammeling) to slow down and address these threats. These include non-native wildlife removal, activities to restore and protect native wildlife, and re-establishment of unique native plant communities. Because of the severe threats to native species, Haleakala's Wilderness is a setting where manipulation of the biophysical environment is required to maintain, protect, and revive the native environment. Because these actions are necessary to preserve the natural environment, it is important to carefully consider restraint before taking actions that impact the untrammeled quality.

The park is currently implementing predator and ungulate control and ground and aerial herbicide spray operations for invasive plant control. Additional ongoing or planned activities include fencing to exclude ungulates, manual removal of invasive plants, and native plant outplantings, all of which adversely affect the untrammeled quality of wilderness. The park would continue current management actions and respond to future needs and conditions to improve the natural quality of the wilderness, while designing these activities to minimize adverse impacts on the untrammeled quality.

Natural

A natural wilderness is one where ecological systems are substantially free from the effects of modern civilization. When indigenous species and ecological conditions are protected and managed to preserve natural conditions, the natural quality is preserved. The natural quality may be improved by controlling or removing non-native species or by restoring ecological conditions. The natural quality is degraded by human-caused changes to the natural environment (i.e. human-caused effects on plants, animals, air, water, ecological processes, etc.).

Kīpahulu Valley and adjacent Manawainui and Hāna Rainforest areas provide refuge for some of Hawai‘i's most unique native plant communities. East of Palikū Ridge, forests of koa and ‘ōhi‘a inhabit Kīpahulu Valley, providing the necessary matrix to sustain intact native watersheds and provide canopy over a wealth of rare species. The diverse plant communities of the Haleakalā Wilderness support several endemic animal species, many of which are now threatened or endangered. Birds are the primary wildlife species here and, like Haleakalā's native plants, native bird species have evolved to occupy a range of specialized niches. For threatened and endangered birds, such as the ‘ua‘u, nēnē, ‘ākohekohe, and kiwikiu, the wilderness provides integral habitat and refuge from predators. Important pollinators, such as Hawaiian yellow-faced bees and nocturnal residents such as the ‘ōpe‘ape‘a (Hawaiian hoary bat), benefit from and contribute to this diversity (NPS 2015a).

The natural quality of the Haleakalā Wilderness has been severely impacted by non-native species introductions, which have led to the extinction or severe decline of many native species. Invasive plants grow quickly and outcompete native vegetation. Prior to rigorous management, feral ungulates overgrazed, trampled, and severely disturbed the crater and wet forest landscapes, damaging and altering vegetative communities, and significantly impacting ground-nesting

birds. Invasive mammalian predators negatively impact the natural quality of wilderness, particularly populations of native bird species that have not evolved with this type of pressure. Avian diseases, such as avian malaria spread by introduced insects, have also taken a toll on native bird distribution and survival (NPS 2015a), thus substantially impacting the natural character of wilderness in the park.

The park is currently implementing predator and ungulate control, forest bird monitoring, and ground and aerial herbicide spray operations for invasive plant control that benefit the natural quality of wilderness. Mosquito surveys and monitoring of avian malaria prevalence have been conducted within the park in the past and recently by USGS and NPS and allow the NPS to evaluate the success of these programs. Additional ongoing or planned activities include fencing to exclude ungulates, manual removal of invasive plants, and native plant outplantings, which also improve the natural quality of wilderness. The park would continue current management actions (see Appendix E) and respond to future needs and conditions to improve the natural quality of the wilderness, while minimizing adverse impacts on the untrammeled and undeveloped qualities of the wilderness. If no new actions are taken, however, avian malaria would continue to devastate native forest bird populations and would likely result in a permanent adverse impact on the natural quality of wilderness character, (i.e., the extirpation and extinction of native forest bird species). This degradation of the natural quality of wilderness would not be a natural phenomenon (the species loss would be caused by invasive mosquitoes and the diseases they transmit).

Undeveloped

An undeveloped wilderness retains its primeval character and influence and is essentially without permanent improvements or modern human occupation. The undeveloped quality is preserved or sustained when it remains free from modern structures, installations, human habitation, motor vehicles, motorized equipment, mechanical transport, and landing of aircraft. It is improved when these prohibited uses are removed or reduced.

Any evidence of human presence, whether large or small, detracts from the undeveloped quality of wilderness. Due to the remote location and difficult access of Kīpahulu Valley and adjacent areas, protection and restoration of this vulnerable environment may sometimes require non-recreational wilderness developments and installations. The developments present within Haleakalā Wilderness include fencing and fence supply caches, snares, monitoring transects, research plots, stream and weather monitoring stations, research shelters, traps and bait stations, trail and tool caches, and administrative trails (NPS 2015a). Developments are intermittent throughout Kīpahulu Valley and are located at maximum distances to achieve management goals. Research shelters exist near adjacent LZs and monitoring transects or administrative trails may be used to strategically travel to both a management site (i.e. invasive plant removal site) and another shelter within an 8-hour hike. These developments would remain in the wilderness in the future and continue to detract from the undeveloped quality of wilderness. A high demand for research permits and research installations also risk impact to the undeveloped nature of this naturally wild area of wilderness, as does the potential need to access these remote areas by helicopter (NPS 2015a).

The 2002 addition of congressionally designated wilderness to the park noted, “construction of fences to exclude feral animals and access into the wilderness via helicopter for fence maintenance, to control destructive invasive alien plants and non-native animals may be necessary to preserve wilderness resources and ecosystem processes” (NPS 2002).

Solitude or Primitive and Unconfined Recreation

Wilderness provides outstanding opportunities for recreation in an environment that is relatively free from the hindrance of modern society. The ability to experience solitude is an integral component of wilderness, while opportunities for primitive and unconfined recreation make the wilderness experience unique. In preserving this wilderness quality, it is important to consider the value of maintaining these places where present and future generations have the opportunity to feel free, at peace, and self-reliant. The solitude or primitive and unconfined recreation quality is preserved or improved when visitors experience minimal encounters, observe landscapes without modern human effects, and experience self-reliance, discovery, self-discovery, traditional skills, and mental and physical challenge. The solitude or primitive and unconfined recreation quality is degraded by sights and sounds of human activity, and by facilities that decrease self-reliant recreation and management restrictions on visitor behavior.

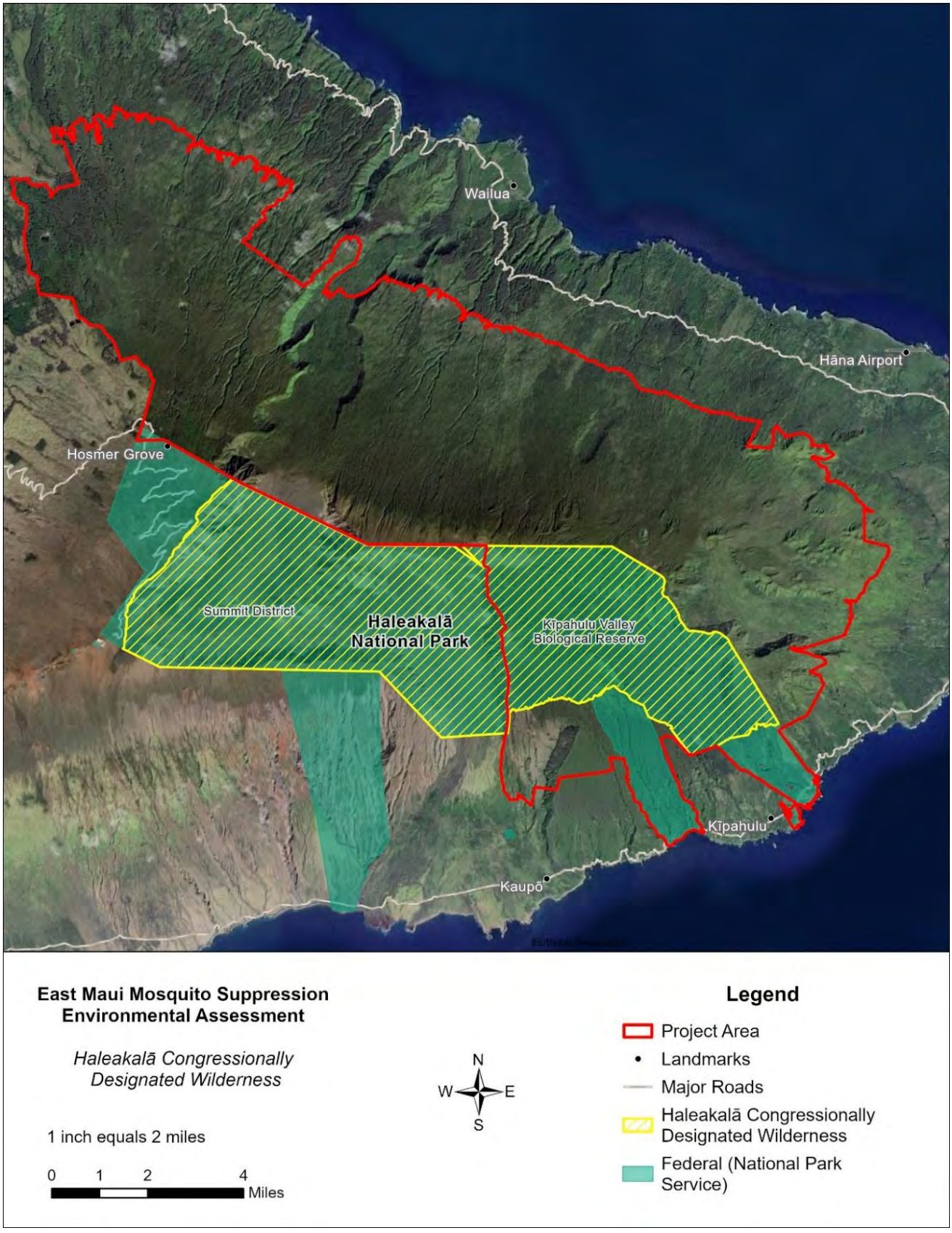

FIGURE 8: DESIGNATED HALEAKALĀ WILDERNESS WITHIN THE PROJECT AREA

Solitude in Haleakalā Wilderness is impacted by administrative flights, commercial helicopter air tours, hikers, campers, and day-use visitors, and administrative use of motorized equipment that audibly and visibly affect the primitive wilderness experience. Administrative flights are more frequent in the Kīpahulu District but are intermittent and do not occur on weekends or after dark (see **Figure 4** for existing flight infrastructure). Alternatively, commercial air tours occur constantly throughout the day and flights that occur just outside of the park can have impacts within Haleakalā Wilderness (see **Figure 7** for flight paths). Haleakalā Wilderness includes enclaves with both visitor and management cabins, and horse pastures to support visitor activities. Recreational infrastructure like cabins that are still visible to visitors may degrade the solitude or primitive and unconfined recreation quality. Sights and sounds of other visitors, along with restrictions for off-trail travel may impact this quality when visiting the Haleakalā Crater area of wilderness. Entry restrictions into areas of the Kīpahulu District of wilderness may also degrade opportunities for unconfined recreation. These impacts to solitude or primitive and unconfined recreation are expected to continue into the future.

Other Features of Value

This quality captures important elements or "features" of a particular wilderness that are not covered by the other four qualities and are truly unique and essential to the character of that wilderness. The Wilderness Act states that wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." Typically, other features of value occur in a specific wilderness location, such as archeological, historical, or paleontological features; some, however, may occur over a broad area such as an extensive geological or paleontological area, or a cultural landscape. This quality is preserved when these "other features of value" are preserved. The other features of value quality are degraded by deterioration or loss of integral site-specific features of value.

Haleakalā, a major geographical and cultural landmark of East Maui, remains intrinsically tied to contemporary Native Hawaiian culture by tangible and intangible cultural resources and values, place names, landscape features, and oral traditions and history. Additionally, the summit of Haleakalā, Kīpahulu Valley, and Kaupō Gap are eligible for the National Register of Historic Places as Traditional Cultural Properties for their association with the cultural landscape of Maui, primarily due to the known uses, oral history, mele (Hawaiian songs and chants), and legends associated with these areas. Potential threats to wilderness cultural sites originate from both environmental and human sources. In a wilderness context, the presence of cultural sites in their natural condition and the continued use of wilderness for traditional practices contribute value to the visitor's sense of human history, provide for the continuation of cultural practices associated with wilderness, and speak to the larger role of humans as an important element of their environment. The rare forest birds within the Haleakalā Wilderness not only have ecological value as captured under the natural quality but also contribute to the cultural resources of the wilderness given their importance to Native Hawaiians. These birds continue to be subject to mortality due to avian malaria, degrading the wilderness character. The proposed action will not adversely affect cultural resources and thus they were dismissed from detailed analysis (see Appendix B); however, a Cultural Impact Assessment has been prepared as required by HEPA (see Appendix C). Cultural resources are briefly considered here as a feature of value of Haleakalā Wilderness that may benefit from the proposed action.

Effects of the Proposed Action on Wilderness

Methods and Assumptions

Potential impacts on designated wilderness were evaluated based on four of the five qualities of wilderness character as described earlier in this section. Impacts on the untrammeled, natural, undeveloped, and solitude or primitive and unconfined recreation qualities are analyzed for the no-action alternative and the proposed action alternative. The analyses only apply to the actions taken within or near the designated Haleakalā Wilderness within the park under each alternative as there is no designated wilderness outside of federal lands.

To ensure an enduring resource of wilderness, the Wilderness Act (section 4(c)) prohibits certain uses within wilderness: "there shall be no temporary road, no use of motor vehicles, motorized equipment, or motorboats, no

landing of aircraft, no other form of mechanical transport, and no structure or installation within such area." The exception for utilizing these prohibited uses is only if they are "necessary to meet minimum requirements for the administration of the area."

Analysis

Under the proposed action, incompatible mosquitoes would be released within the project area using aerial methods, primarily drones. Monitoring activities associated with the proposed action would also include helicopter use and landings within two sites in wilderness in addition to the use of portable generators at two sites in wilderness. The untrammeled, natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation qualities of wilderness would be impacted by the proposed action.

Untrammeled

All three mosquito release deployment methods under the proposed action would have the same impact on the untrammeled quality of wilderness. The broad intervention of wildlife through the release of mosquitoes using any of the three methods would result in an adverse impact on the untrammeled quality of wilderness for the life of the plan, likely at least 20 years, as the methods described in the proposed action are used to suppress mosquito populations to reduce avian malaria mortality in native forest birds.

Natural

Minimal clearing of vegetation at LZs, trails, and fence lines would be required at the onset of the project to accommodate mosquito monitoring, but impacts would be limited to areas that have already been cleared for administrative use and mechanized equipment would not be used. Noise from drone flights (maximum of 47–59 dBA at 100–200 feet AGL) once or twice per week would briefly disturb wildlife from 15 seconds to a few minutes. More pronounced noise would occur from short-term (up to two months), temporary helicopter longline releases (maximum of 82 dBA at 150 feet AGL), but from 15 seconds to a few minutes at any given location. Quarterly pedestrian monitoring and release efforts would include helicopter landings, human activity, and generator use resulting in slightly longer and louder noise impacts. The noise from helicopters, however, would only occur for minutes at a time during take-off and landing and just once every three months. Generator noise (maximum of 52–58 dBA at 23 lateral feet) could occur for up to 3 hours per day for up to 7 consecutive days on a quarterly basis at two monitoring locations within wilderness. The presence of and noise from these motorized and mechanized uses would result in adverse impacts on the natural quality of wilderness during mosquito release and monitoring activities. The reduction in the mosquito population under the proposed action, and the subsequent reduction in native forest bird mortality from the transmission of avian malaria, would result in substantial beneficial impacts to the natural quality of wilderness character because of the resultant stabilization or increase in native forest bird populations over time. The planned incompatible mosquito releases would be a long-term action aimed at restoring natural ecosystem processes that have been degraded by invasive mosquitoes spreading avian malaria. Over the long term, the proposed action would substantially benefit the natural quality of wilderness compared to the existing conditions.

Undeveloped

The use of motorized equipment, such as drones, helicopters, and generators (during monitoring) would result in intermittent, direct, adverse impacts on the undeveloped quality of wilderness character given the presence of this technologically advanced equipment in a wilderness setting. Pedestrian releases may occur within designated wilderness in the Kīpahulu Valley Biological Reserve but only on a quarterly basis simultaneous with ground-based mosquito monitoring. Helicopters would land briefly in wilderness during each incompatible mosquito monitoring and release operation, to pick up and drop off teams and supplies. Generators would likely be used for up to 3 hours per day for up to seven consecutive days during the monitoring trips. The presence of helicopters and generators within wilderness would briefly adversely impact the undeveloped quality given the presence of this technologically advanced equipment in a wilderness setting. Incompatible mosquitoes may be released in small biodegradable packages designed to open on contact with the canopy or forest floor. These mosquito packages (dropped via aerial means) would result in

an impact to the undeveloped quality of wilderness for as long as they remain in the environment (until they biodegrade).

Solitude or Primitive and Unconfined Recreation

Of lands within the designated Haleakalā Wilderness, only the Kīpahulu Valley Biological Reserve portion is within the project area and is closed to all recreation. However, drone and helicopter flights to and from the project area over the Summit District portion of designated wilderness would occur on an intermittent basis (approximately once or twice per week), very briefly (perhaps 15 seconds to a few minutes) audibly and visibly impacting the primitive wilderness experience. As described in Chapter 2, it is conservatively estimated that this project would require up to 72 hours of drone flight time per week during warm months and 49 hours during cold months to achieve the desired mosquito release rate; flights over or near designated wilderness within the Kīpahulu Valley Biological Reserve (2,318 acres of the 64,666 project area), however, would likely require only approximately 2–3 hours of flight time and at any given location these drones would be perceptible either visually or aurally for less than 30 seconds (hovering would last 15 seconds or less over a particular location). The helicopter longline method could result in a maximum estimate of 28–39 hours of flight time per month, but this method would only be used as a short-term (up to two months), temporary release method if or when drones are unavailable and the time to cover areas near or within designated wilderness would likely be approximately 1–2 hours. When helicopters fly or hover above the canopy, noise levels on the ground would not exceed 82 dBA and would only approach that level for less than 15 seconds in any given location. Although helicopter noise would be short lived in any particular area, it would adversely impact the ability of wilderness users to enjoy a sense of solitude or primitive recreation. Pedestrian releases may also occur within designated wilderness in the Kīpahulu Valley Biological Reserve but only on a quarterly basis simultaneous with ground-based mosquito monitoring. Helicopters would land briefly in wilderness during each incompatible mosquito release operation, to pick up and drop off teams and supplies. Direct adverse impacts on the primitive wilderness experience would result, though these would be rarely and intermittently perceptible to visitors in accessible wilderness areas. Project noise created within the Kīpahulu Valley Biological Reserve portion of designated wilderness that does not travel beyond that boundary would not affect opportunities for solitude and primitive experiences in wilderness areas open to public access.

Other Features of Value

As stated previously, the proposed action would not impact physical historical resources within designated wilderness. The proposed action would likely support a considerable recovery of native forest birds that are of cultural importance to Native Hawaiians, thus benefiting the cultural landscape and the other features of value quality of wilderness.

Cumulative Impacts

When the impacts of the proposed action are added to impacts from past, present, and reasonably foreseeable future projects within the park described in Appendix E, the overall cumulative impact on wilderness character would be beneficial. The proposed action would adversely impact some wilderness character qualities due to the noise and presence of drones, helicopters, and generators. These impacts, however, would not permanently affect wilderness and the overall result of reduced mosquito populations would be a long-term benefit to the natural quality of wilderness and other features of value (native forest bird populations). Natural conditions in wilderness would dramatically improve as a result of the suppression of mosquito populations, which would reduce avian malaria mortality in native forest birds.

Conclusion

The no-action alternative is likely to result in fewer impacts to the untrammeled, undeveloped, opportunity for solitude and other features of value in wilderness compared to the proposed action. Uunder the no-action alternative, however, the natural quality of wilderness would continue to severely degrade with the irreparable harm to native forest bird species. The proposed action would affect additional wilderness character qualities including the untrammeled quality, undeveloped quality, and opportunity for solitude from the use of mechanized equipment for incompatible mosquito releases. This alternative, however, would likely support a considerable recovery to natural conditions previously present on the island, thus benefiting the natural and other features of value qualities of wilderness. Both alternatives

therefore detract from wilderness character qualities, but under the proposed action the small adverse impacts to the undeveloped quality, untrammeled quality, and opportunity for solitude from mosquito releases provide a substantial benefit to the natural and other features of value qualities through the protection of native forest birds. Though considerable analysis is presented here, overall adverse impacts to wilderness would be brief and minimal.

VISITOR USE AND EXPERIENCE

Current and Expected Future Condition of Visitor Use and Experience if No Action is Taken

The character and quality of the visitor experience influences perception of natural areas, providing a unique encounter with a place that differentiates it from other regions. Public enjoyment of resources is a fundamental purpose of all national parks (NPS 2006). DLNR manages forest reserves for multiple uses, including visitation. TNC also allows visitors by appointment within the Waikamoi Preserve. The project area lands managed by the park, state, TNC, and private entities are largely inaccessible and remote. Less than 5 percent of the total project area is open to visitors without a permit or readily accessible to visitors, while nearly 40 percent is completely closed to visitation (without a permit) to protect ecologically sensitive resources, including the Kīpahulu Biological Reserve and Hanawī Natural Area Reserve (**Figure 9**).

The current condition of visitor use and experience is described below. A detailed discussion of past, present, and reasonably foreseeable future projects within the park and adjacent lands contributing to the existing conditions and current trends for visitor use and experience are described in more detail in Appendix E. The description below provides an overview of how these ongoing and future actions would affect visitor use and experience.

Under the no-action alternative, visitor use and experience would remain the same or similar to existing conditions, including trends and impacts from past, present and foreseeable planned actions. Therefore, the affected environment and impacts of no-action are the same and discussed only once here.

Haleakalā National Park

The fundamental purpose of the park is to offer opportunities for public education and enjoyment. Visitors come to the park to participate in a range of recreational activities, including viewing sunrise and sunset, hiking, swimming, bicycling, attending ranger programs, scenic flights or driving, stargazing and astronomy, birdwatching, and camping. The enabling legislation that created the park—H.R. 9525, Public, No. 171, Chapter 264—states that, "…the tracts of land on the island of Hawai‘i and on the island of Maui…shall be perpetually dedicated and set apart as a public park or pleasure ground for the benefit and enjoyment of the people of the United States…" Between 2014 and 2017, the park averaged 1.2 million visitors annually (NPS 2018). Visitation was approximately 850,000 in 2021 (NPS 2021). Within the park, the Summit District sees approximately 3–4 times as much visitation as the Kīpahulu District. Most visitors enter the park in vehicles or tour buses.

The majority of the project area within the park is within the Kīpahulu Biological Reserve, which is closed to the public. Access is restricted to authorized scientists and land managers conducting research and management. The absence of public access to the reserve helps conserve the fragile biodiversity of the area (NPS 2018).

The lower portion of the Kīpahulu District (~766 acres) is the second most visited destination in the park. Approximately 325,000 visitors come to the lower Kīpahulu District annually (NPS 2021, FY 2018–2019). Recreational activities in the lower Kīpahulu Valley area include hiking, ranger-led interpretive hikes, commercial vehicle tours of the area, and camping, which all generate noise (NPS 2018). The Kīpahulu Campground has 21 designated sites for camping. Several popular trails include the Pīpīwai and Kūloa Point trails. The Kīpahulu District Visitor Center is open daily (usually from 9 a.m. to 5 p.m.) and the Kīpahulu campground (also open daily) offers 15 drive-up campsites, one group site, and five walk-in campsites.

Other than the lower Kīpahulu District, only 124 acres of the park-managed land within the project area has public visitation, including Hosmer Grove, located in the northwest corner of the project area. Hosmer Grove provides

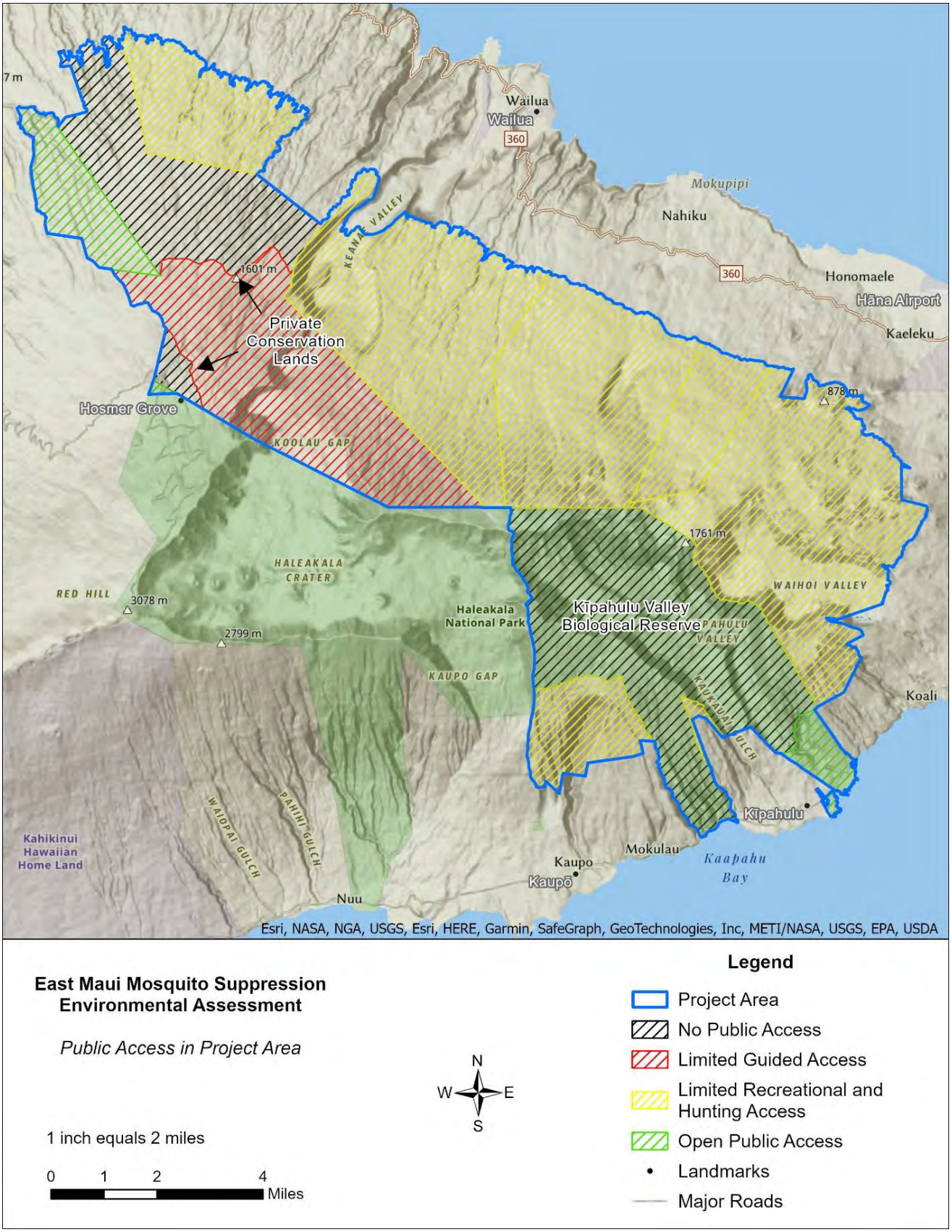

FIGURE 9: PUBLIC ACCESS IN THE PROJECT AREA

opportunities to camp, picnic, hike and birdwatch throughout the year, and is considered a birdwatching "hot spot" (eBird 2022). Neither the lower Kīpahulu Valley or Hosmer Grove areas are within the core mosquito release area.

Commercial air tours and recreational activities such as birdwatching and hiking are anticipated to continue or increase in or near portions of the project area. Periodic management helicopter flights on park lands are also anticipated to continue to facilitate resource stewardship projects and scientific research. Visitor use and experience may be disrupted by helicopter use for park management, but audible and visual impacts are intermittent and average 2-4 hours in duration. Commercial air tours operate year-round and may be constant near visitor use and recreational areas; within the project area air tours are most common above the Kīpahulu District. Visitors to the park may experience disruptions from ongoing infrastructure updates or health and safety management operations. For park projects, disturbance and impacts on visitor experience are assessed and efforts are made to reduce the duration of impacts, for example by avoiding use of load machinery during peak visitation hours or using an alternate tool. Improvements to trails would periodically occur, such as along the Pīpīwai Trail in the lower Kīpahulu District where a new viewing platform is planned. Visitors may also encounter park staff performing surveys or conducting invasive plant or wildlife control projects. Under the no-action alternative, mosquitoes would continue to spread avian malaria. This occurrence would severely impact native forest birds and lead to considerable mortality and likely extinction, which would diminish the experience of visitors seeking to enjoy these birds.

State Natural Area Reserves

The Natural Area Reserves System (NARS) was created to preserve and protect representative samples of Hawaiian biological ecosystems and geological formations (DLNR 1997). The Natural Area Reserves (NARs) are managed by DLNR DOFAW Native Ecosystem and Protection Program. Areas that are designated as NARs are protected by rules and management activities designed to maintain and restore native ecosystems intact, so a sample of that natural community would be preserved. NARs are some of Hawai‘i's most valued, pristine, and biologically diverse forests, coastal areas, and marine ecosystems. Visitor use in the Hanawī NAR is low as there are no legal access locations through adjacent lands. A small number of permits are issued each year for scientific research.

The Nature Conservancy and Private Lands

Public access to TNC's Waikamoi Preserve is limited to guided hikes, educational and service trips, and scientific research. TNC typically leads public hikes into Waikamoi Preserve one to two times per month throughout the year with a maximum of 15 participants. Approximately one volunteer work trip is additionally conducted once a month, and TNC typically provides trips into the preserve twice a month, once for local groups, and once a month for donors or other special guests. Visitation to the preserve by visitors is approximately 1,000 persons per year (TNC 2021). East Maui Irrigation/Mahi Pono lands are closed to the public unless given permission by land managers (M. Vaught, *pers. comm., 10/27/21*). Mosquitoes would continue to spread avian malaria, which would severely impact native forest birds and lead to considerable mortality and likely extinction., This occurrence would diminish the experience of visitors seeking to experience these birds, particularly in this preserve where birdwatching and visitation is popular.

Effects of the Proposed Action on Visitor Experience

Methods and Assumptions

Potential impacts to visitor use and experience under the proposed action would include noise and visual distractions from drones and helicopters. The baseline for evaluating potential impacts to visitor experience was developed using an assumption that visitors are seeking an experience in nature and that proposed management activities would impact that experience. Without a survey of visitors, there is an assumption that most visitors would consider activities under the proposed action to be a distraction, though they may possibly be of interest, as some visitors may not interpret seeing helicopter or drones engaged in conservation activities as an adverse impact to their experience. Given the similarity of conditions on state and TNC-managed lands outside the park, it is assumed existing noise levels in these areas would be similar to those occurring within national park boundaries. Impacts were evaluated based on the potential for

incompatible mosquito release activities through any of the release methods to create impacts that could affect the visitor experience.

Analysis Area

The area of analysis for impacts of the alternatives on visitor use and experience includes the portions of the park, state, and TNC lands where management activities overlap with visitor use (**Figure 9**). Although the project area encompasses 64,666 acres, any considerable visitor use is largely limited to a much smaller area including the lower Kīpahulu District in the park (3,706 acres), Makawao Forest Reserve and scattered hunting in remote areas of State Forest Reserves, and guided hikes in some areas of TNC's Waikamoi Preserve (on less than approximately 10 percent of this preserve). The Summit District outside of the mosquito release area is discussed in this section to account for drone and helicopter flights over this area to reach the mosquito release areas under the proposed action. Much of the project area is remote, roadless, and consists of steep topography, deep ravines, and dense vegetative cover inhibiting sound and sight.

With the exception of Makawao Forest Reserve, which has popular hiking trails, hunting is the primary visitor use in much of the State Forest Reserves (343 sq mi). The Kīpahulu Biological Reserve within the park is closed to visitors. It is assumed for this analysis that the type of impacts on visitor use and experience would be similar for management activities occurring on NPS and adjacent state and private lands within the project area.

Analysis

Under the proposed action, visitor impacts would primarily be associated with some disturbance from aerial operations and pedestrian teams during project implementation. The noise disturbance and other visitor experience impacts vary with release method, location of release activities, and level of visitor access. As incompatible mosquito releases would only occur during the daytime on weekdays, there would be no impacts to visitor experience at night or on weekends. Potential intermittent disturbance may be offset by potentially successful mosquito suppression and conservation of Hawaiian honeycreepers, which would result in a long-term beneficial impact on the visitor experience, especially for visitors that would enjoy hearing and seeing the iconic Hawaiian honeycreepers.

Drone Release

As described in Chapter 2, drones would be the primary mosquito release method and it is conservatively estimated that the proposed action would require up to 49–72 hours of drone flight time per week (depending on the time of year) to achieve the desired incompatible mosquito release rate for mosquito suppression. Drone flight paths would vary substantially depending on the release locations being treated each day, and drones would likely pass over a specific location twice per week or less. Visitors at or near release locations would experience noise (maximum of 47–59 dBA at 100–200 feet AGL) and visual disturbance while the drone is flying above. This method would have minimal adverse impacts on visitor experience on park, state, and TNC lands as the visual and auditory disturbance would be short in duration, likely from 15 seconds to a few minutes (drones may hover for less than 15 seconds over a particular location). Drone mosquito releases would occur in areas largely inaccessible to visitors and would not occur at night or on weekends. Drone noise could potentially be heard (above approximately 27 dBA) up to 0.5 mile of the drone. Notably, the extensive tree canopy cover and rugged terrain can have a dampening effect on sound and may reduce the distance (likely by half or more based on anecdotal experience of park and state staff working in the project area) where sound is heard. The nearest recreational areas where people could experience drone noise are in Makawao Forest Reserve and lower Kīpahulu District. People in these areas could very briefly experience drone noise if drones pass within 0.5 mile of recreational trails or other public use areas. Most of the areas where drones would be conducting releases would be out of earshot for hikers along the Pīpīwai Trail to Waimoku Falls.

Helicopter Longline Release

When drones are not available, intermittent adverse impacts on visitor experience from helicopter overflights would occur. Adverse impacts would result from elevated sound levels along helicopter flight paths while accessing the project area. Impacts to the visitor experience could occur over a relatively short duration (15 seconds to a few minutes)

primarily due to noise (maximum of 82 dBA at 150 feet AGL). Brief visual impacts would also be likely. As described in previous sections, under the worst-case scenario, helicopter noise could be audible up to 3.5 miles from a given helicopter flight path, and noise levels could be above existing ambient up to 1.8 miles from the flight path. Speech interference could occur at 0.47 miles from the flight path. Visitors in the Summit District of the park outside of the core mosquito suppression area could see an increase of helicopter flights, approximately one or two additional flights per week for up to two months, over this area to reach the incompatible mosquito release locations. However, the vast majority of flights (by helicopter or drone) would likely be based out of temporary helibases outside of the Summit District and flights would not cross the area. For flight paths to and from ʻOheʻo, helicopter noise would be audible at Waimoku Falls for a duration of less than four minutes. Speech interference would likely not occur, and noises would rarely exceed existing ambient in lower Kīpahulu Valley as a result of project-related flights. Additionally, lower Kīpahulu Valley already experiences consistent helicopter noise disturbance from commercial air tours. The Kīpahulu acoustic monitoring station recorded noise from helicopters approximately 28 percent of the time (likely up to 10 commercial tour flights per day). Therefore, the limited use of helicopters under the proposed action would likely not be noticeable to the public.

There would be no mosquito releases at night or on the weekends, so noise impacts would only occur during daylight hours (between civil sunrise and civil sunset) on weekdays. During helicopter longline releases, adverse impacts on visitor use and experience would primarily occur along flight paths, at helibases, and when hovering over mosquito release locations. Helicopters would hover for less than 15 seconds over each mosquito release location. At any given location in the core area, the perceived noise levels from helicopter operations would fluctuate for visitors because helicopters would be moving through the area quickly (22 mph during releases and up to 115 mph during transit). The core area contains many places where there is little to no public use. The most well-used areas with established public trails include Makawao Forest Reserve and the lower Kīpahulu District area where many people use the Pīpīwai Trail to access Waimoku Falls. The proposed action would only minimally elevate noises experienced by visitors in the vicinity of lower Kīpahulu Valley.

Pedestrian Release

Using this method, mosquito releases would result in a minimal adverse impact on visitor experience from the use of helicopters, mechanized and motorized equipment, and human activity associated with mosquito release and monitoring activities. Only Makawao Forest Reserve, TNC's Waikamoi Preserve, and other private lands within the project area could be subject to consistent pedestrian releases up to twice per week. Adverse noise impacts on visitor experience from helicopters (maximum of 82 dBA at 150 feet AGL) would be variable but would not be sustained, as ground teams and equipment would only be dropped off and picked up on a quarterly basis at the beginning and end of each monitoring effort (when some pedestrian releases could occur) at five remote LZs in the project area that do not see consistent visitor use other than occasional hunting. Generator noise (maximum of 52–58 dBA at 23 lateral feet) could be audible for up to 3 hours per day and 7 days per week on a quarterly basis. Generators, however, would only be used during mosquito monitoring activities that occur in remote areas and out of earshot of public visitors. Popular birdwatching areas in the project area include Waikamoi (TNC), Hosmer Grove (park), and Kahakapao Trail (Makawao Forest Reserve, state). While the Summit District does offer backpacking and hiking opportunities, mosquito release activities within the project area would be largely shielded from the Summit District by the rim of the crater and only limited visitors, if any, would hear or see helicopters operating in the project area. Overall, noise from this release method would be minimal and would include noise of up to 75 dBA at 50 feet from vehicles approaching and leaving trailheads up to 2 hours per day, 2 days per week. Noise impacts from vehicles would blend into the vehicle traffic/noise already occurring at trailheads.

Mosquito Monitoring

Motorized vehicles (SUVs or trucks) would assist in the transportation of field teams and gear to reach three ground-accessible monitoring sites in Makawao Forest Reserve and TNC's Waikamoi Preserve. Noise from vehicles used during monitoring would primarily occur along the Flume Road shown (in brown) on **Figure** 5 and is not expected to exceed 4 hours per day for up to 7 days on a quarterly basis. It should be noted that vehicles would not be running constantly during that 4-hour time period because crews would be stopping periodically to check mosquito traps. As

previously mentioned, ground vehicles can reach 75 dBA at 50 feet from the source but would be muffled by the surrounding canopy and would not be expected to exceed 60 dBA at 50 feet from the source of noise.

Overall, the noise from helicopters and generators would be focused at the five helicopter-only accessible monitoring camps and LZs. Noise from approaching or departing vehicles would occur at trailheads in Makawao Forest Reserve and TNC's Waikamoi Preserve. Adverse impacts on visitor use and experience during monitoring activities from helicopters, generators, and vehicles would be highly variable and not sustained (would only occur every three months). In addition, it is unlikely that any visitors or recreationists would be aware of the helicopter landings or generator noise due to the remoteness of the LZs used during monitoring and the infrequency of trips required for quarterly monitoring.

Cumulative Impacts

The impacts of past, present, and reasonably foreseeable future actions (see Appendix E) and the no-action alternative are described in the section titled "Current and Expected Future Condition of Visitor Use and Experience if No Action is Taken". Because the no-action alternative would not result in any new actions that would have indirect or direct impacts to visitor use and experience, there would be no cumulative effects associated with the no-action alternative. Under the proposed action, there would be impacts to visitor experience mostly from the use of drones and helicopters to release mosquitoes. These impacts to visitor experience, however, would be limited to drone and helicopter flight paths and landing zones because much of the core mosquito release areas are closed to the public.

When the impacts of the proposed action are added to the impacts of present and reasonably foreseeable actions, an adverse cumulative impact on visitor experience would continue for visitors, due to ongoing actions, primarily in the form of commercial air tours. The proposed action would add a limited incremental adverse impact to visitor use and experience from increased drone and helicopter overflights. The suppression of invasive mosquitoes would additionally result in a long-term beneficial impact on the visitor experience, especially for visitors that would enjoy hearing and seeing the iconic Hawaiian honeycreepers. Overall, cumulative impacts would remain adverse, primarily due to the other past, present, and reasonably foreseeable future actions.

Conclusion

Under the no-action alternative, conditions and trends would remain the same or similar as existing conditions. Visitors would not experience additional disturbances from mosquito release activities and invasive mosquitoes would continue to spread avian malaria, which would severely impact native forest birds leading to considerable mortality and likely extirpation and extinction. Compared to the no-action alternative, mosquito release activities under the proposed action would contribute additional periodic adverse impacts on visitor experience near LZs, helibases, flight paths, and trails from the use of drones, mechanized equipment, and helicopters largely in the form of noise and visual intrusion. Adverse impacts from the pedestrian release method would be confined to a small portion of the overall project area. Because the majority of the project area is closed to the general public, there will be only minimal impacts to visitor experience from mosquito release and monitoring activities. A permanent beneficial impact on the visitor experience is anticipated under the proposed action, assuming the mosquito control effort is successful and native forest bird populations stabilize or recover. For those who are visiting portions of the analysis area to enjoy a unique native rainforest ecosystem or birdwatching, the beneficial impact could be considered substantial. Though considerable analysis is presented here, overall adverse impacts to visitor use and experience would be brief and minimal.

THREATENED AND ENDANGERED PLANT SPECIES AND STATE PLANT SPECIES AT RISK

Plant species listed as threatened or endangered receive federal and state protection under the ESA and Chapter 195D, Hawai‘i Revised Statutes, respectively, and are characterized as those that are in danger of or threatened with extinction throughout all or a significant portion of their range. State plant species at risk include species that are not federally or state listed but are recognized as imperiled or vulnerable by the state and have been identified as important to protect and manage by biologists or land managers as there are fewer than 50 individuals remaining in the wild. While some

plant species at risk may be considered vulnerable to population declines, or extinction, by state or global metrics (e.g., NatureServe Global Conservation Rank), others are lacking enough information to make a status determination.

The analysis area for listed plant species, designated critical habitat, and plant species at risk includes portions of the project area that would be used for ground-based pedestrian mosquito releases and monitoring activities. This includes a 20-foot buffer around management trails, fence lines, and established helicopter LZs and camps that would be used to support ground-based activities. Although there are a few listed plant species and plant species at risk that grow on trees and occur within the project area, these are extremely unlikely to be affected by aerial activities (e.g., rotor wash during helicopter longline release). Therefore, portions of the project area that only include aerial activities (e.g., drone and helicopter longline flights) are not included in the analysis area, as these activities would not affect listed plant species, designated critical habitat, and plant species at risk.

Current and Expected Future Condition of Threatened and Endangered Plant Species and State Plant Species At Risk if No Action is Taken

The current condition of threatened and endangered plant species and state plant species at risk is described below. A detailed discussion of past, present, and reasonably foreseeable future projects within the park contributing to the existing conditions and current trends for threatened and endangered plant species, designated critical habitat, and state plant species at risk are described in more detail in Appendix E. The description below provides an overview of how these ongoing and future actions would affect threatened and endangered plant species and state plant species at risk.

Under the no-action alternative, conditions for threatened and endangered plant species and state plant species at risk would continue to be the same or similar to existing conditions with the same trends and impacts from past, present, and foreseeable planned actions. Therefore, the affected environment and impacts of no-action are the same and discussed only once here.

Currently, 425 plant species in Hawai‘i are federally and state listed as threatened or endangered (USFWS 2022c). Many of these plant species persist at very low numbers and are in rapid decline (USFWS 2021a). Existing threats to listed plant species across the Hawaiian Islands include habitat loss, degradation, and modification of habitat by non-native invasive plants and animals, and disease (USFWS 2021a). While plant species at risk are not currently protected under the ESA and Hawai‘i Revised Statues Chapter 195D, they face the same threats as listed species.

Climate change is exacerbating and accelerating threats to listed and at-risk animal and plant species across the Hawaiian Islands. Rapid climate change, including the global trend of atmospheric warming, is an important factor expected to contribute to numerous extinctions across the globe (Thomas et al. 2004). Changes in environmental conditions, such as increasing storm intensities and temperatures and decreasing precipitation, can result in changes to the microclimate of a species’ habitat, and may lead to the loss of the species or of other native species associated with that species habitat (USFWS 2021a).

In addition, natural ecosystems in Hawai‘i rely on the pollination services of native birds and insects, in particular native honeycreepers and yellow-faced bees (UH Honeybee Project 2022). Native Hawaiian lobeliads coevolved with Hawaiian honeyeaters and honeycreepers. Five genera of Hawaiian lobeliads (*Clermontia*, *Delissea*, *Cyanea*, *Lobelia*, and *Trematolobelia*) are believed to have evolved flowers adapted for pollination by Hawaiian honeycreepers and honeyeaters (Pender et al. 2014). Although information on specific plant-pollinator relationships is limited (Barton et al. 2021), the relationship between native Hawaiian birds and plants is threatened by the loss or functional extinction of much of Hawai‘i’s avifauna (Pratt et al. 2009). Due to the extinction of all native Hawaiian honeyeaters, most honeycreepers, and the decline of remaining nectar-feeding honeycreepers, reproduction in some lobeliads may now be limited (Barton et al 2021). Native birds are increasingly infrequent visitors to lobeliads in many Hawaiian forests, especially at low and mid elevations where introduced avian malaria has decimated native bird populations (Cory et al., 2015 as cited in Barton et al. 2021).

Federal Threatened and Endangered Plant Species and Designated Critical Habitat Within Analysis Area

Twenty-seven plant species listed as endangered under the federal ESA and HRS Chapter 195D occur within the plant analysis area. Table F-1 in Appendix F lists these species and their habitat, as well as the locations of known occurrences of these species within the analysis area. Fourteen of these species are found on park land within the analysis area, 11 on state land, and 11 are found on TNC-managed lands. One of these 27 listed plant species, hāhā (*Cyanea kunthia*), is known to occur on lands managed by all three entities (i.e., park, state, and TNC) within the analysis area. The majority of the listed plant species occurring in the analysis area are found in lowland or montane, wet to mesic forests.

The analysis area includes designated critical habitat for 37 federally listed plant species on park, state, and TNC-managed lands (USFWS 2022b; Appendix F). However, only 19 of the listed plant species with designated critical habitat that overlap the analysis area also have known occurrences within the analysis area (Table F-2 in Appendix F).

Within the analysis area, listed plant species and designated critical habitat have been and would likely continue to be affected by ongoing management activities. Under the no-action alternative, ongoing and future management activities expected within the analysis area include implementing ground and aerial herbicide spray techniques to help control or eradicate invasive plant species, as well as manual removal of invasive plant species; ungulate, predator, and pest control; trail maintenance; fence construction and maintenance; landing zone and shelter maintenance; fire management; and collection, reintroduction, and monitoring of endangered plants. These activities have the potential to inadvertently introduce and spread invasive species through movement of personnel and equipment, which can negatively affect listed plants and designated critical habitat. Invasive plants can outcompete or reduce habitat availability for listed plants. Similarly, feral ungulates can degrade native habitat required for listed plants, including designated critical habitat (USFWS 2021a). Other potential adverse effects from these activities include the accidental trampling of plants or inadvertent harm to listed plant species and designated critical habitat during application of herbicides for invasive plant control.

In addition to ongoing and future management activities, ongoing and future visitor use of the park, state, and TNC lands has the potential to affect listed plants and designated critical habitat. Pedestrian visitors within the plant analysis area have the potential to trample these species or their habitat. However, public access to much of the plant analysis area is generally limited or restricted (**Figure 9**) and visitors are likely to stay on designated hiking trails. Pedestrian visitors also have the potential to introduce or spread invasive species or pathogens, which may adversely affect listed plants and designated critical habitat. Future actions within the analysis area include the Pīpīwai Trail Viewing Platform and inventory and monitoring vegetation plots projects in the park, watershed resource monitoring on state-lands, and installation of cell tower infrastructure within TNC-managed lands have the potential to affect listed plants and designated critical habitat through accidental trampling or introduction of invasive species or pathogens.

Ongoing management actions and pedestrian visitation to the analysis area are discussed in the existing conditions for listed plant species and designated critical habitat. The effects of these activities are included in the affected environment, and the no-action alternative would therefore not result in any new direct or indirect impacts to listed plant species or designated critical habitat. As there would be no new direct and indirect impacts as a result of the no-action alternative, there would be no cumulative effects associated with the no-action alternative. If no action is taken, however, avian malaria would continue to devastate native forest bird populations, which could potentially affect listed plant species due to the loss of pollination services of these native birds. However, information on specific plant-pollinator relationships is limited (Barton et al. 2021) and the likelihood and extent of potential impacts to listed plant species from the continued loss of native forest birds is therefore unknown.

State Plant Species at Risk and Habitat Within Analysis Area

Twenty-three State plant species at risk occur in the plant analysis area. These species are listed in Table F-3 in Appendix F, along with their habitat, and locations within the analysis area. Four of these 23 species are found on park land within the analysis area, none on state land, and 19 are found on TNC-managed lands. None of these plant species at risk occur on lands managed by all three entities (i.e., park, state, and TNC) within the analysis area, and only two

species, Hawai‘i jewel-orchid (*Anoectochilus sandvicensis*) and awapuhiakanaloa (*Liparis hawaiensis*), are known to occur on lands managed by both the park and TNC within the analysis area. Most plant species at risk within the analysis are found within mesic to wet forest habitats.

The impacts to plant species at risk and their habitat within the analysis area from ongoing and future actions would be the same as described above for federal threatened and endangered plant species. The no-action alternative would not result in any new direct or indirect impacts to plant species at risk or their habitat within the analysis area. As a result, there would be no cumulative effects associated with the no-action alternative. If no action is taken, however, avian malaria would continue to devastate native forest bird populations, which could potentially affect plant species at risk due to the loss of pollination services of these native birds. As noted above, however, information on specific plant-pollinator relationships is limited (Barton et al. 2021) and the likelihood and extent of potential impacts to plant species at risk from the continued loss of native forest birds is therefore unknown.

Effects of the Proposed Action on Threatened and Endangered Plant Species and State Plant Species At Risk

Methods and Assumptions

Potential impacts on listed plant species and plant species at risk and their habitat, including designated critical habitat, were evaluated based on resource expert knowledge and professional judgment, review of available research, and anticipated locations where ground-based activities under the proposed action would occur. Listed plant species, designated critical habitat, and plant species assessed to be at risk assessed include those species with known occurrences or designated critical habitat that overlap the analysis area, as defined below. The locations of existing populations of these species within the analysis area were provided by park, state, and TNC staff. Additional sources of data included the locations of designated critical habitat for federally listed species within the analysis area (USFWS 2022b).

Analysis Area

The area of analysis to assess impacts of the alternatives on listed plant species, designated critical habitat, and plant species at risk includes the following:

- Up to 11 miles of fence lines and 100 miles of trails within the project area that may be used during pedestrian mosquito release and monitoring activities, plus a 20-foot buffer; and
- Up to 10 existing LZs and camps that would be used to support pedestrian mosquito release and monitoring activities.

The plant analysis area, including the buffers around the fence lines, trails, existing LZs and camps, was identified in consultation with the USFWS (USFWS 2022d) and internal discussions with park and state staff and encompasses the area where both direct and indirect effects to listed plant species and plant species at risk from the proposed action are likely to occur. As described earlier in this section, 27 listed plant species and 23 plant species at risk are known to occur within the analysis area (Appendix F). The analysis area also includes designated critical habitat for 37 federally listed plant species.

Threatened and Endangered Species Section 7 Determination Definitions

The Endangered Species Act (ESA), NPS Management Policies 2006, NEPA, and applicable regulations require the analysis of potential impacts on special-status species (federal or state endangered, threatened, candidate, or species at risk). According to section 4.4.2.3 of NPS Management Policies 2006, NPS must additionally “manage critical habitat […] to maintain and enhance their value for the recovery of threatened and endangered species” (NPS 2006).

This analysis serves as both a NEPA assessment of impacts on federally listed species (federal endangered, threatened, or candidate) that could be impacted by the project and a biological assessment as required by Section 7 of the ESA.

The USFWS guidance for implementing Section 7 consultation under the ESA (USFWS 2017) uses the following terminology to assess impacts on federally listed species:

No Effect

This conclusion is reached if the proposed action and its interrelated and interdependent actions would not directly or indirectly affect federally listed species or destroy/adversely modify designated critical habitat. Formal section 7 consultation is not required when the no effect conclusion is reached.

May Affect, but Not Likely to Adversely Affect

This conclusion is appropriate when effects to federally listed species or designated critical habitat are expected to be beneficial, discountable, or insignificant. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact, while discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. If the project scientist making the determination and the project manager agree that the project "is not likely to adversely affect" federally listed species or designated critical habitat, the intra-service Section 7 consultation process is completed.

May Affect, Likely to Adversely Affect

This conclusion is reached if any adverse effect to federally listed species or designated critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable or insignificant. In the event the overall effect of the proposed action is beneficial to the federally listed species or designated critical habitat but may also cause some adverse effect on individuals of the listed species or segments of the critical habitat, then the determination should be "is likely to adversely affect." Such a determination requires formal Section 7 consultation.

Analysis

This section discusses the potential effects to federally listed plant species, designated critical habitat, and plant species at risk from each of the three mosquito release methods and mosquito monitoring.

As noted above in the Current and Expected Future Condition of Threatened and Endangered Plant Species and State Plant Species at Risk section, natural ecosystems in Hawai‘i rely on the pollination services of native birds and insects, in particular native honeycreepers, and yellow-faced bees (UH Honeybee Project 2022). Under the proposed action, actions taken to control mosquito populations that carry avian malaria would support recovery of native Hawaiian forest birds, reducing the likelihood for extirpation or extinction of these species. This could potentially have a beneficial impact on native Hawaiian plants, including listed plant species and plant species at risk, which rely on native forest birds for pollination. Information on specific plant-pollinator relationships is limited (Barton et al. 2021) and the potential benefit and level of benefit to listed plant species and plant species at risk from implementation of the proposed action is therefore unknown.

Drone Releases

As noted earlier in this section, the analysis area for listed plant species, designated critical habitat, and plant species at risk is limited to the portions of the project area that would be used for ground-based mosquito release and monitoring activities. The only ground-based activities associated with drone releases would be the use of temporary helibases for drone launch locations. However, as noted in Chapter 2, these drone launch locations would be existing "front country" locations accessible by major roads. As no vegetation clearing would occur at these drone launch locations, there would be no impact to listed plants, designated critical habitat, or plant species at risk from vegetation clearing.

The use of temporary helibases for drone launch locations could result in the introduction or spread of invasive plant species or pathogens (e.g., fungal pathogens responsible for rapid ‘ōhi‘a death) through the spread of invasive plant pathogens, seeds, spores, or propagules on equipment or clothes of personnel. As outlined in Chapter 2, to minimize the

risk of introducing and spreading invasive plant species or pathogens all vehicles, equipment, clothes, and footwear would be regularly inspected and cleaned and personnel would implement existing protocols, such as the PIFWO Office Invasive Species Biosecurity Protocols (USFWS 2022a). With implementation of mitigation measures, potential adverse impacts to listed plant species, designated critical habitat, and plant species at risk from the introduction or spread of invasive plant species or pathogens under the drone release method would be negligible.

Helicopter Longline Releases

Similar to the drone release method, the only ground-based activities associated with short-term (up to two months), temporary helicopter longline releases would be the use of temporary helibases for attachment of the longline and release mechanisms by ground teams. As no vegetation clearing would occur at these temporary helibases, there would be no impact to listed plants, designated critical habitat, or plant species at risk from vegetation clearing at these locations. Although the helicopter longline release method could result in the introduction or spread of invasive plant species or pathogens at temporary helibase locations, implementation of mitigation measures outlined in Chapter 2, such as regularly inspecting and cleaning vehicles, equipment, and clothes and implementing the PIFWO Invasive Species Biosecurity Protocols (USFWS 2022a), would minimize the transport and establishment of invasive plant species or pathogens at these locations. With implementation of mitigation measures, potential adverse impacts to listed plant species, designated critical habitat, and plant species at risk from the introduction or spread of invasive plant species or pathogens under the helicopter longline release method would be negligible.

Pedestrian Releases

Potential adverse impacts to listed plant species, designated critical habitat, and plant species at risk from pedestrian releases could occur through:

- Removal or trampling of individual plants, physical damage to plant parts (e.g., roots, stems, flowers, fruits, seeds), or damage to habitat, including designated critical habitat, from clearing, maintenance, and increased use of existing management trails and fence lines, helicopter LZs, and camps for mosquito release activities; and
- Introduction or spread of invasive plant species or pathogens from pedestrian or helicopter teams during mosquito release and monitoring activities.

As outlined in Chapter 2, the only consistent pedestrian release would be in Makawao Forest Reserve and Waikamoi Preserve; pedestrian releases within upper Kīpahulu Valley Biological Reserve and Hanawī Natural Area Reserve would likely only occur on a quarterly basis, simultaneous with ground-based mosquito monitoring (discussed below). Vegetation clearing around existing management trails and fence lines or LZs, and increased use of existing trails, fence lines, camps, and LZs have the potential to result in physical damage to listed plant species or plant species at risk. Cutting and removal of vegetation surrounding listed plants or plant species at risk has the potential to alter microsite conditions (e.g., light, moisture, temperature), which could alter habitat, including designated critical habitat for these species. Although there is the potential for listed plant species or plant species at risk to be removed or harmed during trail clearing and vegetation removal, implementation of mitigation measures (outlined in Chapter 2) such as flagging the boundaries of areas occupied by listed plant species prior to any clearing, would make any direct harm to these species unlikely.

Vegetation clearing and increased use of existing trails, fence lines, camps, and LZs can increase the risk of invasion or spread of invasive plants or pathogens. This could occur through the direct spread of invasive plants or pathogen seeds, spores or propagules on clothes or equipment of personnel, or indirectly through removal of existing vegetation, which allows openings for invasive plants to colonize. Existing protocols, however, such as the PIFWO Invasive Species Biosecurity Protocols (USFWS 2022a) and other measures outlined in Chapter 2, would be implemented to minimize the risk of introducing and spreading invasive species and pathogens. With implementation of these protocols and mitigation measures, adverse effects from the potential spread of invasive plants and pathogens are anticipated to be negligible.

Temporary disturbances such as vegetation removal around existing trails and LZs may affect the Primary Constituent Elements (PCEs) of designated critical habitat units. These impacts would be minimized by following the mitigation measures such as providing personnel with maps showing the locations of designated critical habitat areas and training them how to avoid unnecessary adverse impacts within critical habitat. With implementation of mitigation measures, the impacts to designated critical habitat are expected to be negligible.

Mosquito Monitoring

Potential impacts of mosquito monitoring to listed plant species, designated critical habitat, and plant species at risk could occur through; a) vegetation clearing, b) the removal or trampling of individual plants, c) physical damage to plant parts (e.g., roots, stems, flowers, fruits, seeds), d) introduction or spread of invasive plants or pathogens, or e) damage to habitat, including designated critical habitat, from clearing, maintenance, and increased use of existing management trails and fence lines, helicopter LZs, and camps. The adverse impacts of these activities would be as described for pedestrian releases.

Monitoring would likely occur quarterly (four times/year) and in some cases, such as within upper Kīpahulu Valley Biological Reserve and Hanawī Natural Area Reserve, could potentially be concurrent with pedestrian releases. As only established trails, fence lines, camps, and helicopter LZs proposed for use under pedestrian releases would be used for monitoring activities, no additional adverse impacts from vegetation removal or trampling in these areas would be anticipated. With implementation of mitigation measures outlined in Chapter 2, such as flagging and avoiding individuals or populations of federally listed plant species and plant species at risk and implementing invasive species biosecurity protocols, potential impacts to federally listed plant species, designated critical habitat, and plant species at risk during mosquito monitoring would be negligible.

Cumulative Impacts

Overall, the impacts on listed plant species, designated critical habitat, and plant species at risk from past, present, and reasonably foreseeable future actions would be as described earlier in the section titled “Current and Expected Future Condition of Threatened and Endangered Plant Species and State Plant Species at Risk”. There would be no new impacts to plants under the no-action alternative. Under the proposed action, steps taken to suppress mosquito populations that carry avian malaria would support recovery of native Hawaiian honeycreepers, reducing the likelihood for extirpation or extinction of these species. This could potentially have a beneficial impact on native Hawaiian plants, including listed and at-risk plant species, which rely on native forest birds for pollination. The proposed action would potentially have an adverse impact on listed plant species, designated critical habitat, and plant species at risk through vegetation clearing and trampling and increased risk of invasion or spread of invasive plants or pathogens. With implementation of mitigation measures described in Chapter 2, however, adverse impacts under the proposed action would be negligible. The incremental impacts of the proposed action would have only a small contribution to overall cumulative impacts.

Conclusion

Under the no-action alternative, conditions would remain the same or similar to existing conditions, including trends and impacts from past, present, and foreseeable future actions. 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 action would potentially result in adverse impacts to federally listed plant species, designated critical habitat, and plant species at risk through removal or physical damage to plants, damage or modification of habitat, and the introduction of invasive plant species or pathogens. However, with implementation of mitigation measures, these adverse impacts are anticipated to be negligible. Additionally, the proposed action would likely support recovery of native Hawaiian forest birds, which may benefit native Hawaiian plants, including listed plants and plant species at risk. Though considerable analysis is presented here, overall adverse impacts to listed plants and plant species at risk would be minimal.

Section 7 Determination Summary

Based on the analysis, project activities under the proposed action, incorporating mitigation measures described in Chapter 2, *may affect, but is not likely to adversely affect*, all analyzed federally listed plant species and their designated critical habitat, as applicable (Appendix F).

THREATENED AND ENDANGERED WILDLIFE SPECIES AND WILDLIFE SPECIES OF CONCERN

Federally and state listed wildlife species receive protection under the ESA and Chapter 195D, Hawai‘i Revised Statutes, respectively, and are characterized as those that are in danger of extinction throughout all or a significant portion of their range. State protected wildlife species include all indigenous wildlife, which are protected under state law (Section 13-124-3, HAR). Other species of concern may be bird species protected under the Migratory Bird Treaty Act, and other species at risk such as species proposed for listing, or species considered globally threatened by organizations other than USFWS (e.g., IUCN, State of Hawai‘i, NPS 2017). Although all threatened and endangered wildlife species and wildlife species of concern in the project area were considered, only those species that have the potential to be impacted by the no-action alternative or the proposed action are described in this EA.

Current and Expected Future Condition of Threatened and Endangered Wildlife Species and Wildlife Species of Concern if No Action is Taken

The current condition of threatened and endangered wildlife species and wildlife species of concern is described below. A detailed discussion of past, present, and reasonably foreseeable future projects within the park contributing to the existing conditions and current trends for threatened and endangered wildlife species and wildlife species of concern are described in more detail in Appendix E. The description below provides an overview of how these ongoing and future actions would affect threatened and endangered wildlife species and wildlife species of concern.

Under the no-action alternative, conditions for threatened and endangered wildlife species and wildlife species of concern would continue to be the same as or similar to existing conditions with the same trends and impacts from past, present, and foreseeable planned actions, including the potential for continued declines in several threatened and endangered forest bird species. The affected environment and impacts of no-action are therefore the same and discussed only once here.

Federally and State Listed Wildlife Species and Habitat within Project Area

Island species co-evolved in isolation over millions of years with unique adaptations to their environments. Hawai‘i’s endemic plants, birds, and insect pollinators are remarkably co-specialized (Carlquist 1974). Habitat destruction, invasive plants, non-native predators and competitors, introduced ungulates, and introduced diseases have decimated the diverse, endemic native animal community of the Hawaiian archipelago (Pratt 2009).

The ecosystems of East Maui (and the project area) include numerous intermittent and perennial streams, bogs, small montane lakes, and rainforest that provide habitat for native birds, bats, invertebrates, and aquatic organisms. The upper elevation habitats, from approximately 3,900 feet to 6,400 feet, are characterized as very wet, high-quality native-dominated rainforest (Price et al. 2007). Nine species of federally listed threatened and endangered wildlife (one insect, eight bird species, and one mammal) are known to occur within the project area. Three of these listed bird species are Hawaiian honeycreepers—kiwikiu, ‘ākohekohe and ‘i‘iwi—and are declining rapidly due to mosquito-borne avian malaria and other threats. Threatened and endangered wildlife species and their trends are described in the following pages.

Birds

Hawaiian Honeycreepers

The introduction of the first mosquitoes to Maui, reported in 1826 (Van Dine 1904), has been devastating to the endemic Hawaiian forest bird species, particularly the Hawaiian honeycreepers (family Fringillidae, subfamily Carduelinae, tribe Drepanidini), in the last half century. The invasive southern house mosquito is highly adaptive and transmits at least two bird diseases in Hawai‘i including avian pox (*Avipoxvirus*) and avian malaria (Atkinson and LaPointe 2009a, Harvey-Samuel et al. 2021). Avian malaria was introduced more than 100 years ago to the avifauna of Hawai‘i and has caused massive endemic forest bird population declines, limited the elevational distribution of Hawaiian forest birds, and caused extinctions across the archipelago (including from the analysis area) as recently as the last two decades (Warner 1968, van Riper et al. 1986, Atkinson and Samuel 2010, USFWS 2021). Avian malaria's acute phase of infection causes anemia (loss of red blood cells and oxygen to the vital organs), with symptoms of weakness, loss of appetite, weight loss, organ failure, and death to susceptible birds after a single infected mosquito bite (Atkinson et al. 1995 and 2000). Highlighting the urgency of action needed to prevent avian malaria transmission, three Hawaiian honeycreeper species that disappeared from the project area within the last two decades were recently declared extinct at least in part due to avian malaria: Maui ‘ākepa (*Loxops ochraceus*), po‘ouli (*Melamprosops phaeosoma*), and Maui nukupu‘u (*Hemignathus affinis*) (USFWS 2021). As discussed in earlier sections of this document, three species of honeycreeper within the project area are federally listed as threatened or endangered and are at risk of continued population decline and/or extinction the next 20 years: kiwikiu, ‘ākohekohe, and ‘i‘iwi.

The endangered kiwikiu is a stout yellow and olive-green honeycreeper with a large, hooked bill. Endemic to the islands of Maui and Moloka‘i, the species is currently only found on East Maui and is ranked as one of the most imperiled Hawaiian birds and is very susceptible to avian malaria (Warren et al. 2019, American Bird Conservancy 2022, USFWS 2019). Kiwikiu may nest all year but primarily breeds between January and June and are primarily insectivorous, using their disproportionately large bill to probe and excavate woody plant material (and, to a lesser extent, fruits) to eat mostly the larvae of beetles (Coleoptera) and caterpillars (Lepidoptera) found on or within native plants and lichens (Mountainspring 1987, Peck et al. 2015, Simon et al. 2020). Critical habitat has been designated for kiwikiu (**Figure 10**; USFWS 2016a), and the majority of the project area lies within it. Their habitat is characterized by wet-mesic and ‘ōhi‘a-dominated rainforest above 5,280 feet (Judge et al. 2021).

The endangered Maui-endemic ‘ākohekohe is a striking forest pollinator with a distinctive crest on its head. Critical habitat has been designated for ‘ākohekohe (**Figure 10**; USFWS 2016a), which entirely overlaps the critical habitat of the kiwikiu; the majority of the project area lies within the critical habitat for these species. The ‘ākohekohe persists on less than 7,400 acres of native rainforest above 5,280 feet (Judge et al. 2021), with breeding typically occurring between November and June (Wang et al 2020). Elevational range contraction and risks associated with avian malaria have been well documented for the species (Scott et al. 1986, Berlin and VanGelder 2020, Wang et al. 2020).

The ‘i‘iwi (federally listed as threatened) is a honeycreeper historically widespread and occurring at all elevations, but now persists only in the high-elevation forests primarily of Hawai‘i, Maui, and Kaua‘i (Scott et al. 1986, Fancy and Ralph 2020, USFWS 2016b). Breeding may occur all year but peaks from February through June (Fancy and Ralph 2020). The ‘i‘iwi is a strong flier with high, long flights to locate nectar sources (Guillaumet et al 2017, Fancy and Ralph 2020) and makes seasonal movements in response to patchy availability of flowering ‘ōhi‘a (*Metrosideros polymorpha*), māmane (*Sophora chrysophylla*), and other native plants. As the ‘i‘iwi is highly susceptible to avian malaria (Atkinson et al. 1995), the species' seasonal movement patterns across the landscape negatively affect its long-term population dynamics (Guillaumet et al. 2017). On the island of Hawai‘i the movements into low elevations occur primarily during the post-breeding season (Guillaumet et al. 2017), an important time of year for the proposed action to target reducing southern house mosquito densities, thereby decreasing the risk of malaria infections. The USFWS is in the process of designating critical habitat for ‘i‘iwi.

Most honeycreeper species currently persist only in high-elevation forests where the risk of malaria transmission is lower due in large part to colder temperatures that limit both the reproduction of the malaria parasite and its mosquito vector (van Riper et al. 1986, Scott et al. 1986, Atkinson and LaPointe 2009b, Atkinson et al. 2014). Even though much of the high elevation threatened and endangered bird habitat in the project area is largely protected from feral ungulates

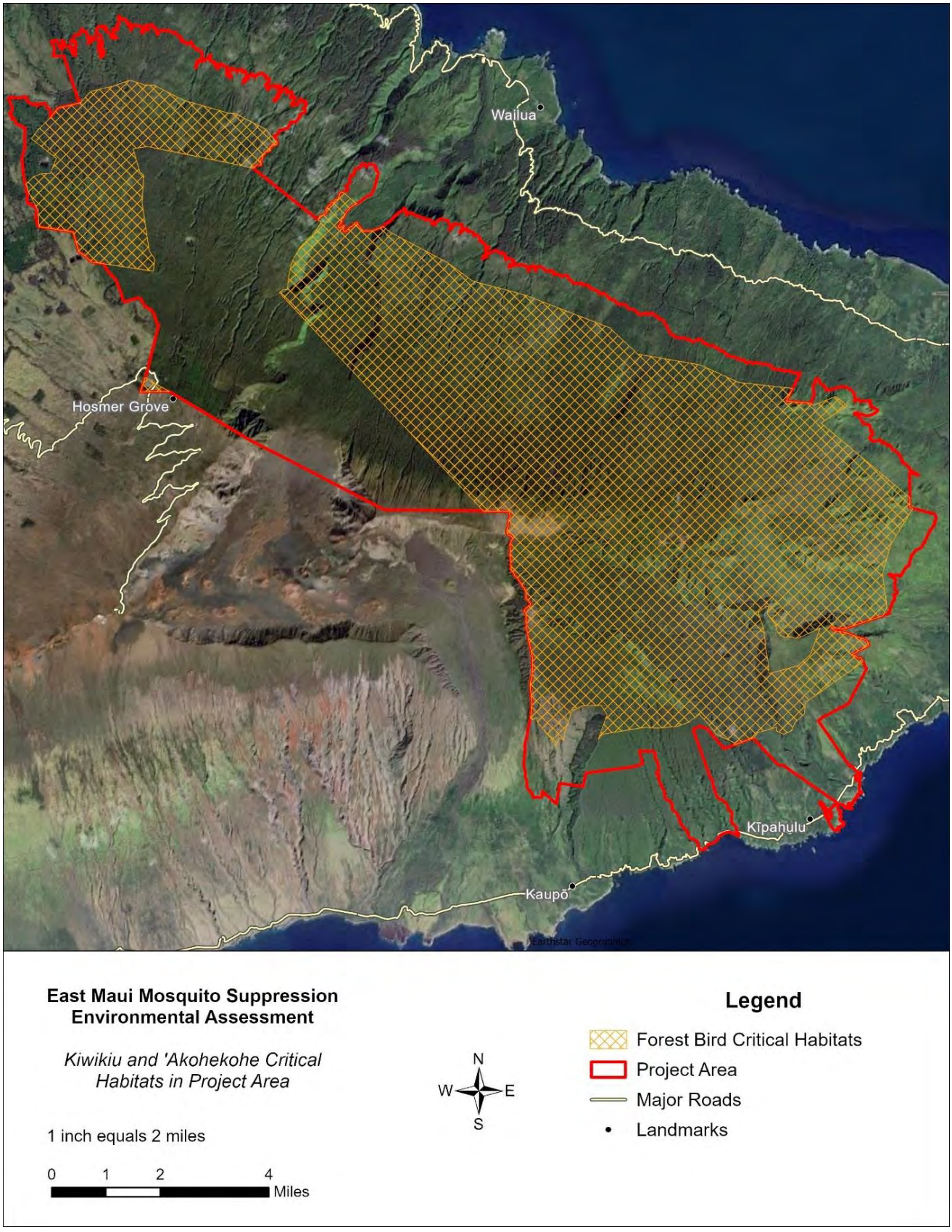

FIGURE 10: DESIGNATED FOREST BIRD CRITICAL HABITAT WITHIN THE PROJECT AREA

and direct human-caused habitat loss, there is evidence of continuing range contraction and population declines, especially from lower-elevation portions of their ranges since 1980 (Baker and Baker 2000, Camp et al. 2009, Vetter et al. 2012, Judge et al. 2021). Precipitous negative population trends have been observed for kiwikiu and ʻākohekohe across their small ranges (Judge et al. 2013, 2017, 2021). Kiwikiu and ʻākohekohe population estimates from surveys in 2017 are 157 individuals (44–312 individuals [95 percent confidence interval]) and 1,768 individuals (1193–2411), respectively (Judge et al. 2021). Kiwikiu and ʻākohekohe abundance has declined by more than 70 percent since 2001 (Judge et al. 2021), and a predicted range loss of more than 90 percent may occur by the end of this century under moderate climate change scenarios (Fortini et al. 2015).

ʻIʻiwi has disappeared from most of its historic range and is extremely susceptible to mortality from avian malaria (Atkinson et al.1995, USFWS 2016b). The species, however, is still common at elevations above 5,250 feet in the project area. Recent surveys in 2017 resulted in a population estimate of 50,252 (43,908–57,146 individual [95 percent confidence interval]) ʻiʻiwi on East Maui (Judge et al. 2019). A long- term trend analysis of the national park's ʻiʻiwi population showed stability in the park's upper Kīpahulu Valley, but with a declining population trend elsewhere in the park (Brink 2020). Surveys revealed an increasing trend of ʻiʻiwi between 2011 and 2017 within the project area outside the park (Judge et al. 2019). The majority of Maui's ʻiʻiwi population occurs within the project area (Judge et al. 2019).

Southern house mosquito and avian malaria parasite lifecycles are influenced by rainfall and temperature. Warming temperatures, increasing storm and drought intensity (Thomas et al. 2004), and fluctuating rainfall patterns (Krushelnycky et al. 2016) associated with climate change are intensifying avian malarial infections at mid-elevations and expanding the transmission of avian malaria to higher-elevation forests (Atkinson et al. 2014, Liao et al. 2015, Fortini et al. 2015). Increases in both mosquito abundance and prevalence of avian malaria indicate that disease transmission has indeed expanded to higher elevations (Atkinson et al. 2014, Glad and Crampton 2015, Warren et al. 2019, Fortini et al. 2020). As a result, the high-elevation forest habitats are no longer a safe refuge from avian malaria transmission, and it is becoming increasingly important to act quickly to suppress mosquito populations before Hawaiian honeycreeper populations decline even further (Atkinson et al. 2014, Liao et al. 2015, 2017). The continued and increasing threat of avian malaria means that under the no-action alternative, it is likely that additional Hawaiian honeycreeper species will go extinct in the next few years. Additional conservation actions to recover endangered bird species such as captive rearing and future reintroductions as well as translocations to Hawaiʻi Island are under consideration, but long-term conservation of these species is contingent on suppression of mosquitoes and malaria (Paxton et al. 2022).

Within the project area, land managers of the NPS, DLNR, and TNC are currently implementing ground and/or aerial treatment operations to manage invasive species and promote native plant species survival. Weed, predator and ungulate control benefit honeycreeper populations and their habitats (Banko et al. 2019) by protecting native habitat and forage plant availability for honeycreeper species. Monitoring of mosquitoes, avian malaria, and forest birds have been conducted and will continue into the future. Other management activities within the project area that could potentially affect wildlife habitat (including designated critical habitat for honeycreeper species) include trail maintenance, maintenance of LZs and campsites, fencing and fence maintenance and fire management. These activities are primarily beneficial because they also enable weed, predator, and ungulate control, yet have the potential to accidentally introduce invasive species or forest pathogens through movement of personnel, gear, and equipment, which can negatively, indirectly affect listed honeycreeper species. The NPS Inventory & Monitoring Vegetation Monitoring project at the park, watershed resource monitoring on state lands, and installation of cell tower infrastructure within TNC-managed lands have the potential to affect honeycreeper habitat (and designated critical habitat) with accidental trampling or introduction of invasive species or forest pathogens that tend to degrade listed honeycreeper habitat. The park, state, and TNC would continue current management actions and respond to future needs and conditions without major changes in the present course.

As discussed in the "Acoustic Environment" section of this document, helicopter use for park administrative activities averaged approximately 200 hours/year (approximately 100 operations), state administrative flights also averaged approximately 200 hours/year within or immediately near the project area, and approximately 60 helicopter operations are conducted per year (estimated 75 flight hours/year) into and out of the TNC's Waikamoi Preserve. The Hughes

500D helicopter (used for most of these administrative operations) has a small rotor diameter, yet rotor wash has some potential risk to disturb nesting birds during takeoff, landing, and while hovering, depending on the proximity, terrain, tilt, wind, and altitude of the helicopter relative to the habitat feature. Honeycreeper disturbance and displacement risk in this case depends on the proximity of trees to the active helicopter and duration of the disturbance. As discussed in the "Acoustic Environment" section of this document, commercial air tours also generally occur seven days a week year-round and have averaged approximately 10-13 air tours per day in recent years (approximately 2 hours per day or 750 hours per year). These flights intersect the project area primarily in its southernmost reaches, including around Kīpahulu Valley, Kaʻāpahu, and Kaupō Gap. Tour operator helicopters and administrative flights for the park, state, and TNC in the project areas averaging more than 1000 hours per year have not reported listed or native migratory bird collisions.

The noise levels and honeycreeper disturbance risks within the project area associated with ongoing administrative activities, helicopter flights, and air tours would likely continue at current levels. Helicopters, mechanized equipment, and work crews would generate noise during overflights/landings/takeoffs, fencing activities, and maintenance of trails and LZs. There are no anticipated changes to public access within the project area, so ongoing impacts to honeycreepers from visitors would remain unchanged in the foreseeable future. Overall, current and reasonably foreseeable actions would continue to result in minimal adverse direct and indirect impacts to honeycreeper species and their habitat. The effects of these activities are included in the affected environment and the no-action alternative would therefore not result in any new direct or indirect impacts to listed honeycreeper species or designated critical habitat. As there would be no new direct and indirect impacts resulting from the no-action alternative, there would be no cumulative effects associated with this alternative. If no action is taken, however, avian malaria would continue to devastate native Hawaiian honeycreeper populations, resulting in significant adverse impacts.

Nēnē

The federally threatened nēnē, or Hawaiian Goose (*Branta sandvicensis*), was extirpated from all islands except Hawaiʻi by the early 1900s and was reestablished on the island of Maui through a captive-breeding and release program (Banko et al. 2020). The nēnē, the official state bird that is state listed as endangered, typically nests in the national park between October and April (*personal communication, J. Tamayose, April 6, 2021*). The species uses diverse habitats including sub-alpine grasslands, open native shrubland and grasslands, as well as mid- and low-elevation pasture and managed grasslands, to forage on leaves of grass, berries, seeds, and flowers. Some individuals or pairs make elevational movements for breeding, foraging, and molting (USFWS 2019, Banko et al. 2020, Leopold and Hess). Nēnē require intensive species management to protect breeding (ground-nesting) birds from introduced predators on Maui, especially the mongoose (*Herpestes javanicus*). Nēnē on Maui are also susceptible to vehicle collisions, wind turbine collisions and human or vehicle-related injuries and trauma, toxoplasmosis (a pathogen carried by feral cats), and mosquito-borne avian pox virus (Work et al. 2015).

The Maui nēnē population is relatively small, fluctuating around approximately 250 breeding pairs (USFWS 2019), is supplemented with captive-bred and translocated birds, and is reliant on breeding pens that exclude predators and predator control at breeding sites on NPS, state, and privately managed lands. In 2020 and 2021, respectively, there were 223 and 164 nēnē individuals outside the park, and 254 and 190 in the park. Breeding failures occur often during drought conditions (Black et al. 1997), and increasing drought or other extremes in climate variability, expanding invasives species, and associated climate change scenarios are likely to negatively affect nēnē. Climate change may disrupt seasonal movements and some habitats used by nēnē for molting, breeding, and foraging.

Ongoing and planned actions that could affect the nēnē population are nearly the same as those actions described in the "Hawaiian Honeycreepers" section of this chapter. Forest-based activities, however, do not necessarily impact nēnē since suitable habitat does not exist for them in forested areas. The park, state, and TNC would continue current management actions and respond to future needs and conditions without major changes in the present course. These activities are primarily beneficial because they also enable weed, predator, and ungulate control, yet have the potential to accidentally introduce invasive species or pathogens through movement of personnel, gear, and equipment, which can negatively, indirectly affect listed wildlife. The noise levels and nēnē disturbance risks within the project area associated with ongoing administrative activities, administrative helicopter flights, and air tours (see description of these impacts in the "Hawaiian Honeycreepers" section above) would likely continue at current levels. Helicopters,

mechanized equipment, and work crews would generate noise during overflights/landings/takeoffs, fencing activities, and maintenance of trails and LZs. There are no anticipated changes to public access within the project area, so ongoing impacts to nēnē from visitors would remain unchanged in the foreseeable future. Overall, current and reasonably foreseeable actions would continue to result in minimal adverse direct and indirect impacts to nēnē and their habitat. The effects of these activities are included in the affected environment and the no-action alternative would therefore not result in any new direct or indirect impacts to nēnē, there would be no new direct and indirect impacts as a result of the no-action alternative, and no cumulative effects associated with the no-action alternative. With current climate variability and projected climate change trends, however, exposure to and transmission of avian pox would also be expected to increase under the no-action alternative. Under the no-action alternative the nēnē population is therefore expected to remain stable or continue to decline as a result of climate change impacts to the species' habitat.

Seabirds

Many tubenosed seabirds (albatrosses, petrels, shearwaters, and storm-petrels; order Procellariiformes) live at sea and return to the Hawaiian Islands to pair-bond and breed between February and November, laying a single egg cared for by both parents. These species fly into and out of their nests at night. During their breeding season, listed seabirds commute between the ocean for foraging and their cryptic underground burrows to feed their young (Ainley et al. 2019, Slotterback 2020). Feral cats, other invasive predators, and light pollution are the primary threats to Hawai‘i's nocturnal ground-nesting seabirds (Raine et al. 2020).

The largest breeding colony of the endangered seabird ‘ua‘u or Hawaiian Petrel (*Pterodroma sandwichensis*), is within the park near the summit of Haleakalā, mostly outside the project area. Two other listed seabird species, the ‘ake‘ake (Band-rumped Storm-Petrel, *Oceanodroma castro*), and ‘a‘o (Newell‘s Shearwater, *Puffinus newelli*) are known to occur in or transit through the project area, but their nesting distributions and abundance are not known (Aruch 2006, Krushelnycky et al. 2019).

The breeding colony of ‘ua‘u in and around the Summit District of the park has been monitored since the 1960s and mammalian predator populations have been managed/reduced since 1982 (Krushelnycky et al. 2019). Most nests are known to occur in the higher and drier habitats outside the project area; however, ‘ua‘u fly through the project area and breeding pairs are known to occur within the crater at the edge of the project area and other nearby areas with suitable habitat (Krushelnycky et al. 2019). The ‘ua‘u population in the park is estimated at 3,000–4,000 breeding pairs and a total of 8,000–9,000 individual birds. The most recent count of known burrows within the park is 2,784 (*personal communication, J. Tamayose, April 6, 2021*); the ‘ua‘u population in the park has grown since the 1980s due to invasive predator control (Hodges and Nagata 2001).

Climate change affects seabirds' breeding success with increasing variability in the distribution and availability of at-sea prey, which is being affected by rising ocean temperatures. Little, however, is known about the potential effects of climate driven changes on the availability of prey for ‘ua‘u. Range expansions of invasive species are also associated with climate change scenarios, which can degrade the breeding habitat of the ‘ua‘u. (Ainley et al. 2019). Invasive Hymenoptera, for example, have caused seabird nest failures and burrow abandonment (Plentovich et al. 2008, Raine and McFarland 2015).

Ongoing and planned actions that could affect seabirds are nearly the same as those actions described in the "Hawaiian Honeycreepers" section of this chapter. Forest-based activities, however, do not necessarily apply to seabirds on Maui since the vast majority of known nesting sites on the island are in subalpine habitat. The park, state, and TNC would continue current management actions and respond to future needs and conditions without major changes in the present course. The noise levels and seabird disturbance risks within the project area associated with ongoing administrative activities, administrative helicopter flights, and air tours (see description of these impacts in the "Hawaiian Honeycreepers" section above) would likely continue at current levels. Helicopters, mechanized equipment, and work crews would generate noise during overflights/landings/takeoffs, fencing activities, and maintenance of trails and LZs. There are no anticipated changes to public access within the project area and ongoing impacts to seabirds from visitors would remain unchanged in the foreseeable future. Overall, current and reasonably foreseeable actions would continue to result in minimal adverse direct impacts to seabirds and their habitats. The effects of these activities are included in the affected environment and the no-action alternative would therefore not result in any new direct or indirect impacts

to seabirds. As there would be no new direct and indirect impacts as a result of the no-action alternative, there would be no cumulative effects associated with the no-action alternative.

ʻŌpeʻapeʻa, Hawaiian Hoary Bat

The ʻōpeʻapeʻa, or Hawaiian Hoary Bat, is the only fully terrestrial native mammal in the Hawaiian Islands and is state and federally listed as endangered. ʻŌpeʻapeʻa are found from sea level to 11,800 feet, with most observations occurring in native rain forests up to at least 6,000 feet (Bonaccorso et al. 2015). Data indicate that ʻōpeʻapeʻa commonly traverse and forage in large parts of the project area and likely roost there. A summary of detections reported from within the national park, or the vicinity of the project area are documented in Krushelnycky et al. (2019), and include Pīpīwai Trail, Hosmer Grove, and numerous locations bordering the park (Krushelnycky et al. 2019, and Todd 2016).

Females typically give birth to twin pups from June to August and juveniles reach independence by November. ʻŌpeʻapeʻa are known to roost alone in tree foliage in a variety of tree species and in an assortment of habitats and elevations (native and non-native habitats). Roost trees are usually larger than randomly selected trees (Montoya-Aiona 2020). ʻŌpeʻapeʻa are vulnerable to roost disturbance while resting during the day and during pupping and pup care (June-November).

ʻŌpeʻapeʻa are insectivores, and prey items include a variety of night-flying insects, primarily moths and beetles (Whitaker and Tomich 1983, Pinzari et al. 2019). Acoustic detection studies show seasonal patterns of habitat occupancy with increased activity in the higher elevations (higher than 3,300 feet) during the non-breeding season (November to April), and increased activity in the low elevations during the breeding season (Bonaccorso et al. 2015).

Due to its solitary and cryptic roosting behavior (Bonaccorso et al. 2015), robust estimates of the population size and trends of the ʻōpeʻapeʻa are currently unavailable. ʻŌpeʻapeʻa can be injured and killed from collisions with man-made structures including barbed wire fences, wind turbines, and communication towers; limiting factors, however, are poorly understood.

Ongoing and planned actions that could affect ʻōpeʻapeʻa are nearly the same as those actions described in the "Hawaiian Honeycreepers" section of this chapter. The park, state, and TNC would continue current management actions and respond to future needs and conditions without major changes in the present course. The noise levels and ʻōpeʻapeʻa disturbance risks within the project area associated with ongoing administrative activities, administrative helicopter flights, and air tours (see description of these impacts in the "Hawaiian Honeycreepers" section above) would likely continue at current levels. Helicopters, mechanized equipment, and work crews would generate noise during overflights/landings/takeoffs, fencing activities, and maintenance of trails and LZs potentially impacting roosting ʻōpeʻapeʻa. Management actions are unlikely to affect foraging bats because bats are nocturnal and management activities would occur during the day. There are no anticipated changes to public access within the project area and ongoing impacts to ʻōpeʻapeʻa from visitors would therefore remain unchanged in the foreseeable future. Overall, current and reasonably foreseeable actions would continue to result in minimal adverse direct impacts to ʻōpeʻapeʻa and their habitat. Tthe effects of these activities are included in the affected environment and the no-action alternative would therefore not result in any new direct or indirect impacts to ʻōpeʻapeʻa. As there would be no new direct and indirect impacts as a result of the no-action alternative, there would be no cumulative effects associated with the no-action alternative.

Wildlife Species Of Concern

Wildlife species of concern (NPS 2017), also designated as State Protected Wildlife Species (Section 13-124-3, HAR), within the project area include at least 30 protected wildlife species of concern; 13 insect species, 3 snail species, 1 shrimp species, 5 fish species, and 8 native bird species protected under the Migratory Bird Treaty Act (MBTA). Some species may be considered vulnerable to population declines or extinction by state or global metrics (e.g., Nature Serve Global Conservation Rank), or are lacking information to make a status determination. Only a few of these species could potentially be impacted by the proposed action and are generally described below. Wildlife species of concern are found on or transiting park land, state land, and TNC-managed lands within the analysis area.

Birds

Three Hawaiian honeycreeper species (in addition to the three federally protected species described earlier) found within the project area are protected under the MBTA and HAR section 13-124-3: ʻapapane (*Himatione sanguinea*), Hawaiʻi ʻamakihi (*Chlorodrepanis virens wilsoni*), and Maui ʻalauahio (*Paroreomyza montana*). Although ʻapapane and Hawaiʻi ʻamakihi are most common in native forests above 3,000 feet in elevation, they are also found in lower elevation forests. The Maui ʻalauahio occurs only on Maui in forests between 3,900 to 7,500 feet (Baker and Baker 2020, Judge et al. 2021). ʻApapane, Hawaiʻi ʻamakihi, and Maui ʻalauahio are susceptible to avian malaria, avian pox, and extreme weather associated with climate change, as well as the ecosystem threats common to native forest across Hawaiʻi (Pratt 2009, Atkinson and Samuel 2010, Harvey-Samuel et al. 2021). ʻApapane annual mortality during seasonal avian malaria outbreaks was estimated at 50 percent of juveniles and 25 percent of adults (Atkinson and Samuel 2010). Likewise, Hawaiʻi ʻamakihi exposed to a single infective mosquito bite experienced 65 percent mortality (Atkinson et al 2000). There is strong evidence that the Maui ʻalauahio population is dramatically declining (Brink 2020, Judge et al. 2021), and the species is known to be extremely susceptible to avian malaria (Atkinson et al. 2001). Recent estimates indicate a 48 percent decline in population abundance for the species within the analysis area (Judge et al. 2021).

The pueo or Hawaiian Short-eared Owl (*Asio flammeus sandwichensis*) is listed as endangered by the State of Hawaiʻi only on the island of Oʻahu. This species is not federally listed but is protected under the MBTA and HAR section 13-124-3. Pueo are found on all the main Hawaiian Islands, at elevations ranging from sea level to 8,000 feet. Pueo occupy a variety of habitats, including agricultural lands, grasslands, wetlands, shrublands, and native forests. Ground nests are well concealed and lined with grasses and feather down (Price and Cotín 2018). Threats to this species include loss and degradation of habitat, predation by invasive mammals, vehicle and wind turbine collisions, and other human interaction (Pueo Project 2019). Pueo potentially forage and nest within and around the project area, yet their abundance and distribution has not been well studied on Maui.

Migrant or transiting birds that may occur in the project area include the kōlea or Pacific Golden-Plover (*Pluvialis fulva*), an overwintering migrant shorebird that occasionally may rest and forage within the project area; the noio or Hawaiian Black Noddy (*Anous minutus melanogenys*), which nests on the coasts; and ʻiwa or the Great Frigatebird (*Fregata minor palmerstoni*) and koaʻe kea or White-tailed Tropicbirds (*Phaethon lepturus*), both of which fly over the project area. All are protected under the MBTA and HAR section 13-124-3.

Changes in environmental conditions in the project area expected as a result of global climate change include increasing temperatures, decreasing precipitation, increasing storm intensities, and increasing variability in weather patterns (Thomas et al. 2004, Frazier and Giambelluca 2017). Existing trends of declining populations of species of concern are expected to continue.

Ongoing and planned actions that could affect wildlife species of concern are nearly the same as those actions described in the “Hawaiian Honeycreepers” section of this chapter. These ongoing and planned actions could result in minimal adverse indirect or direct impacts to most species of concern. Without action to suppress mosquitoes and reduce avian malaria transmission, native forest birds of concern would be subject to continuing exposure to southern house mosquitoes and resultant mortality from avian malaria. With current climate variability and projected climate change trends, exposure to and transmission of avian malaria and avian pox would also be expected to increase under the no-action alternative for wildlife species of concern. The no-action alternative, therefore,is expected to adversely affect native Hawaiian forest birds and possibly other native birds of concern that are vulnerable to mosquito borne diseases.

The park, state, and TNC would continue current management actions and respond to future needs and conditions without major changes in the present course. The noise levels and disturbance risk to wildlife species of concern within the project area associated with ongoing administrative activities, administrative helicopter flights, and air tours (see description of these impacts in the “Hawaiian Honeycreepers” section above) would likely continue at current levels. Helicopters, mechanized equipment, and work crews would generate noise during overflights/landings/takeoffs, fencing activities, and maintenance of trails and LZs. There are no anticipated changes to public access within the project area and ongoing impacts to wildlife species of concern from visitors would remain unchanged in the

foreseeable future. Overall, current and reasonably foreseeable actions would continue to result in minimal adverse direct impacts to wildlife and their habitats. The effects of these activities are included in the affected environment and the no-action alternative would therefore not result in any new direct or indirect impacts to wildlife species of concern. As there would be no new direct and indirect impacts as a result of the no-action alternative, there would be no cumulative effects associated with the no-action alternative. As stated earlier, however, if no action is taken, avian malaria would continue to devastate native forest bird populations resulting in permanent, long-term adverse impacts.

Effects of the Proposed Action on Threatened and Endangered Wildlife Species and Species of Concern

Methods and Assumptions

Impacts to federally listed wildlife species, designated critical habitat, and state-protected wildlife species of concern and their habitats occurring or possibly occurring in the analysis area were analyzed using expert opinions from park, state, USFWS, and contractor staff. Information from published scientific literature, technical reports, monitoring, observations, and databases managed by the NPS and NatureServe were also taken into consideration and used for this analysis. General assumptions for impacts on federally listed wildlife species, designated critical habitat, and wildlife species of concern are described below.

The area of analysis for impacts of alternatives on federally listed wildlife species, designated critical habitat, and wildlife species of concern is the proposed project area including 64,666 acres of park, state, TNC-managed lands, and private conservation lands where mosquito control releases would occur.

The following analysis includes a description of direct impacts primarily associated with drone and helicopter flights, motorized equipment, vehicles, and pedestrian teams during the proposed project's implementation, and risks of indirect negative impacts associated with biosecurity lapses (accidental harmful invasive species introductions into the project area) on 44 possible species, 12 of which are federally listed as threatened or endangered. Six listed species known to occur in the analysis area are emphasized: five bird species, and one mammal. Approximately 32 wildlife species of concern potentially occur in the analysis area but only eight native and migratory bird species protected under the MBTA that occur or transit NPS, state, and TNC/private lands could possibly be impacted by the proposed action.

For a description of the USFWS terminology to assess impacts on federally listed species, refer to the "Threatened and Endangered Species Section 7 Determinations" subsection of the "Threatened and Endangered Plant Species and State Plant Species at Risk" section of this EA.

Potential Impacts and Relevant Studies

Aircraft Impacts on Wildlife

Aircraft disturbance (e.g., from noise or visual detection) can be defined as any aircraft activity that changes the behavior or physiology of wildlife. Impacts of various aircraft on birds have been found to include increased heart rate, changes in energy conversion, feeding times, alert behaviors, agitated behaviors, and protective or escape behaviors (Drewitt 1999). The response of wildlife to aircraft may depend on both the properties (aircraft size and engine) and flight pattern of the aircraft, and the attributes and context of the wildlife (species, life-history stage and aggregation or flock size). Owing to their low-altitude capabilities, helicopters have been widely viewed as the most disturbing type of aircraft for birds (Drewitt 1999). Although birds may not be always affected by helicopters more than other types of disturbance, chronic noise disturbance may change vocalization behaviors. Distance, speed, trajectory, frequency and previous exposure/habituation to aircraft, species, breeding status and colony or flock size have also been described as key factors influencing birds' response or disturbance to normal behaviors from various aircraft (Burger 1981; Hoang 2013, van der Kolk et al. 2020).

Noise Impacts on Wildlife

Sound levels can vary greatly, depending on location, topography, vegetation, biological activity, weather conditions, and other factors. The magnitude of sound levels is usually described by its sound pressure; the dBA scale is commonly used to describe sound levels. For a detailed discussion on noise impacts see "Acoustic Environment" section of this document. The potential exists for human-caused sounds to adversely impact wildlife under any of the release methods described in Chapter 2 because many animals rely on auditory cues for predator avoidance, mate attraction, obtaining nesting territories, and finding prey (Dufour 1980). Sound levels greater than 60 dBA may approach disturbance levels in some sensitive birds with the duration and frequency of the of the noise and vibrational movement interacting. Wildlife reactions to human-caused sounds can range from no reaction to mild reactions, such as a temporary increase in heart rate, to more severe reactions, such as damaging effects on metabolism and hormone balance (Kleist et al. 2018, Gallardo Cruz et al. 2021, Francis et al. 2011). Behavioral and physiological responses could potentially cause injury, energy loss and decreased food intake (resulting from continual movement away from a noise source or reduced foraging), impeded communication, habitat avoidance and abandonment, and reproductive losses (NPS 1994, Halfwerk et al. 2011, Shannon et al. 2015, Gallardo Cruz et al. 2021). Some wildlife, however, becomes accustomed to air traffic and other human caused noises if it occurs regularly (Kempf and Hüppop 1998) and the extent to which birds may be disturbed by aircraft may depend in part on their ability to habituate to them. Birds may learn that a stimulus does not pose a danger after repeated exposure and, as a result, may not display any substantial signs of behavior change. The ability to habituate may be a function of the species of bird as well as the frequency of aircraft overflights and the amplitude of the noise (Hoang 2013, Gallardo Cruz et al. 2021).

Hawaiian forest birds at Hawai‘i Volcanoes National Park exposed to frequent helicopter overflights (4 passes per hour) at noise levels above 75 dBA showed a decrease in vocalizing behavior, which may limit communication between birds and therefore possibly affect breeding success (Gallardo Cruz et al. 2021). Aircraft operating at higher altitudes (e.g., over 328 feet AGL) where noise is attenuated and aircraft emit less than 75 dBA may be of less disturbance (Mulero-Pázmány 2017, Gallardo Cruz et al. 2021).

Aircraft Wildlife Collisions

Helicopters present the potential for bird collision (Lyons et al. 2018), but under the proposed action, helicopter use would be short-term with drones being the primary mosquito release vehicle. The FAA database on aircraft bird collision (https://wildlife.faa.gov/search) reports that the most common native species aircraft bird strikes on Maui primarily occur with larger commercial aircraft at the OGG airport, involving the seasonal migrant kōlea and resident pueo. Other species potentially using the project area involved in aircraft collisions across Hawai‘i included koa‘e kea and nēnē (FAA 1990 wildlife strike database 1990 accessed July 5, 2022). Although it is possible that a drone could inadvertently fly into a flock of birds, there have not yet been any reported instances of accidental drone-bird strikes or midair collisions. Seasonally flocking birds include the migratory kōlea in late April-early May, and nēnē, which may form small flocks in June-August; both species may occur in open grassy fields outside of the core area but within or near portions of the project area. Tour operator helicopters and administrative flights for the park, state, and TNC in the project areas averaging more than 1000 hours per year have not reported listed or native migratory bird collisions.

Rotor Wash Impacts

Helicopters flying at low altitudes can create a vertical down wash of air (rotor wash) that can cause a ground surface wind. Helicopter rotor wash is influenced by the mass of the helicopter and the diameter of the helicopter rotor, height above the ground, and various terrain or environmental conditions. As mentioned earlier, the Hughes 500D helicopter (the likely aircraft proposed for release operations) has a small rotor diameter. Associated rotor wash, however, has some potential risk to disturb wildlife using the tree canopy (birds and possibly roosting bats) during takeoff, landing, and while hovering, depending on the proximity, terrain, tilt, wind, and altitude of the helicopter relative to the habitat. Wildlife disturbance and displacement risk in this case is dependent on proximity of trees and the duration of the disturbance.

Drone–Wildlife Interactions

Data are accumulating on the behavior of some wildlife species around drones used for natural resource applications in natural areas. The behavioral responses of birds are variable by species, season, and habitat. Typically, the effect of drones on Hawai‘i’s federally listed wildlife species, designated critical habitat, and wildlife species of concern is anecdotal, observational, or non-existent. Potential adverse impacts from drones are influenced by the engine type and size of the drone, as well as the flight pattern (Mulero-Pázmány et al. 2017). Target-oriented flight patterns (such as those used for wildlife photography), larger drone sizes, and fuel-powered (noisier) engines evoked stronger reactions in wildlife whereas electric-powered drones and “lawn-mower” pattern flights performed at higher altitudes and following regular trajectories were found less likely to affect wildlife (Mulero-Pázmány et al. 2017). This agrees with observations of wildlife responses to traditional aircraft indicating that directness of aircraft approach influences wildlife responses and could be related to anti-predator behavior, since animals perceive higher risks when the threat is on a trajectory towards them (Mulero-Pázmány et al. 2017). Flushing of waterfowl flocks and aggression by territorial birds of prey (usually hawks and eagles) have been described in other ecosystems (Lyons et al. 2018).

Analysis

Under the proposed action, impacts to federally listed wildlife and wildlife species of concern could be generated by drone–wildlife interaction, aircraft disturbance, rotor wash and collisions, accidental invasive species dispersal, pedestrian teams, motorized vehicles, and noise from helicopters, drones, and generators. The frequency and duration of these impacts would be dependent on the release method employed.

Drone Release

Under the proposed action, drones would systematically release incompatible mosquitoes at each location to achieve complete coverage of the core area. Drones would fly approximately 50–100 feet above the tree canopy during mosquito releases but no higher than 500 feet AGL when ferrying between release locations and the operator, as described in Chapter 2. The proposed action would require an estimated 49–72 hours of drone flight-time per week to achieve the desired incompatible mosquito release rate for mosquito suppression. Depending on the drone model in use, noise levels experienced by wildlife where the drone is flying at 100 feet AGL could range from 47 to 65 dBA and from 41 to 59 dBA at 200 feet AGL (**Table 10**). Drones are considerably less noisy than helicopters and would likely present fewer indirect impacts to federally listed species and wildlife species of concern.

Hawaiian forest birds have not demonstrated a change in vocalization rates with aircraft noise levels lower than 75 dBA, suggesting the adverse effects of noise increase with intensity (Gallardo Cruz et al. 2021). Gallardo Cruz et al. (2021) found thatHawaiian forest birds changed their vocalization behavior with four helicopter overflights per hour, illustrating that frequency of disturbance is also a key factor influencing adverse effects to forest birds. Less frequent passes as proposed for this project are expected to have less adverse effects to Hawaiian honeycreepers in the project area, especially with a drone that would produce far less intense noise than a helicopter. Drone flight paths would vary substantially depending on the release locations being treated, and drones would likely pass over a specific location only twice per week. Although drone flight speeds during transiting may reach 62 mph, the estimated speeds during incompatible mosquito releases are slower (less than 25 mph), thus reducing potential wildlife collision risks. As drones would move swiftly through the project area above the tree canopy during incompatible mosquito releases, wildlife responses to drones in the project area are expected to be minimal and short term (15 seconds to a few minutes). Given this information and the expected minimal and short-term exposure to noise, disturbance under this release method would be infrequent and of short duration to individual federally listed forest bird species and forest bird species of concern.

Studies of bird behavior in other regions during drone monitoring suggest that breeding raptors initiated aggressive interactions with drones (Lyons et al. 2018). The only native bird of prey in the project area is the pueo, which is most active around sunrise and sunset, nests primarily in grasslands, and is not expected to interact with drones flying above the forest canopy (Pueo Project 2019). Drone–pueo interactions have not been documented and mosquito suppression operations would only occur after sunrise and before sunset, reducing the opportunity for drone–pueo interactions. The risk of birds accidentally colliding with drones is considered low when compared to other aircraft. From studies

conducted in other ecosystems, large flocks of migrating birds or waterbirds are expected to have a higher risk of aircraft collision (Mulero-Pázmány 2017). Endangered waterbirds do not generally flock to or use the project area, but they occur nearby. The one exception is nēnē, which tend to form small flocks seasonally in open grassy areas in portions of the project area or proximity thereof during the summer. Migratory kōlea (a species of concern) also form flocks in seasonally in fields and open areas. There maybe a low risk of collision with drones for these species, primarily because of the tendency of flocking birds to take flight together. Listed ʻōpeʻapeʻa and burrow-nesting seabirds are active at night, but drone releases would only occur during the day. To direct interactions or impacts to flying bats or birds would therefore occur. Day roosting and breeding ōpeʻapeʻa are unlikely to be disturbed by drones flying more than 50 feet above the canopy for 15 seconds to a few minutes.

Overall, with implementation of mitigation measures (i.e., daytime releases, higher flight altitudes, etc.) and with the exceptions of potential minimal impacts listed above (the low risk of collision with nēnē and unlikely risk of disturbance to native forest birds), listed wildlife and wildlife species of concern are unlikely to be adversely affected by drone activity (see **Table 14**). Over the long term, drone releases would benefit all six remaining Hawaiian honeycreeper species on Maui in the project area by contributing to the successful suppression of mosquito populations and the associated transmission of avian malaria.

Helicopter Longline Release

Under the proposed action, helicopters would be used as a short-term (up to two months), temporary release method, if needed, and flown approximately 150–200 feet AGL to release incompatible mosquitoes via a 50–100-foot longline. Short-term, temporary helicopter longline releases (up to 6 hours of flight time per day, 5–7 days per month for up to two months per year) could produce a maximum of 82 dBA at 150 feet AGL for less than 15 seconds at any given release location in the core area. This altitude would reduce rotor wash experienced in the tree canopy and on the ground (see Chapter 2).

Under this release method, the potential exists for limited indirect noise-related impacts to Hawaiian honeycreeper species during helicopter longline releases. Helicopter noise-related impacts could include interference with avian communication and breeding success (Halfwerk et al. 2011). Other species of nesting birds in other ecosystems have been observed flushing from nests in response to noise (Meillere et al. 2015). However, most incompatible mosquito releases in higher elevation habitat would be less frequent (outside of the core nesting areas of endangered kiwikiu and ʻākohekohe), occurring only as a short-term temporary release method on an as needed basis.

There is a low risk of bird collisions during helicopter longline operations. The native species most commonly affected by aircraft collisions are kōlea, koaʻe kea, and nēnē (FAA 1990); collisions with pueo, ʻiwa, and ʻuaʻu are possible but would be very rare. There is also a low risk of potential disturbance to roosting ʻōpeʻapeʻa or pueo, particularly if there are roosts near flight paths. Except for breeding females roosting with their pups, these bats roost alone in trees and roost locations and roost abundances are not known within the project area.

Overall, the disturbance exposure to federally listed wildlife species and wildlife species of concern (birds and bats) from helicopters in the project area would be short term and of limited duration, as release locations would shift with each helicopter flight, and the helicopter is estimated to spend less than 15 seconds over each release location during each flight. Any potential minimal impacts described in this section (i.e., a low risk of kōlea, koaʻe kea, pueo, ʻiwa, ʻuaʻu, and nēnē collision, low risk of pueo disturbance and/or collision, low risk of Hawaiian honey creeper disturbance, and low risk of roosting ʻōpeʻapeʻa disturbance) would be substantially limited by the infrequency and temporary nature of helicopter longline release. Over the long term, helicopter longline releases would benefit all six remaining Hawaiian honeycreeper species on Maui in the project area by contributing to the successful suppression of mosquito populations and the associated transmission of avian malaria.

Pedestrian Release

Consistent pedestrian release is possible over a very limited portion (less than 10%) of the project area. Potential impacts from pedestrian releases conducted concurrently with monitoring at helicopter-only accessible backcountry sites is discussed under “Mosquito Monitoring” on the following page. Vehicles would be used for pedestrian access

TABLE 14: THREATENED AND ENDANGERED WILDLIFE SPECIES AND WILDLIFE SPECIES OF CONCERN (SOC) WITH POTENTIAL RISK FOR ADVERSE IMPACTS AND SUGGESTED MITIGATION.

Scientific Name	Common Name	Status	Potential Impact (Direct or Indirect)	Mitigation Measures
Lasiurus cinereus semotus	ʻŌpeʻapeʻa, Hawaiian Hoary Bat	ESA Federally Endangered	Direct: Very low risk of aircraft collision as this is a nocturnal species and drones and helicopters would only be used during daylight hours. Indirect: Small risk of pup and day roost disturbance with helicopter rotor wash and LZ use. Most LZs are in open areas away from potential roost trees. Low risk of drone disturbance at day roosts. Helicopter noise may result in infrequent mild reactions such as a temporary increase in heart rate or brief flight.	Standard helicopter and mechanized equipment BMPs would be implemented. Drones flying 50-500 feet above canopy.
Asio flammeus sandwichensis	Pueo, Hawaiian Short-eared Owl	SOC; Migratory Bird Treaty Act	Direct: Low risk of aircraft or vehicle collision. Low risk of drone interaction. Helicopter noise may result in infrequent mild reactions such as a temporary increase in heart rate or brief flight.	Standard flight and vehicular operation BMPs would be implemented.
Family Fringillidae, Subfamily Carduelinae,	Hawaiian honeycreepers	ESA Federally Threatened and Endangered Species, SOC/Migratory Bird Treaty Act	Reduction in avian malaria and avian pox transmission would be a substantial beneficial impact. Low risk of disturbance by drones; Helicopter noise may result in infrequent mild reactions such as a temporary increase in heart rate or brief flight.	Standard flight operation BMPs would be implemented
Branta sandvicensis	Nēnē, Hawaiian Goose	ESA Federally Threatened	Reduction in avian pox infections would be a beneficial impact. Direct: Low risk of helicopter, drone and vehicle disturbance or interaction-collisions Indirect: Low risk of flock or brood disturbance Helicopter noise may result in infrequent mild reactions such as a temporary increase in heart rate or brief flight.	Standard flight and vehicular operation BMPs would be implemented.
Frigata minor palmerstoni	ʻIwa, Great Frigatebird	SOC; Migratory Bird Treaty Act	Direct: Low risk of aircraft collision; infrequent transit through project area	Standard flight and vehicular operation BMPs would be implemented.
Phaethon lepturus	Koaʻe kea, White-tailed Tropicbird	MBTA, SOC	Direct: Low risk of aircraft collision infrequently transits across project area.	Standard flight operation BMPs would be implemented
Pluvialis fulva	Kōlea, Pacific Golden-Plover	SOC	Direct: Low risk of aircraft collision, low risk of drone disturbance	Standard flight operation BMPs would be implemented.
Pterodroma sandwichensis	ʻUaʻu, Hawaiian Petrel	ESA Federally Endangered	Direct: Very Low risk of aircraft collision. Nocturnal in project area. Aerial operations under the proposed action would only occur during daylight hours.	Standard flight and vehicular operation BMPs would be implemented.

(*) indicates species is not known to occur in the project area

(to reach trailheads) in portions of the project area with roads and readily accessible trails in Makawao Forest Reserve and Waikamoi Preserve (less than 2 percent of the project area) and noise from these vehicles may briefly induce a "flight" response in wildlife nearby. There is biosecurity risk associated with trail maintenance, trail use, and four-wheel drive vehicles delivering pedestrians and gear (e.g., invasive seeds, insects, fungal pathogens, and animals contaminating gear). There is also a very low risk of vehicle collision with nēnē and pueo (bird species susceptible to vehicle collisions) as driving would be limited to short distances and slow speeds in one small section of the project area (see **Figure 5**).

The potential direct and indirect adverse effects of pedestrian release on federally listed wildlife species, designated critical habitat, and wildlife species of concern that may result from the use of trails/fence lines and vehicles are detailed in Error! Reference source not found.. Field operations under this method may result in a minimal risk of a dverse impacts to some federally listed wildlife species and species of concern (primarily Hawaiian honeycreeper species and ʻōpeʻapeʻa) and their habitats from the human activity and noise in fragile habitats. Established roads and trails would be used, however, and species in the areas where pedestrian release could occur are likely accustomed to at least low levels of human presence and noise because the trails proposed for use are well-established and/or traveled by the public. Indirect impacts are possible if a biosecurity lapse introduces harmful invasive species or pathogens. For example, introduction of forest pathogens such as *Ceratocystis huliohia* and *C. lukuohia* (causes of Rapid ʻŌhiʻa Death) could result in adverse effects. Strict oversight and mitigation measures would be applied for effective biosecurity protocol implementation including appropriate cleaning, storage, and inspections of field equipment to reduce these risks and prevent adverse impacts.

Overall, the pedestrian release method is likely to have minimal impacts on wildlife and their habitats due to the limited area for pedestrian release activities and the mitigation measures that will be implemented. Pedestrian releases would benefit all six remaining Hawaiian honeycreeper species in the project area on Maui by contributing to the successful suppression of mosquito populations and the associated transmission of avian malaria.

Mosquito Monitoring

Motorized vehicles (SUVs or trucks) would assist in the transportation of field teams and gear to reach three ground-accessible monitoring sites in Makawao Forest Reserve and TNC's Waikamoi Preserve. Noise from vehicles used during monitoring would primarily occur along the Flume Road shown in brown on **Figure 5** and is not expected to exceed 4 hours per day for up to 7 days on a quarterly basis. It should be noted that vehicles would not be running constantly during that 4-hour time period because crews would stop periodically to check mosquito traps. As previously mentioned, ground vehicles can reach 75 dBA at 50 feet from the source but would be muffled by the surrounding canopy and would not be expected to exceed 60 dBA at 50 feet from the source of noise. Noise from vehicles may briefly induce a "flight" response in nearby wildlife as vehicles pass through.

To conduct monitoring at the five helicopter-only accessible monitoring camps and LZs, helicopters would transport teams to the backcountry sites and crews would need to use quiet generators to power equipment necessary for mosquito monitoring activities. The duration and frequency of helicopter flights required for monitoring (2–6 hours per day for a total of approximately 17.5 hours per week for one week each quarter), and therefore the amount of time wildlife could experience helicopter noise impacts, would be brief, inconsistent, and vary by distance from the source. Noise levels along helicopter flight paths would reach less than 72 dBA at 500 feet AGL during overflights at the beginning and end of each monitoring session and helicopters would be flying faster than 62 mph, thereby decreasing the time exposure to noise. The most pronounced noise impacts from helicopter use would be focused at the five monitoring sites accessible only by helicopter and could reach 82–93 dBA during pick-ups and drop-offs (less than 10 minutes each). During the 7-day quarterly monitoring sessions, adverse noise impacts from generators would be limited to less than 58 dBA at 23 feet for up to 3 hours per day at five monitoring camps. Many of these camps are within or near sensitive habitat for Hawaiian forest birds, and noise from helicopter activity and generators could cause mild annoyance to birds nesting, roosting, or foraging in the area. Owing to the thick canopy that surrounds the camps, however, noise impacts would be limited to a very small radius around each camp and noise impacts would not be constant during that 7-day period.

The potential exists for limited indirect noise-related impacts to Hawaiian honeycreeper species during helicopter operations especially when hovering or taking off and landing with noise levels likely exceeding 82 dBA. Those noise related impacts include interference with avian communication and breeding success associated with chronic human-caused noise disturbance (Halfwerk et al. 2011). Other species of nesting birds in other ecosystems have been observed flushing from nests in response to noise (Meillere et al. 2015). There is a low risk of bird collisions during helicopter flights to and from monitoring locations. The most common native species affected by aircraft collisions are kōlea, koaʻe kea, and nēnē (FAA 1990); collisions with pueo, ʻiwa, and ʻuaʻu are possible but very rare. There is also a low risk of potential disturbance to roosting ʻōpeʻapeʻa or pueo, particularly if there are roosts near take-off and landing sites. Except for breeding females roosting with their pups, these bats roost alone in trees and roost locations and roost abundances are not known within the project area. As mentioned under "Pedestrian Release" above, increased trail use during monitoring and associated mosquito pedestrian releases could lead to higher risk of introducing and spreading invasive species during monitoring.

Overall, adverse impacts on wildlife during monitoring activities from helicopters, generators, and vehicles would be highly variable and not sustained (effects would only occur for up to 7 days every three months). Any potential minimal impacts described in this section (a low risk of kōlea, koaʻe kea, pueo, ʻiwa, ʻuaʻu, and nēnē collision, low risk of pueo disturbance and/or collision, low risk of Hawaiian honey creeper disturbance, and low risk of roosting ʻōpeʻapeʻa disturbance) would be substantially limited by the infrequency and temporary nature of helicopter flights for monitoring. Mosquito monitoring is therefore unlikely to have long-term adverse impacts on wildlife and their habitats because of its limited frequency and implementation of best practices to mitigate adverse effects from biosecurity lapses. Mosquito monitoring would indirectly benefit all six remaining Hawaiian honeycreeper species in the project area on East Maui by contributing to the successful suppression of mosquito populations and the associated transmission of avian malaria.

Cumulative Impacts

Overall, reasonably foreseeable actions would continue to result in minimal adverse direct impacts to wildlife and their habitats. With mitigation actions and best management practices described in Chapter 2, the ongoing and planned actions described in the "Hawaiian Honeycreeper" section of "Current and Expected Future Condition of Threatened and Endangered Wildlife Species and Wildlife Species of Concern if No Action is Taken" and in Appendix E, would result in minimal impacts to federally listed and most wildlife species of concern. Under the proposed action, adverse impacts would be intermittent and of short duration and would infrequently affect individual birds and other wildlife. Although there would be temporary and localized impacts to wildlife from mosquito release activities, the population and health of federally listed species and wildlife species of concern and their habitats would improve or remain stable. As previously described, the proposed action would directly reduce mortality of listed Hawaiian honeycreeper species due to the suppression of mosquitoes that spread avian malaria. The proposed action along with other park, state and TNC 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 park, state, and TNC to manage for avian malaria and other threats. The overall cumulative impacts of the proposed action, therefore, would be substantially beneficial.

Conclusion

Under the no-action alternative, there would be no direct impacts to ʻōpeʻapeʻa nor to most wildlife species of concern. Without action to suppress mosquitoes and reduce avian malaria transmission, six Hawaiian honeycreeper species (kiwikiu, ʻākohekohe, ʻiʻiwi, ʻapapane, Hawaiʻi ʻamakihi, and Maui ʻalauahio) would be subject to continuing exposure to southern house mosquitoes and resultant mortality from avian malaria. With current climate variability and projected climate change trends, exposure to and transmission of avian malaria and avian pox would also be expected to increase under the no-action alternative, likely causing the extinction of kiwikiu, ʻākohekohe, and Maui ʻalauahio, extirpation of ʻiʻiwi, and increased risk to nēnē and seabirds to avian pox virus. The no-action alternative is therefore expected to substantially and permanently adversely affect Hawaiian honeycreepers and to a lesser extent, other native birds.

The proposed action would result in limited adverse impacts to federally listed wildlife species, designated critical habitat, and wildlife species of concern and their habitats, The proposed action would primarily include a risk of wildlife noise disturbance from drones, helicopters, and generators, but a minimal risk of wildlife collision, and an indirect impact of increased risk of invasive species introduction from failed biosecurity during field operations. The most pronounced risk of impacts from noise disturbance, risk of collision, or biosecurity lapses would occur in the vicinity of LZs, helibases, fence lines, roads, and trails. Under the proposed action, noise from drones could occur throughout the 48,164-acre core area for 49–72 hours per week. Noise levels from drones could reach a maximum of 47–59 dBA at 100–200 feet AGL (the altitude where most releases would occur) for less than 15 seconds as the drone passes over any given location in the core area one to two times per week. Helicopter noise would only occur for 2–6 hours per day potentially spread over the course of 7 days for a total of approximately 17.5 hours per week for quarterly monitoring trips. Most helicopter flight noise would be highly variable depending on the flight height and lateral distance to a person or wildlife but could reach a maximum of 82–93 dBA during pick-ups and drop-offs at LZs. Short-term, temporary helicopter longline releases (with up to 6 hours of flight time per day, 5–7 days per month for up to two months per year) could produce a maximum of 82 dBA at 150 feet AGL for less than 15 seconds at any given release location in the core area. Generator noise (maximum of 52–58 dBA at 23 lateral feet) could occur for up to 3 hours per day for up to 7 consecutive days on a quarterly basis at the five backcountry monitoring locations. Noise from vehicles (maximum of 75 dBA at 50 feet from the source) would occur intermittently in Makawao Forest Reserve and TNC's Waikamoi Preserve for up to 4 hours per day for up to 7 days during quarterly monitoring and up to 2 hours per day, up to 2 times per week for pedestrian releases that are scheduled to occur in those areas.

Impacts may decline over time as releases are needed less frequently and/or become more efficient. Potential minimal adverse effects to federally listed wildlife or wildlife species of concern from mosquito releases and monitoring include a low risk of the following:1) disturbance from the presence of drones and drone/helicopter/generator noise to Hawaiian honeycreeper species; 2) aircraft, drone, or vehicle collision with or noise disturbance to pueo; 3) pup and day roost disturbance with helicopter rotor wash, drone use, and LZ/camp use to'ōpe'ape'a; 4) flock or brood disturbance and helicopter drone or vehicle interaction-collisions to nēnē; and 5) drone or helicopter collision with or disturbance to transiting seabirds ('iwa, koa'e kea, kōlea, and 'ua'u). Potential impacts to Hawaiian honeycreeper species would be minimized by the planned flight elevations, speed of release operations, use of drones, and limited ground or helicopter activity in critical habitats. The risk of roosting bat or pup disturbance or displacement with the presence of drones or helicopters is reduced given the planned flight elevations and the use of general best management practices, and the proposed action is unlikely to affect foraging bats because bats are nocturnal and release activities would only occur during the day. Daytime helicopter and drone activities are very unlikely to influence listed seabirds that generally fly near the project area at night. Pedestrian release teams are unlikely to encounter endangered seabird nests on established trails but should be aware of their possible existence in the project area and should report any nocturnal seabird vocalizations heard.

All six remaining Hawaiian honeycreeper species (both federally listed and species of concern) on Maui in the project area would substantially benefit from the proposed action to suppress mosquito populations and thereby avian malaria transmission. Indirect beneficial impacts include conservation biodiversity and reduced exposure by Hawaiian honeycreepers, nēnē, and other disease-susceptible birds to avian pox virus. More broadly, the proposed action may help restore ecosystem integrity of the rainforest (including designated critical habitat) by substantially reducing the extinction risk of culturally significant and vital avian pollinators and seed dispersers (the Hawaiian honeycreepers).

Though considerable analysis is presented here, adverse impacts to listed wildlife and wildlife species of concern would minimal because very few direct impacts are anticipated, and indirect impacts would be limited in duration, frequency, and intensity. Over the long term, there would be a beneficial impact to listed birds and bird species of concern due to anticipated suppression of the mosquito population that transmits avian malaria to forest birds in the project area.

ESA Section 7 Determination Summary

Threatened and endangered species Section 7 determination definitions were previously defined. Based on the analysis, the project activities under the proposed action and the incorporation of mitigation measures described in Chapter 2, *may affect, but are not likely to adversely affect*, all analyzed federally listed wildlife species and their designated

critical habitat, as applicable. **Table 15** provides Section 7 determinations for listed wildlife species under the proposed action.

TABLE 15: THREATENED AND ENDANGERED WILDLIFE SECTION 7 DETERMINATIONS

Scientific Name	Common Name	Proposed Action Sec. 7 Determination
Branta sandvicensis	Nēnē, Hawaiian Goose	*May affect, but not likely to adversely affect*
Drepanis coccina	ʻIʻiwi	*May affect, but not likely to adversely affect*
Palmeria dolei	ʻĀkohekohe	*May affect, but not likely to adversely affect*
Pseudonestor xanthrophys	Kiwikiu or Maui Parrotbill	*May affect, but not likely to adversely affect*
Lasiurus cinereus semotus	ʻŌpeʻapeʻa, Hawaiian Hoary Bat	*May affect, but not likely to adversely affect*
Oceanodroma castro	'Akē'akē, Band-rumped Storm-Petrel	*May affect, but not likely to adversely affect*
Pterodroma sandwichensis	ʻUaʻu, Hawaiian Petrel	*May affect, but not likely to adversely affect*
Puffinus auricularis newelli	ʻAʻo, Newell's Shearwater	*May affect, but not likely to adversely affect*

CHAPTER 4: CONSULTATION AND COORDINATION

This chapter describes the civic engagement and agency consultation during the preparation of this EA. A combination of activities, including internal and public scoping, helped guide NPS and DLNR in developing this EA.

PLANNING

NEPA regulations require an "early and open process to determine the scope of issues for analysis" (40 CFR 1501.9). The internal scoping process for the project began in early 2021. Internal and external scoping associated with this EA has been extensive and has included numerous interdisciplinary team meetings and reviews and bi-weekly project meetings. Planning and public input for this project has also been in compliance with HEPA regulations at HRS Chapter 343.

A Pre-NEPA Workshop, "Addressing Avian Malaria and other Threats to Endangered Forest Birds at Haleakalā National Park," was conducted virtually from February 9-11, 2021. Representatives from NPS, DLNR, State of Hawai‘i Department of Health, USFWS, and contractors Tetra Tech and JE Fuller participated and contributed. Day 1 of the workshop covered project background and a law and policy overview; Day 2 covered project issues, purpose and need, and potential management actions; and Day 3 addressed outreach, preliminary proposed action, available data, and next steps.

CIVIC ENGAGEMENT

Staff from the NPS, DLNR, and other partner agencies led civic engagement efforts with the local community and interested stakeholders prior to initiating the NEPA/HEPA process. The intent of civic engagement was to connect with and inform the public and stakeholders about proposed efforts on East Maui to reduce populations of mosquitoes and thus the effects of avian malaria among threatened and endangered bird populations. Civic engagement efforts were conducted through the use of informative websites, videos/multimedia, social media, virtual and in-person meetings, media kits, newsletters, meetings and webinars, and direct email/mail/phone campaigns. Park staff also participated in a series of civic engagement calls to notify the public and stakeholders via the outreach strategy of this project before the NEPA process began.

PUBLIC SCOPING

The NPS and DLNR held a 45-day public scoping period from December 6, 2021, to January 20, 2022, which initiated the NEPA/HEPA process. Virtual public scoping meetings were held on December 14, 2021, and January 6, 2022. Public notices of the comment period and meetings were distributed through the following sources:

- A news release posted on the park website
- A project newsletter posted to the NPS's Planning, Environment and Public Comment (PEPC) website: https://parkplanning.nps.gov/HALE-mosquito
- A news release sent electronically (via email) to various stakeholders, agencies, and media groups
- A news release posted on the park's social media accounts (Facebook and Instagram) and postings to the Hawai‘i DLNR newsfeed, as well as the Oahu and Kauai DOFAW Facebook pages.

In total, 51 people attended the virtual public scoping meetings, including 34 on December 14, 2021, and 17 on January 6, 2022. The content was the same for both meetings and included a presentation followed by a "question and answer" session. Video recordings of the public scoping meetings were posted on the project's PEPC website. The project team received 72 correspondences during the 45-day scoping period. All 72 were submitted through the NPS PEPC system.

The comments received were reviewed by the NPS and DLNR and considered in developing this EA. A public scoping report documenting the process is available on the NPS PEPC project site at https://parkplanning.nps.gov/HALE-mosquito.

AGENCY CONSULTATION

NPS and DLNR initiated consultation with relevant agencies and organizations during the preparation of this EA. Copies of correspondence between NPS and other agencies, and responses from the agencies, if applicable, will be provided in the decision document.

Section 7 of the Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that the actions they authorize, fund, or carry out do not jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. NPS is coordinating with the USFWS Pacific Islands Field Office to ensure compliance with Section 7 of the ESA. An official Species List and associated avoidance and minimization measures from the USFWS Pacific Islands Fish and Wildlife Office was received on January 20, 2022 and aided in developing mitigation measures and assessing potential impacts of the project. The USFWS reviewed and commented on an internal draft EA and a call with the NPS was held on October 24, 2022, to discuss potential impacts to threatened and endangered species. The NPS and DLNR will continue to work closely with the USFWS throughout the NEPA, HEPA, and Section 7 ESA processes. This EA is serving as a Biological Assessment with Section 7 determinations provided for federally listed plant and wildlife species.

Section 106 of the National Historic Preservation Act

Compliance with section 106 of the National Historic Preservation Act is being conducted in consultation with the Hawai‘i State Historic Preservation Division (SHPD), Native Hawaiian Organizations, and individuals with familial/traditional ties to Haleakalā concurrently during the NEPA/HEPA planning process. The expected determination of effect is *No adverse effect* under Section 106 and *No historic properties affected* under HRS Chapter 6e. In December 2021, NPS sent initial letters establishing the Area of Potential Effect (APE) and identifying historic properties to the Hawai‘i SHPD and consulting parties. SHPD replied on January 5, 2022. The SHPD had no objections to the APE. The SHPD noted that the APE is a very large area and requested "additional information pertaining to what type of work, if any, will be conducted on the ground that may impact historic properties, if present, and the location of that work” (Project No. 2021PR01527; Doc No. 2201SH01). No substantial comments were received by consulting parties. In August 2022, NPS sent preliminary determination of effect letters to the Hawai‘i SHPD and consulting parties, including additional information pertaining to what type of work, if any, will be conducted on the ground that may impact historic properties, if present, and the location of that work. No comments have been received to date. The project is under review by the Hawai‘i SHPD History and Culture Branch. A third letter, describing refinements to the proposed action based on new information gathered during the EA process, as well as final determination of effect, will be sent to consulting parties with this EA and Cultural Impact Assessment when released to the public.

APPENDIX A:
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APPENDIX A: REFERENCES

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APPENDIX B:
Issues, Impact Topics, and Alternatives Dismissed from Detailed Analysis

APPENDIX B: ISSUES, IMPACT TOPICS, AND ALTERNATIVES DISMISSED FROM DETAILED ANALYSIS

ISSUES AND IMPACT TOPICS DISMISSED FROM DETAILED ANALYSIS

Section 4.2 E of the National Park Service (NPS) NEPA Handbook (NPS 2015) states that, generally, issues should be discussed in detail in an Environmental Assessment (EA) if any of the following apply:

- the environmental impacts associated with the issue are central to the proposal or of critical importance
- a detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives
- the environmental impacts associated with the issue are a big point of contention among the public or other agencies
- there are potentially significant impacts to resources associated with the issue

The NPS NEPA Handbook further states that if the considerations above do not apply, issues should be dismissed from detailed analysis. The following issues and impact topics were not fully addressed in the EA because the listed resources are not in the project area; the environmental impacts associated with the issue are not central to the proposal, pivotal, or of critical importance; a detailed analysis of environmental impacts related to the issue is not necessary to make a reasoned choice between alternatives; or the resource would not be or only negligibly impacted and there is no potential for significant impacts. More details about the dismissal for these issues and impact topics are provided in the sections below.

Air Quality, Greenhouse Gas Emissions, and Climate Change

The park regularly monitors air quality in the frontcountry (headquarters area) and baseline data is available. Air quality in the project area is typically very good, and Maui is in attainment for National Ambient Air Quality Standards (EPA 2021).

Under the proposed action, there are several release methods, ranging from pedestrian release with relatively limited helicopter flight times to helicopter long line and drone dispersal, but none of these would perceptibly adversely affect air quality. The primary mosquito release method would use drones, which do not burn fossil fuels.

Although some management actions would result in emissions of criteria pollutants pursuant to the Clean Air Act and greenhouse gases due to the use of helicopters and other motorized vehicles, contributions would be extremely low and would result in impacts on air quality and greenhouse gas emissions that would be below *de minimis* levels. Overall, any effects resulting from the proposed alternatives would be negligible. The 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). As suggested by some climate change models, the mean temperatures in Hawai‘i may increase by 2°– 3°C by 2100 (IPCC 2007). The effects of climate change can result in increased stress to natural systems through altered temperatures and rainfall patterns (Alexander et al. 2016). Frazier and Giambelluca (2017) examined trends by elevation and showed that the highest rates of drying during dry season months were found in high-elevation areas where populations of threatened or endangered populations of forest birds are still able to persist.

Though climate change and associated adverse impacts have and will continue to affect specific resources on Maui and within the project area (Alexander et al. 2016, Pauchard et al. 2016), greenhouse gases from helicopter and motor vehicle emissions are not expected to have a measurable effect on local climatic conditions. For example, the management activities proposed to release mosquitoes would result in fossil fuel consumption from helicopters, but the greenhouse gas emissions associated with these activities would be negligible because of the comparatively limited number of flights anticipated, compared to ongoing commercial and administrative flights on Maui.

Based on the considerations discussed above, air quality, greenhouse gas emissions, and climate change were dismissed from detailed analysis as an impact topic. However, climate change was addressed in terms of impacts on the existing conditions of resources, and their long-term trends, as applicable.

Vegetation (Non-threatened/Endangered)

The Kīpahulu Valley and other portions of the project area above approximately 1,650 feet (502 meters) in elevation include important rainforest. The native koa (*Acacia koa*), and in some areas, invasive guava (*Psidium* spp.), dominate the forest from 2,000 to approximately 4,000 feet (610–1,219 meters), while ʻōhiʻa (*Metrosideros polymorpha*) dominates the forest above 4,000 feet. Tree ferns (*Cibotium* spp.) are important in the understory. Lobelioids (*Cyanea* spp., *Clermontia* spp., *Lobelia* spp., and *Trematolobelia macrostachys*) and mints (*Stenogyne* spp. and *Phyllostegia* spp.) are among the rare and spectacular endemic plant species of the Kīpahulu Valley.

If rare forest birds recover through the release of incompatible mosquitoes, project activities could indirectly benefit East Maui's native vegetation. Hawaiian honeycreepers play a critical role in ecosystem function by dispersing seeds and pollinating native plants. Maintaining populations of these species benefits the native plant community and preserves ecosystem function.

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 cleared through previous environmental compliance conducted by the state or park. To help mitigate any vegetation/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 (BMPs) 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. Given previous environmental compliance of proposed activities and anticipated negligible impacts, this issue was considered and dismissed from further analysis.

Wildlife and/or Wildlife Habitat

There may be *de minimis* adverse impacts to general wildlife (those not federally listed or deemed as species of concern) or wildlife habitats that would result from the presence of people, drones, or helicopters used for implementation of the proposed action. In general, if the project were to be successful at reducing the prevalence of non-native *Culex* mosquitoes in the environment of East Maui, there would be periodic, short-term adverse impacts due to increased air and foot traffic, but long-term beneficial indirect impacts to general wildlife or wildlife habitat from the suppression of non-native mosquito populations and in turn avian malaria. Given the anticipated negligible impacts on general wildlife and/or wildlife habitat, this topic was dismissed from further analysis.

Museum Collections

No impacts to museum collections would result from the proposed action as none are present within the project area. This issue was considered and dismissed from further analysis.

Prehistoric/Historic Structures

No impacts to prehistoric or historic structures are anticipated to result from the proposed action. Much of the project area has not been surveyed, but no new ground disturbance would occur. To help mitigate potential effects of ground-based activities on previously undiscovered prehistoric or historic structures, pedestrian releases and monitoring would only be conducted via existing, previously disturbed resource management trails and fence lines, as well as camping at established remote camps or helicopter landing zones for overnight stays, to avoid new ground disturbance. 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 environmental compliance conducted by the state or park. Therefore, this issue was considered and dismissed from further analysis.

Archeological Resources

As defined by NPS *Management Policies 2006*, the term "archeological resources" refers to any material remains or physical evidence of past human life or activities and includes precontact and historic sites and features. The project area within Haleakalā encompasses the entirety of the Kīpahulu Historic District. The Kīpahulu Historic District was determined eligible and nominated for listing on the National Register of Historic Places (NRHP) in 1976. Kīpahulu Historic District was listed on the Hawai‘i State Inventory of Historic Places (SIHP) in 1977 (Site# 50-50-17-299). The historic district encompasses 327 hectares (810 acres) of lands around ‘Ohe‘o Gulch, from sea level to about 1,640 feet (500 meters) above sea level. The Kīpahulu Historic District encompasses the lower sections of five traditional ahupua‘a within the larger ancient moku (district) of Kīpahulu. These are Kaumakani, Papauluana, ‘Alae Iki, ‘Alae Nui, and Kakalehale. The individual archeological sites in the Kīpahulu District, all of which have been determined eligible for listing in the National Register of Historic Places through consultation with the Hawai‘i State Historic Preservation Division, represent occupational periods from pre-historic (pre-1778) through to the modern period (1850–present) and are associated with agriculture and animal husbandry, permanent residences, temporary encampments, and ceremonial purposes. Site types include mounds, terraces, walls, burials, platforms, enclosures, walled shelters, trails, and rock shelters, with rock mounds, walls, and terraces making up the majority of recorded archeological features.

The proposed action would occur just within the boundaries of the Crater Historic District, which was listed on both the State Inventory of Historic Places SIHP (SIHP 50-50-11-12-1739) and on the National Register of Historic Places (NRHP) on November 1, 1974. The Crater Historic District encompasses 17,000 acres within Haleakalā National Park, encompassing the original park boundaries and lands throughout the crater wilderness and "frontcountry" shrubland on the northwest-facing slopes of Haleakalā. The district consists of 56 recorded archeological sites and is significant under Criterion D because it has yielded, and is likely to yield, information important in prehistory or history. No known individual archeological sites in the Crater Historic District are within the project area.

Individual archeological sites are also present and have been documented in the coastal area of Ka‘āpahu Ahupua‘a within Kalepa, ‘Alelele, Lelekēa, and Kukui‘ula Valleys. Portions of the Nu‘u parcel, including the proposed road corridor and helicopter landing zone, were surveyed between 2012 and 2014, with over 1,600 features identified and grouped into 76 archeological sites (Tomonari-Tuggle et al. 2015).

In addition, limited surveys have been completed in the upper elevations of Haleakalā National Park. Previous archeological surveys between the 1,800-foot and 4,600-foot elevation contour levels of the

Kīpahulu District of the park conducted by NPS Pacific Archeologist Gary Somers between 1985 and 1989 encountered no surface archeological sites. Similarly, a previous archaeological survey between the 2,400-foot and 5,000-foot elevation contour levels of the Kīpahulu District of the park conducted by Haleakalā National Park Archeologist Elizabeth Gordon in 2004 encountered no surface archeological sites. In 2015, Haleakalā National Park Archeologist Rachel Hodara Nelson surveyed portions of the Nu‘u parcel between the 2,500-foot and 1,400-foot contours. No new sites were identified during that survey.

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. To help mitigate potential effects of ground-based activities on previously undiscovered archaeological resources, pedestrian releases and monitoring would only be conducted via existing, previously disturbed resource management trails and fence lines, as well as camping at established remote camps or helicopter landing zones for overnight stays, to avoid new ground disturbance. 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 environmental compliance conducted by the state or park. Therefore, this issue was considered and dismissed from further analysis.

Cultural Landscapes

The NPS defines cultural landscapes as geographic areas associated with historic events, activities, or people that reflect the history of the park unit, development patterns, and the relationship between people and the park. Portions of the Haleakalā Highway Historic District, Pu‘unianiau Area, and Hosmer Grove Campground and Picnic Area cultural landscapes are within the project area near the entrance to Haleakalā National Park. No impacts to cultural landscapes 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. To help mitigate potential effects of ground-based activities on cultural landscapes, pedestrian releases and monitoring would only be conducted via existing, previously disturbed resource management trails and fence lines, as well as camping at established remote camps or helicopter landing zones for overnight stays, to avoid new ground disturbance. 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 environmental compliance conducted by the state or park. The proposed action will result in limited visual and noise impacts to the feeling and setting of historic period cultural landscapes. However, these noise and visual impacts have been minimized in order to limit negative impacts to cultural landscapes. The proposed action has minimized the use of helicopters with the increased focus on the use of drones, which are smaller and quieter than helicopters. Therefore, this issue was considered but dismissed from further analysis.

Ethnographic Resources and Traditional Cultural Practices

As defined in NPS Director’s Order 28: Cultural Resource Management Guidelines (NPS 1998), ethnographic resources can be both natural and cultural resources that have been identified as having cultural significance by culturally associated users. They can include subsistence and ceremonial sites, structures, objects, and rural and urban landscapes assigned cultural significance by traditional users. The Summit of Haleakalā, including the Kīpahulu Valley and Kaupō Gap, has been determined eligible for the National Register of Historic Places as a traditional cultural property (TCP) “for its association with the cultural landscape of Maui and because it has known uses, oral history, mele, and legends, was a source for both traditional materials and sacred uses, and is a place exhibiting spiritual power. The sacred essence of the mountain includes the sky above (Prasad and Tomonari-Tuggle 2008).

Approximately 300–500 Hawaiians enter the Lower Kīpahulu Valley area of the park for traditional cultural practices annually; the Upper Kīpahulu Valley is a designated Biological Reserve closed to all public access. Archeological resources, recorded and oral histories, and Native Hawaiian traditions provide valuable information related to cultural land use, settlement patterns, and ethnographic practices within the Kīpahulu District. Cultural practices known to occur in this section of the park include performance of ceremonies and spiritual training, and farming. Native Hawaiians have strong cultural and spiritual connections to the resources and land located within the park as well as on DLNR and private lands within the project area.

Section 5.3.5.3 of NPS *Management Policies 2006* commits the NPS to adopt "a comprehensive approach towards appreciating the diverse human heritage and associated resources that characterize the national park system." The proposed action will result in limited visual and noise impacts to the feeling and setting of ethnographic resources, including the Haleakalā Summit, Kīpahulu Valley, and Kaupō Gap Traditional Cultural Property. Noise associated with helicopter or drone flights and their visual intrusion could potentially be a disturbance to the traditional users of park or state areas and could potentially detract from their enjoyment and use. However, these noise and visual impacts have been minimized in order to limit negative impacts to ethnographic resources. Park operations, e.g., flight times and flight paths, would be planned to balance efficiency and any potential impacts. The proposed action will minimize the use of helicopters and focus on the use of drones, which are smaller and quieter than helicopters. Any necessary helicopter flights would be planned to avoid the park's annual commercial-free days. As specified in the park's Commercial Services Plan, commercial-free days are opportunities for Kānaka Maoli (Native Hawaiians) to conduct traditional cultural practices in the park without commercial tours present. In 2023, the commercial-free days will occur on January 6 (end of Makahiki); May 24 (Zenith Noon); June 21 (Summer Solstice); July 18 (Zenith Noon); October 27 (start of Makahiki); and December 21 (Winter Solstice). The commercial-free days are designated prior to the start of the calendar year and change slightly each year. They are determined in consultation with the Native Hawaiian Community. The NPS consulted with the Native Hawaiian Community to identify any impacts from the proposed action and no substantial comments have been received to date. DLNR prepared a Cultural Impact Assessment (CIA) as part of compliance with the Hawai'i, Environmental Policy Act (HEPA). The CIA states:"Due to the size of the project area, this cultural impact assessment did not identify or inventory individual historic sites within the project area. Due to the nature of the activities, it is not anticipated that these activities could impact, modify, or effect historic properties in the project area" (Watson 2022: 43).

In the CIA (Honua Consulting 2022: 25-26) Kepā Maly describes the significance of natural resources to Native Hawaiians:

> We find in native traditions and beliefs, that Hawaiians shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything on the land and in the ocean was believed to be alive. Indeed, every form of nature in ancient Hawai'i was believed to be a body-form of some god or lesser deity. In the Hawaiian mind, care for each aspect of nature, the kino lau (myriad body-forms) of the elder life forms, was a way of life. This concept is still expressed by Hawaiian kūpuna (elders) through the present day and passed on in many native families. Also, in this cultural context, anything which damages the native nature of the land, forests, ocean, and kino lau therein, damages the integrity of the whole. Thus, caring for, and protecting the land and ocean resources, is a way of life. Furthermore, in the traditional context above referenced, we find that the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the natural landscape itself is a highly valued cultural property. It's protection, and the

> continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws.

Based on the research and ethnographic data within the CIA report, it was found that it would be unlikely that the proposed action would adversely impact traditional or customary practices. Yet, it is clear that additional education and outreach is needed, particularly to the practitioner community. Hunters use the project area extensively, and they hunt for subsistence. This subsistence lifestyle provides critical protein and food resources to families in East Maui" (Watson 2022: 84). Thus far the NPS has conducted two virtual public meetings to collect initial comments in the development of the draft EA. Information may be found here: Park planning - Suppression of Non-native Mosquito Populations to Address the Impacts of Avian Malaria on Threatened and Endangered Forest Birds (nps.gov) and here: Birds Not Mosquitoes. The state DLNR and Birds not Mosquitoes, a public-private partnership, plans to do additional outreach to East Maui communities to educate about this project. To mitigate potential public concerns regarding Wolbachia-incompatible mosquito releases, the IIT project team consulted with the DLNR Maui Branch Manager to identify areas on state lands commonly used by hunters or cultural practitioners. Most public hunting areas within the East Maui project area are only open on weekends, when it's unlikely that mosquito release operations will take place. Further, most treatment area points on public hunting lands are in remote upland areas rarely visited by hunters. The one exception is the Makawao Forest Reserve, where there are 60 release points, which would take approximately 1-2 hours to treat by aerial methods. The reserve is open for hunting and other recreational activities daily. Those activities may include plant and flower gathering for lei making and other traditional Hawaiian practices. The project team met with the DLNR Na Ala Hele trail advisory committee on July 27, 2022, to discuss potential concerns and how best to communicate IIT implementation plans in that popular recreational area. The project team will work with DLNR to post signage on trails communicating release plans, and to participate in public outreach events. On DLNR lands, Native Hawaiian organizations would be notified prior to any planned release efforts.The CIA also found that native birds could be considered a cultural resource as they are entwined in both Hawaiian culture and tradition across the islands. The history of the birds in Hawai‘i is one of tremendous adaptive radiation due to geographic isolation resulting in numerous species of birds found nowhere else on earth. The use of helicopters and drones under the proposed action could temporarily disturb native forest birds, but over the long term there would be substantial benefits by minimizing the spread of avian malaria and reducing bird mortality.

In conclusion, any minimal 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. This issue was considered and dismissed from further analysis in the EA but was assessed in the aforementioned CIA which is included as an appendix to the EA.

Geological Features and Soils

No impacts to geological features are anticipated to result from the proposed action. Any disturbances to bedrock geology or soils from pedestrian release activities and monitoring would be minimal, and therefore have negligible effects on soils. To help mitigate any effects of ground disturbance, ground-based monitoring efforts and pedestrian mosquito releases would be conducted on existing resource management trails and fence lines to avoid disturbance. Helicopter operations would utilize existing, previously disturbed landing zones. For these reasons, impacts to geology and soils were considered and dismissed from further analysis.

Lightscapes

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

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.

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, 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 East Maui are comprised of populations where at least 50 percent of the population is considered a minority. Therefore, environmental justice communities exist in the study area. The proposed action involves the use of drones and helicopters to release incompatible mosquitoes for the purpose of suppressing the spread of avian malaria. The mosquitoes that would be released provide no threat to the public as they would be male mosquitoes (which don't bite) and do not transmit disease to humans. While the suppression of avian malaria should result in a positive overall effect on the East Maui ecosystem, mosquito release methods would involve the use of aircraft which could adversely impact the public who are recreating on public and conservation lands during project implementation. These potential impacts would mostly be due to the noise or visual disturbance from aircraft. Similar aerial operations are already ongoing on state and federal lands on East Maui. There would be minimal or no adverse effects on the public outside of the project area. Because noise and visual impacts could primarily affect only those members of the public that are actively recreating in the project area during implementation, there would be no low income or minority populations that would be disproportionately affected by project activities. Therefore, this issue was considered and dismissed from further analysis.

Socioeconomics

The economy of Maui County has a high reliance on the visitor industry, with 34,400 jobs or approximately 41 percent of all jobs in the county being visitor-related in the categories of food services, accommodation, retail trade, and arts, entertainment, and recreation (Department of Business, Economic Development & Tourism 2018). The majority of visitors travel to Kīpahulu by way of the state- and county-maintained Hāna Highway through the community of Hāna. The Kīpahulu District can receive over 500 cars per day and as many as 1,500 to 1,800 people per day during peak times (NPS 2022).

Tourism is the largest single source of private capital for Hawai‘i's economy. Tourism in Maui contributed $14.0 million per day to the local economy in 2019. The Hawai‘i Tourism Authority anticipates continued growth in tourism from "upgrades" to natural resources and increased distribution of visitors to the "neighbor" islands. In 2007 $35 million in tourism spending in the State of Hawai‘i

supported 172,000 jobs; in 2017 these figures had grown to $46 million in spending and 203,000 jobs supported (Hawai‘i Tourism Authority 2019). Birding significantly drives visitation within The Nature Conservancy's (TNC's) Waikamoi Preserve because much of the pristine forest habitat where rare forest birds can be viewed within state forest reserves and the park is inaccessible to birders seeking a glimpse of rare forest birds. Exceptions would be Hosmer Grove and Palikū, which is adjacent to Kīpahulu Valley, in the park where ‘i‘iwi can be seen. The Waikamoi Preserve can only be accessed with permission from TNC. Public trips for birding typically occur once per month and have a maximum of 15 participants.

The proposed action could potentially adversely impact birding trips within the Waikamoi Preserve, but only minimally due to occasional noise from field crews, helicopters, or drones; however, tourism related to birding only comprises a small portion of local tourism, and there would be a beneficial impact to birding from suppression of avian malaria and increased viability of native forest bird populations. No measurable impact to the local economy would occur as a result of the proposed action. Therefore, this issue was considered and dismissed from further analysis.

Viewsheds

Under the proposed action, helicopters and drones would be visible above the tree canopy for very limited periods of time during flights to release mosquitoes, but the visual intrusion would be temporary, perhaps a few minutes at a time in each location and impacts would be considered *de minimis*. There would be no permanent impacts to viewsheds. Therefore, this issue was considered and dismissed from further analysis.

Floodplains

No impacts to floodplains are anticipated to result from the proposed action because the project would not result in disturbance to designated floodplains which are primarily located downstream of the project area. According to the State of Hawai‘i, DLNR, Flood Hazard Assessment Tool, the project area overlaps with many streams originating on the slopes of the park that have designated floodways. However, only pedestrian release routes via existing trails and fence lines and helicopter or drone landing zones or camps would be used. Therefore, this issue was considered and dismissed from further analysis.

Marine or Estuarine Resources

No impacts to marine or estuarine resources are anticipated to result from the proposed action as the project area is in terrestrial areas only. Therefore, this issue was considered and dismissed from further analysis.

Water Quality or Quantity

The proposed action would not affect water quality in any measurable manner because care would be taken to avoid water sources during pedestrian, helicopter, or drone releases of mosquitoes. This project would involve no change to water quantity in East Maui as water is not required for implementation of this project. Therefore, this issue was considered and dismissed from further analysis.

Wetlands

No impacts to wetlands are anticipated to result from the proposed action because pedestrian release routes and helicopter and drone landing sites would avoid wetland areas. Ground-based monitoring efforts and mosquito releases would be conducted on existing resource management trails and fence lines. 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 environmental

compliance conducted by the state or park. No protected wetland areas would be disturbed during implementation of the proposed action. Therefore, this issue was considered and dismissed from further analysis.

Human Health and Safety

Under the proposed action, pedestrian release, helicopter long line, and drone operations would present some risk of accidents or injuries to employees and contractors during ground crew transportation or mosquito release. In addition, ground crews would be subject to some risk of injury from hiking in remote areas and through difficult terrain. The NPS and State of Hawai‘i have strict guidelines and safety/training standards that are followed on all management projects and would be followed under the proposed action. Safety is paramount to all missions.

The released mosquitoes pose no risk to human health. Only male mosquitoes will be released and only female mosquitoes bite animals or humans. The risk of females being accidentally released is estimated to be 1 out of 900 million (Crawford et al. 2020). Even if a female is released, a bite from a released female will pose no risk to humans and no greater risk to wildlife than a wild female mosquito currently in the environment. Wolbachia cannot live within vertebrate cells and cannot be transferred to humans even through the bite of an infected mosquito (Popovici et al. 2010). Additionally, no new organisms would be introduced to Hawai‘i by the proposed action. Humans are commonly bitten by the Asian tiger mosquito, Aedes albopictus, infected with the strain of Wolbachia that would be transfected into the southern house mosquitoes for release. The southern house mosquito also bites humans, and this species is also naturally infected with Wolbachia. Thus, humans in Hawai‘i are regularly bitten by mosquitoes containing Wolbachia, including the strain that would be used in the proposed action, and no ill effects have ever been reported nor would there be a mechanism for this to occur. Further, there is no indication that the released mosquitoes would be any better at transmitting disease to humans or wildlife. Popovici et al. (2010) addresses many potential concerns regarding releasing Wolbachia-infected mosquitoes.

Aerial mosquito release operations would be carried out by only trained personnel and contractors approved by the U.S. Department of Interior Office of Aviation Services and would be required to observe proper safety protocols and use proper personal protective equipment. Equipment would be well-maintained and helicopter flights would only occur during favorable weather conditions. In addition, an aviation safety plan specific to this project would be developed and implemented. A safety briefing would be performed for each flight. Agencies would seek to minimize the risk of accident or injury during helicopter-based release activities and temporarily cease operations if unsafe conditions exist. Given the proposed action includes activities that are routinely carried out already and there would be no or only minimal risk to visitors, and that released mosquitoes pose no risk to human health, this issue was considered and dismissed from further analysis.

Alternatives Potentially Considered but Dismissed from Further Consideration

During the development of the proposed action and refinement of the project’s purpose and need statement, the NPS and DLNR considered numerous alternatives that were ultimately dismissed from detailed analysis. A summary of these alternatives and reasons for their dismissal from further consideration are provided below. The NPS and DLNR dismissed alternatives determined to be infeasible and as such would not accomplish the purpose and need of the project, which is to substantially suppress or eliminate wild mosquito populations and thus avian malaria in threatened and endangered forest bird populations on East Maui. The following alternatives were therefore considered but dismissed from further consideration in the EA.

Sterile Insect Technique

The Sterile Insect Technique (SIT) aims to sterilize male insects and release them into the wild population to reduce reproductive output and suppress insect populations. The technique has been successfully applied globally to several species of pests, including some species of mosquito (Dyck et al. 2021). The primary method for sterilizing male mosquitoes is through gamma ray exposure, which induces random breaks in the DNA to cause infertility (Klassen and Curtis 2021). Captive reared gamma-irradiated males are released into a population to mate with wild females, which in turn would lay non-viable eggs. Initial *Culex* SIT field trials demonstrated success in inducing modest to high levels of sterility in wild females by releasing irradiated males in small areas of India and Florida (Patterson et al. 1975, 1977). Larger SIT field trials were complicated by mated female immigration (Yasuno et al. 1975) and several *Aedes* SIT trials indicated that irriadiated males had reduced mating competitiveness (Bellini et al. 2013, Yamada et al. 2014). Concerns regarding the quality of SIT males and their mating competitiveness were alleviated by several successful *Aedes* SIT trials (Ageep et al. 2014, Madakacherry et al. 2014), but uncertainties remained for *Culex*. During the "To Restore a Mosquito-Free Hawai'i" workshop in 2016, experts weighed the advantages and disadvantages of both the Incompative Insect Technique (IIT) and SIT methods and cited evidence of reduced fitness of SIT male *Aedes* mosquitoes when compared to IIT *Wolbachia* males (Atyame et al. 2016). The group expressed the need for additional laboratory research for identifying the irradiation dose that would fully sterilize males and maintain competitiveness with wild *Culex* males in Hawaiian rainforests. Elsewhere, SIT has been applied in conjunction with several *Aedes* IIT programs, primarily as a means for ensuring that no sterile *Wolbachia* females are released accidentally with *Wolbachia* males (Zhang et al. 2015, Bourtzis et al. 2016). Advancements in sex-sorting techniques reduced the need for integrated SIT and IIT programs and help propel IIT as the primary means for suppressing *Culex* populations in Hawai'i. Researchers are working to overcome the complication of reduced competitiveness in irradiated *Culex* males and their findings should determine if SIT will be a viable tool worth considering in the future. Because this is not a viable tool at this time, this alternative would not meet the purpose and need for taking action, and therefore has been dismissed from detailed consideration.

Introducing Self-Limiting Male Mosquitoes with Edited Genes

Male mosquitoes may be engineered to contain a self-limiting gene that, when passed to offspring, prevents the offspring from developing into adulthood. This method has been proposed for implementation in Florida, and an Experimental Use Permit was issued by the Food and Drug Administration. After extensive evaluation of the best available science and public input, the U.S. Environmental Protection Agency (EPA) granted an experimental use permit to Oxitec Ltd. to field test the use of genetically engineered *Aedes aegypti* mosquitoes as a way to reduce mosquito populations to protect public health from mosquito-borne illnesses (EPA 2020). However, this technology is not currently available for near-term implementation of *Culex* mosquitoes. There may also be considerable public resistance to this method as has been seen in Florida. Because this technology is not currently available, this alternative would not meet the purpose and need for taking action, and therefore has been dismissed from detailed consideration.

Gene Drive

The gene drive method involves introducing a novel DNA sequence that permanently transfers a useful trait into a wild population to eliminate the population or render it inert for the threat it poses. In this system, this would be done by engineering *Culex* mosquitoes to carry a certain gene and releasing those mosquitoes into the wild to spread that particular trait. The gene in the released mosquitoes may theoretically code for any number of traits including mutations resulting in mortality or even alter vector-parasite compatibility. This method has the ability to eliminate mosquito populations island-wide or alter the population in a lasting manner. Although there would be up-front development costs, there may be no

need to repeatedly deploy treatment mosquitoes once introduced as this is not a self-limiting method. However, this technology is still approximately 10–20 years away from viability and has not been proven or tested in the field. Safeguards would also need to be developed and there may be some public resistance to a tool using genetic modification. Because this technology is not currently available, this alternative would not meet the purpose and need for taking action, and therefore has been dismissed from detailed consideration.

Mosquito Habitat Source Reduction

Alteration or removal of water bodies has long been used to control mosquito numbers through reduction in larval habitat. Draining or channelizing waterways has been an effective method of reducing standing water and thus suppressing mosquito reproduction for centuries. However, alteration of the natural hydrology of an area can have significant effects, impacting numerous species and entire ecosystems. The hydrology of the mountainous regions of Hawai‘i, including the project area considered here, is driven by rainfall patterns and little ground water is maintained for long periods in lakes, ponds, or wetlands that could act as breeding grounds for mosquitoes. Thus, there are few wetland/marsh habitats to drain or alter in the project area, even if such an action was considered. Additionally, enumerable species depend on the natural flow of water on the landscape and there is a high likelihood of significant adverse impacts to other listed species or species of concern. Because this alternative would not meet the purpose and need for taking action and due to the potential for severe environmental impacts, it has been dismissed from detailed consideration.

Biological Larvicide Controls

Bacterial and other biological larvicides have been developed and are commercially available for the control of mosquito populations. One such bacterial control agent, *Bacillus thuringiensis* var. *israelensis* (Bti), can be effective for reducing mosquito larvae abundance. When applied to larval habitat, the microbe produces a toxin that is lethal when ingested by developing mosquito larvae. Bti larvicides (e.g., Vectomax® FG, Vectobac®, MosquitoDunks®) have demonstrated success for reducing *Culex* larvae abundance in areas of Kaua‘i Island, where pedestrian crews could access and apply the granular pesticide to standing pools of water (LaPointe et al. 2021). Because *Culex* are capable of breeding in a variety of habitats, including habitats rich in organic matter, the species can take advantage of pooled water in tree wells, pig wallows, and stagnant ground pools far from streams; thus, it is difficult to locate and treat these sources that are diffusely spread throughout native forest bird habitat. *Culex* mosquitoes can travel up to 3 kilometers in less than 12 days (LaPointe 2008), thus individuals can infiltrate relatively small locally treated areas. In 2019, standing pools of water were treated with Vectomax® FG in a 170-ha area where 14 kiwikiu birds were translocated and nearly every individual bird suffered mortality because of exposure to avian malaria (Warren et al. 2021). Scaling up Bti treatments to a landscape level in wet and steep environments could be logistically infeasible. Bti has been aerially broadcasted in several parts of the world, but its application in densely forested areas of Hawai‘i has not been tested. Additionally, Bti degrades under ultraviolet exposore (Zogo et al. 2019) and active ingredients can be flushed or diffused during rain events, thus the frequency of treatments could depend on local conditions and readily available resources, which may be impractical in most cases. Further, while Lapointe et al. (2021) observed no evidence of population level impacts to two non-target invertebrates, effects to several endemic flies, midges, and gnats have not been tested. Bti has potential for reducing larval abundance in combination with an IIT program, but the method alone is inadequate for suppressing mosquito populations within the entire East Maui project area. Because this alternative would not meet the purpose and need for taking action, it has been dismissed from detailed analysis.

Chemical Controls

Successful control and eradication of disease-carrying mosquitoes has been accomplished globally using several pesticides, such as organophosphate or organochloride insecticides. Widescale application of insecticides, in addition to removal of larval habitat, is responsible for the eradication of human malaria throughout the United States. However, there are no mosquito-specific insecticides available and most of the available insecticides are indiscriminate and could cause mortality of non-target native and listed insects and arthropods in the treatment area. Insecticides have also proven to have higher adverse effects through bioaccumulation (e.g., DDT in raptor eggs). Organophosphate and pyrethroid adulticides are among the most used insecticides used to control mosquitoes. However, resistance to these chemical agents has been documented in *Culex* spp. mosquitoes over the past several decades, potentially reducing the efficacy of these chemicals (Pasteur et al. 1984, Raymond et al. 2001, Liu et al. 2009). Targeted application of larvicides would be expected to impact federally listed damselflies. . Because implementation of this alternative could result in greater environmental effects to species in the project area, it has been dismissed from detailed consideration.

Translocation of Birds to Mosquito-free Areas

Translocation is the intentional effort to transport organisms from their current range to distinct locations to establish a second sustaining population. The practice has been applied with variable success for a number of rare birds in Hawai‘i. Successful translocations are primarily restricted to the Northwestern Hawaiian Islands where *Culex* mosquitoes and avian malaria are absent. The U.S. Fish and Wildlife Service successfully established new populations of the Laysan Finch (*Telespiza cantans*) and ulūlu (Nihoa Millerbird; *Acrocephalus familiaris*) on Pearl and Hermes Atoll and Laysan Island, respectively (Morin and Conant 2020 a, b). However, most translocations in the main Hawaiian Islands have failed, including the recent translocation of wild and captive kiwikiu to a restored area of Nakula Natural Area Reserve on Leeward Maui. Nearly every bird died of avian malaria shortly after being released (Warren et al. 2021). Several efforts to reintroduce the endangered Palila (*Loxioides bailleui*) to former areas of its range in high montane and sub-alpine forests on Hawai‘i Island failed, primarily because birds quickly returned to their native range where they had established pair bonds and territories (Banko et al. 2014). Because of the current conservation crisis, the translocation of four critically endangered honeycreepers (including kiwikiu and ‘ākohekohe) to high elevation forests (>1,500 meters in elevation) on Hawai‘i Island, where birds may be less vulnerable to disease because of cooler annual mean temperatures, was assessed by a group of translocation experts, cultural practitioners, and resource managers (Paxton et al. 2022). A panel of experts scored the probability of success for each species, and native Hawaiians, with strong connections to native birds, shared perspectives regarding moving birds from their endemic range to a separate island. The probability of success for each species ranged from 38 percent to 51 percent, meaning most experts predicted that the translocations would fail, except for the endangered ‘ākohekohe, which had a near equal probability of failure and success. Cultural practitioners shared concerns about losing the cultural and familial connection to native avifauna and the potential suffering to individual birds during capture and transport efforts. The lack of remaining individuals in the wild to move and start a new population was one of the biggest factors in the decision process and there was little indication that translocated birds would be free from the threat of avian malaria, because of evidence that species vulnerable to the disease, such as the threatened ‘i‘iwi, were in decline throughout most of their range on Hawai‘i island (Paxton et al. 2013, Kendall et al. 2022). Further, climate projections reduce current ranges of endangered birds on Hawai‘i Island by more than 75 percent by years 2080–2100 and those species and translocated species would face similar challenges (Fortini et al. 2015). Translocation may be considered a complementary approach to the proposed action, potentially buying time for species in the wild while the threat of disease-carrying mosquitoes is being addressed, but the action would not meet the urgent need of preventing extinction of several endangered birds. Because this alternative would not meet the purpose and need for taking action, it has been dismissed from detailed analysis.

Treatment of Birds with Acute Infections using Anti-malarial Drugs

Vulnerable bird populations could be treated with injections of anti-malarial drugs (e.g., chloroquine, artesunate, primaquine, doxycycline). This approach could be effective in reducing the adverse effects of malaria in treated birds for a short period of time. The efficacy of anti-malarial drugs has been tested with variable success on poultry and captive penguins (Chitty 2011, Sohsuebngarm et al. 2014). Infected Hawaiian honeycreepers have also been successfully treated with these medications as well (Warren et al. 2021). This option is generally not feasible on a landscape or population scale because each individual bird would require repeated treatment. Individuals would need to be captured and identified for acute malaria with rapid testing techniques. Infected birds would be transported to a captive facility where a veterinarian could administer multiple doses of anti-malarial drugs. The birds' health and measures of malaria parasitemia would need to be monitored for several weeks until experts are confident to release individuals back into the wild, whereupon individuals would again be vulnerable to re-infection. The capture and transportation of infected birds, as well as the stress of captivity, could cause fatalities of sick individuals. It would be extremely labor intensive and impractical for reducing the impact of malaria among an entire community of threatened and endangered forest birds on East Maui. The approach could result in considerable environmental impact and possibly adverse impacts to threatened and endangered forest bird species. This approach was dismissed from further consideration because it does not meet the purpose and need and is technologically and economically infeasible.

Genetic Modification of Forest Birds

Under this scenario, forest bird genetic information would be modified to promote resistance to malarial infections. The practice of gene editing with CRISPR-Cas9 technology has been applied to domestic animals (Novak et al. 2018); for example, the genome of pigs was edited to enhance resistance to porcine reproductive and respiratory syndrome virus (Whitworth et al. 2016). Recently, the CRISPR-Cas9 tool was assessed in the conservation and recovery of the endangered black-footed ferret, a species vulnerable to sylvatic plague. The U.S. Fish and Wildlife Service approved an Endangered Species Recovery Permit for the foundational laboratory research for the genetic rescue of the species (Revive and Restore 2021), but the tool has not been applied to wild populations yet. Similarly, CRISPR-Cas9 could be applied to enhance resistance to avian malaria in Hawai‘i. This facilitated adaptation through gene editing has been a modeled approach, but the tool has not been developed for honeycreepers in Hawai‘i (Samuel et al. 2020). Technology for this approach is not available for near-term implementation. Genetic modification of culturally significant species could be highly controversial. This approach would not meet the purpose and need and is technologically infeasible at this time and has been dismissed from detailed analysis.

Ground Release of Mosquitoes using Cars, Trucks, or ATVs

Under this approach, *Wolbachia*-incompatible male mosquitoes are released into the wild via motor vehicles on the ground; wild female mosquitoes who mate with incompatible males lay eggs that do not hatch. Similar to the proposed action for this project, the regulatory path to obtain approval is defined and approvals are in place to use the approach to control mosquitoes of public health concern. The proposed project area covering the targeted birds' current and historic range is nearly entirely roadless. To release *Wolbachia*-incompatible male mosquitoes at the intervals necessary to achieve effective control, this approach would require construction of a vast network of roads that would be cost-prohibitive and would result in adverse environmental impacts to various natural and cultural resources. Roads and vehicles can create more larval habitat for mosquitoes as well as fragment critical habitat for endangered plants and animals present in the proposed project area. This approach, given current infrastructure, would not meet the project purpose and need and would likely result in significant adverse environmental impacts, and has therefore been dismissed from detailed analysis.

Pedestrian Release of Mosquitoes Without the Use of Helicopters

The project area in East Maui is 64,666 acres and is characterized by very remote, heavily forested, and exceptionally rugged terrain. Only a few roads penetrate this area and the only established trails accessible without the use of helicopters occur in Makawao Forest Reserve, Waikamoi Preserve, and the Lower Kīpahulu Valley comprising less than 2% of the overall project area. In order to release mosquitoes using only the pedestrian release method, a massive trail system would need to be developed over the entire East Maui project area at great cost and with resultant environmental impacts. In addition to the current lack of infrastructure that would potentially allow for mosquito releases without the use of helicopters, the short life span of the incompatible mosquitos would require rapid dispersal following shipment to Maui from the mainland, on the order of 24 hours. Pedestrian releases could not feasibly release mosquitoes throughout the project area within the required timeframe. Therefore, this alternative has been dismissed from detailed analysis.

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APPENDIX C:
Cultural Impact Assessment

Cultural Impact Assessment Report for the Proposed Activities Associated with the Suppression of Non-Native Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on Maui

Prepared for

State of Hawai‘i Department of Land and Natural Resources

Prepared by

HONUA CONSULTING

May 2022

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Note on Hawaiian Language Use

In keeping with other Hawaiian scholars, we do not italicize Hawaiian words. Hawaiian is both the native language of the paeʻāina of Hawaiʻi and an official language of the State of Hawaiʻi. Some authors will leave Hawaiian words italicized if part of a quote; we do not. In the narrative, we use diacritical markings to assist our readers, except in direct quotes, in which we keep the markings used in the original text. We provide translations contextually when appropriate. Unless otherwise noted, all translations are by Honua Consulting authors.

Front Cover Credit

Hawaii State Archives
n.d. Image of ʻIʻiwi bird, Jack Jefferies

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2022 Cultural Impact Assessment for the Proposed Activities Associated with the Suppression of Non-Native Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on Maui Prepared for Tetra Tech and State of Hawaiʻi, Departmetnt of Land and Natural Resources, Honua Consulting, Honolulu, Hawaiʻi.

Executive Summary

At the request of Tetra Tech, Inc,, Honua Consulting, LLC prepared a Cultural Impact Assessment (CIA) for the State of Hawai'i Department of Land and Natural Resources for the Proposed Activities Associated with the Suppression of Non-Native Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on Maui. The "Project Area" includes 262-square kilometers in East Maui on various Tax Map Keys (TMKs).

Research in preparation of this report consisted of a thorough search of Hawaiian language documents, including but not limited to the Bishop Museum Mele Index and Bishop Museum archival documents, including the Hawaiian language archival cache. All Hawaiian language documents were reviewed by Hawaiian language experts to search for relevant information to include in the report. Documents considered relevant to this analysis are included herein, and translations are provided when appropriate to the discussion. Summaries of interviews and information on other oral testimonies are also provided herein.

Based on the information gathered and the assessment of the resources conducted, the project is not anticipated to have any adverse impacts on cultural resources, traditions, customs, or practices.

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Abbreviations and Acronyms

AIS: Archaeological Inventory Survey
BMP: Best Management Practice
CIA: Cultural Impact Assessment
DC: Direct Current
EA: Enviornmental Assessment
ESP: Environmental Review Project, Office of Planning and Sustainable Development
HAR: Hawaii Administrative Rules
HRS: Hawaii Revised Statutes
ILK: Indigenous Local Knowledge
Ka Pa‘akai: *Ka Pa‘akai O Ka ‘Āina v. Land Use Commission*, 94 Haw. 31 (2000)
LRFI: Literature Review and Field Investigation
NPS: U.S. National Park Service
NRHP: National Register of Historic Places
OEQC: Office of Enviornmental Quality and Control
ROI: Range of Influence
SHPD: State Historic Preservation Division
SIHP: State Inventory of Historic Places
SLH: Session Laws of Hawaii
TEK: Traditional Ecological Knowledge
TMK: Tax Map Key
UH: University of Hawai‘i
USGS: U.S. Geological Survey

1.0 Project Description and Compliance

At the request of Tetra Tech, Inc., Honua Consulting, LLC prepared a Cultural Impact Assessment (CIA) for the State of Hawai'i Department of Land and Natural Reesources for the Proposed Activities Associated with the Suppression of Non-Native Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on Maui. The "Project Area" includes 262-square kilometers in East Maui on various Tax Map Keys (TMKs).

The proposed action consists of releasing *Wolbachia*-infected male *Culex quinquefasciatus* mosquitos within an approximately 262-square-kilometer (64,660-acre) project area on East Maui, Hawai'i. *Wolbachia* is a naturally occurring bacterium. This approach renders the *Wolbachia*-infected male mosquitos incapable of producing viable offspring after mating with wild-type females, thus providing landscape-scale control of the *Culex* population.

1.1 Project Description and Proposed Action

The Project Area Overview map (Figure 1) illustrates the overall project area. As noted, this project will involve releasing *Wolbachia*-infected male *Culex quinquefasciatus* mosquitos. There is no ground disturbance or construction activities associated with these activities. It is unique among cultural assessments in that these activities are largely programmatic in nature and involve a large area rather than project-based involving only a defined project area.

Additionally, species are not limited to physical boundaries. Therefore, while there is a specified project area in east Maui, depending on where these individuals are released, they may travel, to the extent they are physically capable, within the region as a whole.

Therefore, this cultural assessment focuses primarily on the following:

1. Any potential cultural value of mosquitoes themselves, as the proposed activities would result in a decline of the population on Maui.
2. The cultural value of Hawaiian forest birds, which would positively benefit from a reduction in mosquitoes that carry diseases harmful to these birds.
3. Traditional or customary practices in the project area.

Due to the programmatic nature of this action, a more cursory background on the project area is provided. East Maui is a tremendously significant cultural environment, with an important political history. This history is provided to the extent appropriate to assess the proposed activities.

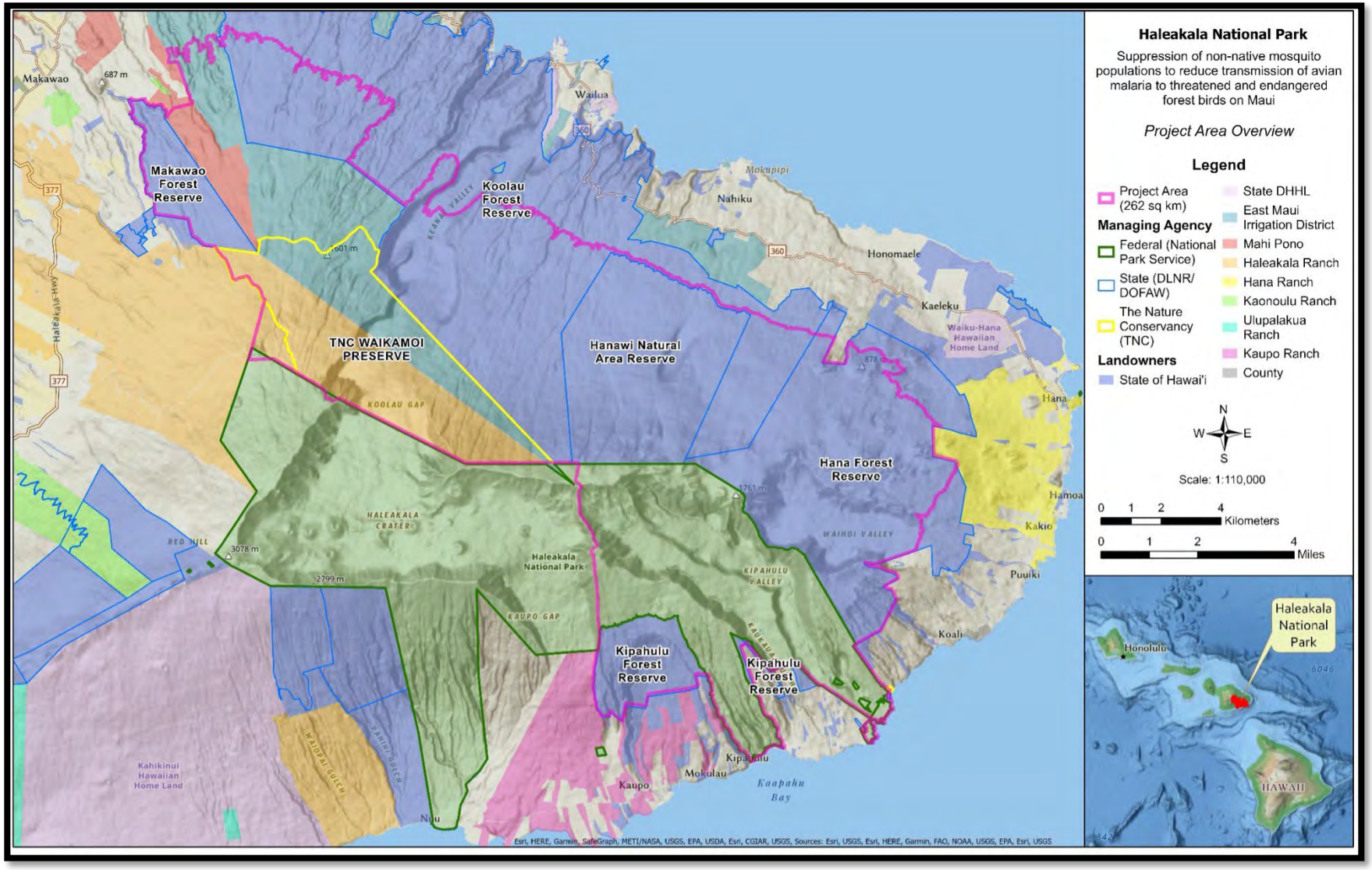


Figure 1. Project Area Overview (Tetra Tech)

1.2 Background

Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to protect and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. To assist decision makers in the protection of cultural resources, Chapter 343, HRS and Hawai'i Administrative Rules (HAR) § 11-200 rules for the environmental impact assessment process require project proponents to assess proposed actions for their potential impacts to cultural properties, practices, and beliefs.

This process was clarified by the Act 50, Session Laws of Hawai'i (SLH) 2000. Act 50 recognized the importance of protecting Native Hawaiian cultural resources and required some environmental review documents include the disclosure of the effects of a proposed action on the cultural practices of the community and state, and the Native Hawaiian community in particular. Specifically, the Environmental Council suggested the CIAs should include information relating to practices and beliefs of a particular cultural or ethnic group or groups. Such information may be obtained through public scoping, community meetings, ethnographic interviews, and oral histories.

It is important to note that while similar in their areas of studies, archaeological surveys and CIAs are concerned with distinct and different foci. Archaeological studies are primarily concerned with historic properties and tangible heritage, whereas CIAs look at cultural practices and beliefs, which can be associated with a specific location, but also often intangible in nature.

The State and its agencies have an affirmative obligation to preserve and protect Native Hawaiians' customarily and traditionally exercised rights to the extent feasible.[1] State law further recognizes that the cultural landscapes provide living and valuable cultural resources where Native Hawaiians have and continue to exercise traditional and customary practices, including hunting, fishing, gathering, and religious practices. In *Ka Pa'akai*, the Hawai'i Supreme Court provided government agencies an analytical framework to ensure the protection and preservation of traditional and customary Native Hawaiian rights while reasonably accommodating competing private development interests. This is accomplished through:

1) The identification of valued cultural, historical, or natural resources in the project area, including the extent to which traditional and customary Native Hawaiian rights are exercised in the project area;
2) The extent to which those resources—including traditional and customary Native Hawaiian rights—will be affected or impaired by the proposed action; and

1 Article XII, Section 7 of the Hawai'i State Constitution, Ka Pa'akai O Ka 'Āina v. Land Use Commission, 94 Haw. 31 [2000] (Ka Pa'akai), Act 50 SLH 2000.

3) The feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist.

The appropriate information concerning east Maui has been collected, focusing on areas near or adjacent to the project area. A thorough analysis of this project and potential impacts to cultural resources, historical resources, and archaeological sites is included in this assessment.

The CIA provides an overview of cultural and historic resources in the project area using thorough literature review, community and cultural practitioner consultation, and high-level, project-specific surveys. The CIA will focus on identifying areas in which disturbance should be avoided or minimized to reduce impacts to historic properties or culturally important features. The paramount goal is to prevent impacts through avoidance of sensitive areas and mitigating for impacts only if avoidance is not possible.

1.3 Geographic Extent

The geographic extent for impacts to cultural resources and historic properties includes the project area and localized surroundings. This CIA also reviews some of the resources primarily covered by the regulatory review. It primarily researches and reviews the range of biocultural resources identified through historical documents, traditional knowledge, information found in the Hawaiian language historical cache, and oral histories and knowledge collected from cultural practitioners and experts.

There is clear guidance from the Office of Environmental Quality and Control (OEQC), now known as the Environmental Review Project, Office of Planning and Sustainable Development (ESP), that recommends a geographic extent beyond the identified or typical boundaries of the geographic project area. The recommended area is typically the size of the traditional land area (ahupua‘a) or region (moku), but this can be larger or smaller depending on what best helps to identify the resources appropriately.

The geographic extent of the CIA is based on the position that the “project area” is part of a cultural landscape or cultural landscapes that therefore it is most appropriate to set and study the proposed alternatives within that cultural context.

In this case, the project area includes most of east Maui.

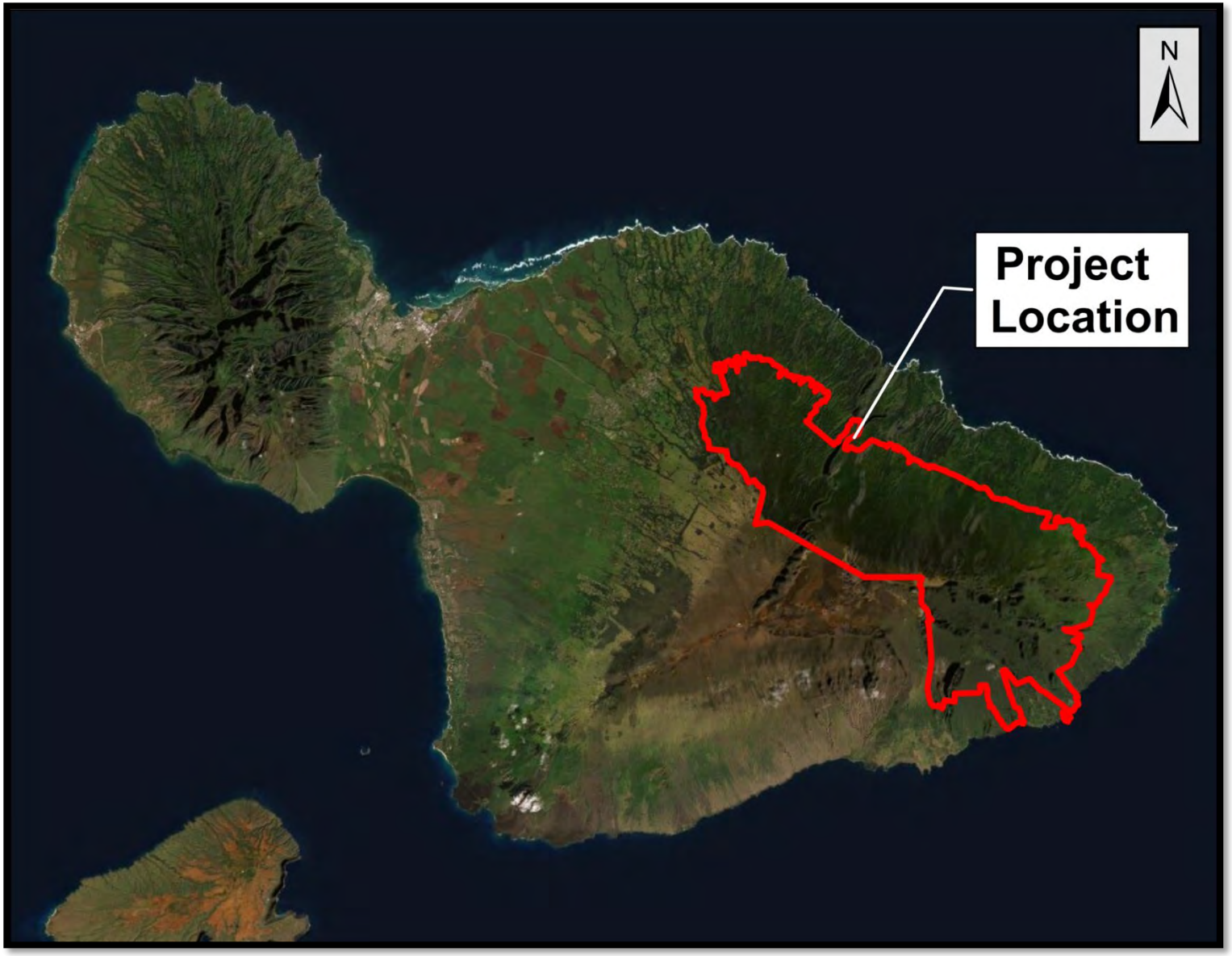


Figure 2. Project Area in relationship to the Island of Maui

Figure 3. Enlarged image of project area

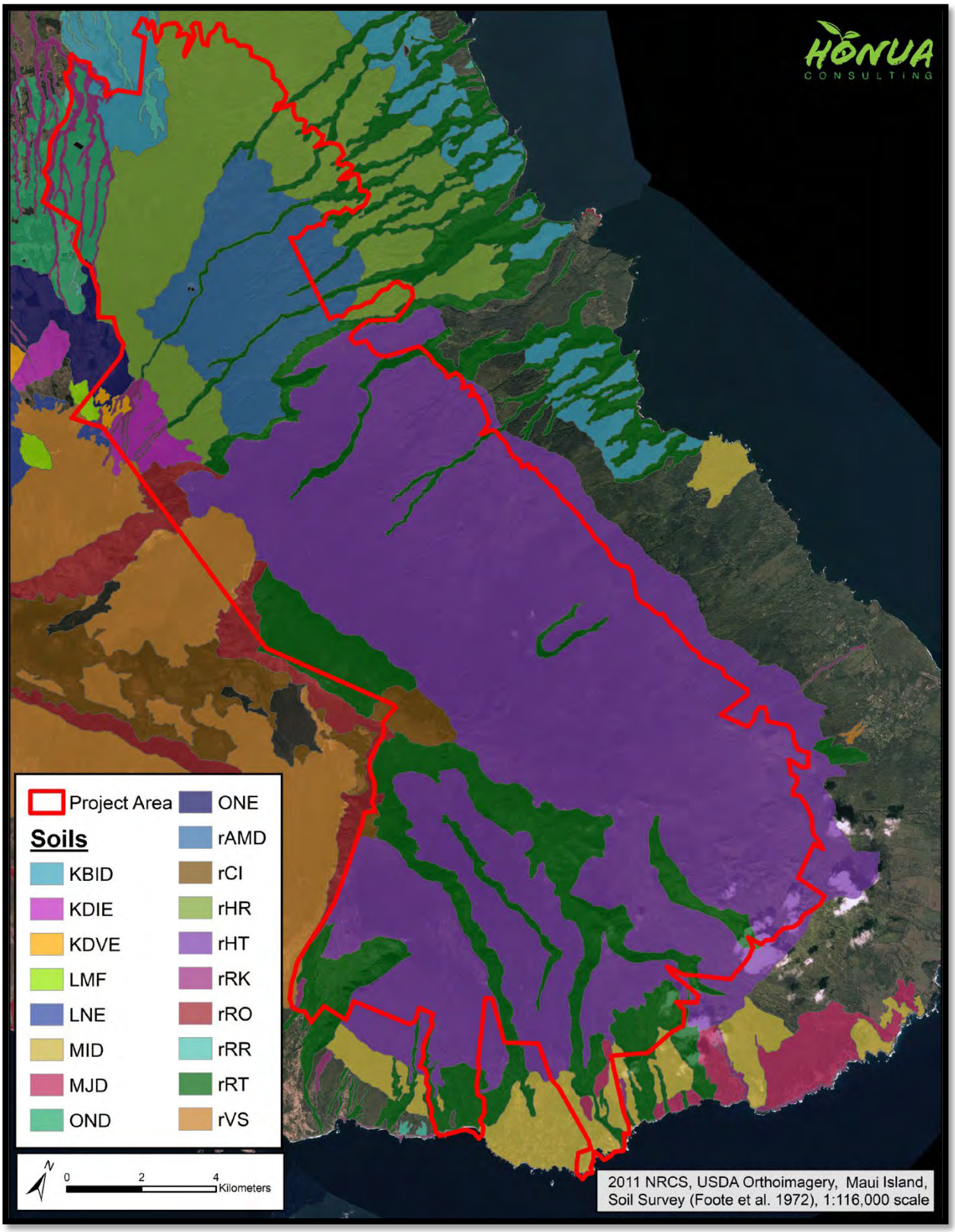


Figure 4. Soil types throughout project area

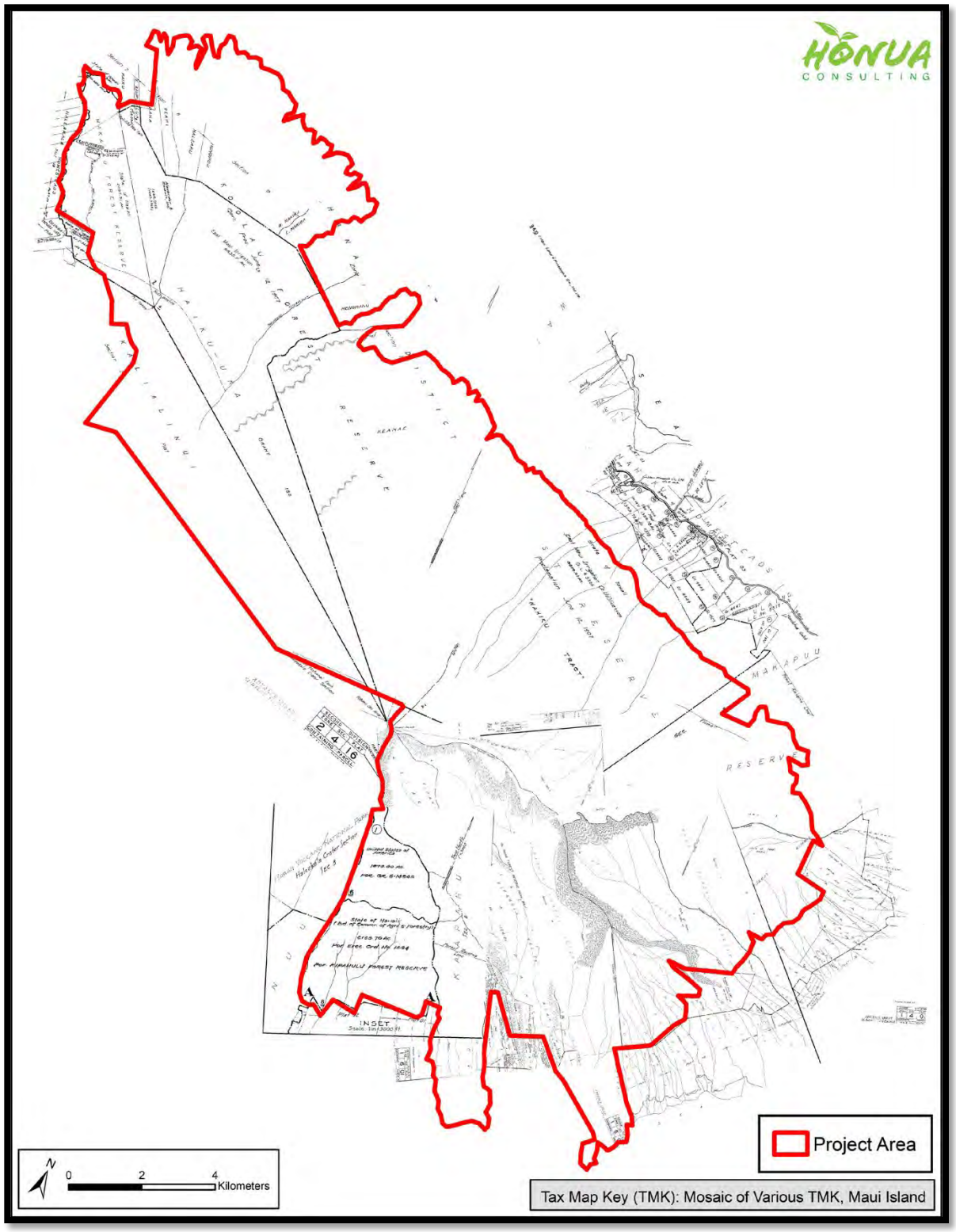


Figure 5. Project area with corresponding TMKs

1.4 Goal of Cultural Impact Assessment

This cultural impact assessment looks to partially fulfill the requirement of taking into account the Project's potential impacts on historic and cultural resources and, at a minimum, describe: a) any valued cultural, historic, or natural resources in the area in questions, including the extent to which traditional and customary native Hawaiian rights are exercised in the area, b) the extent to which those resources – including traditional and customary native Hawaiians rights – will be affected or impaired by the Project; and c) the feasible action, if any, to be taken to reasonably protect native Hawaiian rights if they are found to exist.

1.5 Regulatory Background

Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to protect and preserve cultural beliefs, practices, and resources of Kānaka ʻŌiwi (Native Hawaiians) and other ethnic groups. To assist decision makers in the protection of cultural resources, Chapter 343, HRS and Hawaiʻi Administrative Rules (HAR) § 11-200 rules for the environmental impact assessment process require project proponents to assess proposed actions for their potential impacts to cultural properties, practices, and beliefs.

This process was clarified by the Act 50, Session Laws of Hawaiʻi (SLH) 2000. Act 50 recognized the importance of protecting Native Hawaiian cultural resources and required that EAs include the disclosure of the effects of a proposed action on the cultural practices of the community and state, and the Native Hawaiian community in particular. Specifically, the Environmental Council suggested the CIAs should include information relating to practices and beliefs of a particular cultural or ethnic group or groups. Such information may be obtained through public scoping, community meetings, ethnographic interviews, and oral histories.

It is important to note that while similar in their areas of studies, archaeological surveys and CIAs are concerned with distinct and different foci. Archaeological studies are primarily concerned with historic properties and tangible heritage, whereas CIAs look at cultural practices and beliefs, which can be associated with a specific location, but also often intangible in nature.

1.6 Compliance

The State and its agencies have an affirmative obligation to preserve and protect Native Hawaiians' customarily and traditionally exercised rights to the extent feasible.[2] State law

2 Article XII, Section 7 of the Hawaiʻi State Constitution, Ka Paʻakai O Ka ʻĀina v. Land Use Commission, 94 Haw. 31 [2000] (Ka Paʻakai), Act 50 SLH 2000.

further recognizes that the cultural landscapes provide living and valuable cultural resources where Native Hawaiians have and continue to exercise traditional and customary practices, including hunting, fishing, gathering, and religious practices. In *Ka Pa'akai*, the Hawai'i Supreme Court provided government agencies an analytical framework to ensure the protection and preservation of traditional and customary Native Hawaiian rights while reasonably accommodating competing private development interests. This is accomplished through:

4) The identification of valued cultural, historical, or natural resources in the project area, including the extent to which traditional and customary Native Hawaiian rights are exercised in the project area;
5) The extent to which those resources—including traditional and customary Native Hawaiian rights—will be affected or impaired by the proposed action; and
6) The feasible action, if any, to be taken to reasonably protect Native Hawaiian rights if they are found to exist.

While not attached to a HRS Chapter 343 action, this CIA was prepared under HRS Chapter 343 and Act 50 SLH 2000 as those are the prevailing standards and best practices for CIAs. The appropriate information concerning the ahupua'a has been collected, focusing on areas near or adjacent to the project area. A thorough analysis of this project and potential impacts to cultural resources, historical resources, and archaeological sites is included in this assessment.

The present analyses of archival documents, oral traditions (oli or chants, mele or songs, and/or hula or dance texts), and Hawaiian language sources including books, manuscripts, and newspaper articles, are focused on identifying recorded cultural and archaeological resources present on the landscape, including: Hawaiian and non-Hawaiian place names; landscape features (ridges, gulches, cinder cones); archaeological features (kuleana parcel walls, house platforms, shrines, heiau or places of worship, etc.); culturally significant areas (viewsheds, unmodified areas where gathering practices and/or rituals were performed); and significant biocultural resources. The information gathered through research helped to focus interview questions on specific features and elements within the project area.

Interviews with lineal and cultural descendants are instrumental in procuring information about the project area's transformation through time and changing uses. Interviews were conducted with recognized cultural experts and summaries of those interviews are included herein.

2.0 Methodology

The approach to developing the CIA is as follows:

1) Gather Best Information Available
   a) Gather historic cultural information from stories and other oral histories about the affected area to provide cultural foundation for the report;
   b) Inventory as much information as can be identified about as many known cultural, historic, and natural resources, including previous archaeological inventory surveys, CIAs, etc. that may have been completed for the possible range of areas; and
   c) Update the information with interviews with cultural or lineal descendants or other knowledgeable cultural practitioners.
2) Identify Potential Impacts to Cultural Resources
3) Develop Reasonable Mitigation Measures to Reduce Potential Impacts
   a) Involve the community and cultural experts in developing culturally appropriate mitigation measures; and
   b) Develop specific Best Management Practices (BMPs), if any are required, for conducting the project in a culturally appropriate and/or sensitive manner as to mitigation and/or reduce any impacts to cultural practices and/or resources.

While numerous studies have been conducted on this area, very few have effectively utilized Hawaiian language resources and Hawaiian knowledge. This appears to have impacted modern understanding of this location, as many of the relevant documents are native testimonies given by Kanaka Hawai'i (Hawaiians) who lived on this land.

While hundreds of place names and primary source historical accounts (from both Hawaiian and English language narratives) are cited on the following pages, it is impossible to tell the whole story of these lands in any given manuscript. A range of history, spanning the generations, has been covered. Importantly, the resources herein are a means of connecting people with the history of their communities—that they are part of that history. Knowledge of place will, in turn, promote appreciation for place and encourage acts of stewardship for the valued resources that we pass on to the future.

Background research for the literature review was conducted using materials obtained from the State Historic Preservation Division (SHPD) library in Kapolei and the Honua Consulting LLC. report library. On-line materials consulted included the Ulukau Electronic Hawaiian Database (www.ulukau.com), Papakilo Database (www.papakilodatabase.com), the State Library on-line (http://www.librarieshawaii.org/Serials/databases.html), and Waihona 'Āina Māhele database (http://www.waihona.com). Hawaiian terms and place names were translated using the on-line Hawaiian dictionaries (Nā Puke Wehewehe 'Ōlelo Hawai'i)

(www.wehewehe.com), *Place Names of Hawai'i* (Pukui et al. 1974), and *Hawai'i Place Names* (Clark 2002). Historic maps were obtained from the State Archives, State of Hawai'i Land Survey Division website (http://ags.hawaii.gov/survey/map-search/), UH-Mānoa Maps, Aerial Photographs, and GIS (MAGIS) website (http://guides.library.manoa.hawaii.edu/magis). Maps were geo-referenced for this report using ArcGIS 10.3. GIS is not 100% precise and historic maps were created with inherent flaws; therefore, geo-referenced maps should be understood to have some built-in inaccuracy.

While conducting the research, primary references included, but were not limited to: land use records, including the Hawaiian L.C.A. records from the Māhele 'Āina (Land Division) of 1848; the Boundary Commission Testimonies and Survey records of the Kingdom and Territory of Hawai'i; and historical texts authored or compiled by: David Malo (1987); Samuel M. Kamakau (1964, 1991, 1992); records of the American Board of Commissioners of Foreign Missions (A.B.C.F.M.) (1820–1860); Charles Wilkes (1845); Alexander & Preston (1892–1894); Abraham Fornander (1916–1919); and many other native and foreign writers. The study also includes several native accounts from Hawaiian language newspapers (primarily compiled and translated from Hawaiian to English by K. Maly), and historical records authored by nineteenth century visitors, and residents of the region.

Historical and archival resources were located in the collections of the Hawai'i State Archives, Survey Division, Land Management Division, Survey Division, and Bureau of Conveyances; the Bishop Museum Library and Archives; the Hawaiian Historical Society and the Hawaiian Mission Children's Society Library; University of Hawai'i-Hilo Mo'okini Library; the National Archives and Records Administration (NARA), Maryland; the Library of Congress, Washington D.C.; the National Oceanic and Atmospheric Administration National Library, Maryland; the Smithsonian Institution Natural History and National Anthropological Archives libraries, Washington, D.C.; the Houghton Library at Harvard; the United States Geological Survey (USGS) Library, Denver; the Paniolo Preservation Society and Parker Ranch collections; private family collections; and in the collection of Kumu Pono Associates LLC. This information is generally cited in categories by chronological order of the period depicted in the narratives.

M. P. Nogelmeier (2010) discusses the adverse impacts of methodology that fails to properly research and consider Hawaiian language resources. He strongly cautions against a mono-rhetorical approach that marginalizes important native voices and evidence from consideration, specifically in the field of archaeology. For this reason, Honua Consulting consciously employs a poly-rhetorical approach, whereby all data, regardless of language, is researched and considered. To fail to access these millions of pages of information within the Hawaiian language cache could arguably be a violation of Act 50, as such an approach would fundamentally fail to gather the best information available, especially considering the

voluminous amounts of historical accounts available for native tenants in the Hawaiian language.

Hawaiian culture views natural and cultural resources as largely being one and the same: without the resources provided by nature, cultural resources could and would not be procured. From a Hawaiian perspective, all natural and cultural resources are interrelated, and all natural and cultural resources are culturally significant. Kepā Maly (2001), ethnographer and Hawaiian language scholar, points out, "In any culturally sensitive discussion on land use in Hawai'i, one must understand that Hawaiian culture evolved in close partnership with its natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture ends and nature begins" (Maly 2001:1). As a leading researcher and scholars on Hawaiian culture, Maly, along with his wife, Onaona, have conducted numerous ground-breaking studies on cultural histories throughout Hawai'i. A substantial part of the archival research utilized in this study was previously compiled and published by Kepā and Onaona Maly, who have granted their permission to use this important work and are identified properly as associated authors and researchers to this study.

This study also specifically looks to identify intangible resources. Tangible and intangible heritage are inextricably linked (Bouchenaki 2003). Intangible cultural resources, also identified as intangible cultural heritage (ICH), are critical to the perpetuation of cultures globally. International and human rights law professor Federico Lenzerini notes that, "At present, we are aware on a daily basis of the definitive loss—throughout the world—of language, knowledge, knowhow, customs, and ideas, leading to the progressive impoverishment of human society" (Lenzerini 2011:12). He goes on to warn that:

> the rich cultural variety of humanity is progressively and dangerously tending towards uniformity. In cultural terms, uniformity means not only loss of cultural heritage—conceived as the totality of perceptible manifestations of the different human groups and communities that are exteriorized and put at the others' disposal—but also standardization of the different peoples of the world and of their social and cultural identity into a few stereotyped ways of life, of thinking, and of perceiving the world. Diversity of cultures reflects diversity of peoples; this is particularly linked to ICH, because such a heritage represents the living expression of the idiosyncratic traits of the different communities. Preservation of cultural diversity, as emphasized by Article 1 of the UNESCO Universal Declaration on Cultural Diversity, 'is embodied in the uniqueness and plurality of the identities of the groups and societies making up humankind'. Being a 'source of exchange, innovation and creativity', cultural diversity is vital to humanity and is inextricably linked to the safeguarding of ICH. Mutual recognition and respect for cultural diversity—and, *a fortiori*, appropriate safeguarding of the ICH of the diverse peoples making up the world—Is essential for promoting

> harmony in intercultural relations, through fostering better appreciation and understanding of the differences between human communities. (Lenzarini 2011:103)

Therefore, tradition and practice, as elements of Hawaiian ICH, are essential to the protection of Hawaiian rights and the perpetuation of the Hawaiian culture.

2.1 Identifying Traditional or Customary Practices

It is within this context that traditional or customary practices are studied. The concept of traditional or customary practices can often be a challenging one for people to grasp. Traditional or customary practices can be defined as follows:

Figure 6. Diagram of elements that contribute to traditional or customary practices (Honua Consulting)

The first element is knowledge. This has been referred to as traditional ecological knowledge (TEK), Indigenous local knowledge (ILK), or ethnoscience. In the context of this study, it is the information, data, knowledge, or expertise Native Hawaiians or local communities possessed or possess about an area's environment. In a traditional context, this would have included information Hawaiians possessed in order to have the skills to utilize the area's resources for a range of purposes, including, but not limited to, travel, food, worship or habitation. This element is largely intangible.

The second element are the resources themselves. These are primarily tangible resources, either archaeological resources (i.e., habitation structures, walls, etc.) or natural resources (i.e., plants, animals, etc.). These can also be places, such as a sacred or culturally important sites or wahi pana. Sometimes these wahi pana are general locations, this does not diminish their importance or value. Nonetheless, it is important to recognize that potential eligibility as a "historic site" on the National Register of Historic Places (NRHP) would require identifiable boundaries of a site.

The third element is access. The first two elements alone are not enough to allow for traditional or customary practices to take place. The practitioners must have access to the resource in order to be able to practice their traditional customs. Access does not just mean the ability to physically access a location, but it also means access to resources. For example,

if a particular plant is used for medicinal purposes, there needs to be a sufficient amount of that plant available to practitioners for us. Therefore, an action that would adversely impact the population of a particular plant with cultural properties would impact practitioners' ability to access that plant. By extension, it would adversely impact the traditional or customary practice.

Traditional or customary practices are, therefore, the combination of knowledge(s), resource(s) and access. Each of these individual elements should be researched and identified in assessing any potential practices or impacts to said practices.

2.2 Traditional Knowledge, or Ethnoscience, and the Identification of Cultural Resources

The concept of ethnoscience was first established in the 1960s and has been defined "the field of inquiry concerned with the identification of the conceptual schemata that indigenous peoples use to organize their experience of the environment" (Roth 2019). Ethnoscience includes a wide range of subfields, includes, but is not limited to, ethnoecology, ethnobotany, ethnozoology, ethnoclimatology, ethnomedicine and ethnopedology. All of these fields are important to properly identify traditional knowledge within a certain area.

Traditional Native Hawaiian practitioners were scientists and expert natural resource managers by necessity. Without modern technological conveniences to rely on, Hawaiians developed and maintained prosperous and symbiotic relationships with their natural environment for thousands of years. Their environments were their families, their homes, and their laboratories. They knew the names of every wind and every rain. The elements taught and inspired. The ability of Indigenous people to combine spirituality and science led to the formation of unique land-based methologides that spurred unsurpassed innovation. Therefore, identifying significant places requires a baseline understanding of what made places significant for Hawaiians.

Hawaiians were both settlers and explorers. In *Plants in Hawaiian Culture,* B. Krauss explains: "Exploration of the forests revealed trees, the timber of which was valuable for building houses and making canoes. The forests also yielded plants that could be used for making and dying tapa, for medicine, and for a variety of other artifacts" (Krauss 1993). Analysis of native plants and resource management practices reveals the depth to which Hawaiians excelled in their environmental science practices:

> [Hawaiians] demonstrated great ability in systematic differentiation, identification, and naming of the plants they cultivated and gathered for use. Their knowledge of the gross morphology of plants, their habits of growth, and the requirements for greatest yields is not excelled by expert agriculturists of more complicated cultures. They worked out the procedures of cultivation for every locality, for all altitudes, for different

> weather conditions and exposures, and for soils of all types. In their close observations of the plants they grew, they noted and selected mutants (spores) and natural hybrids, and so created varieties of the plants they already had. Thus over the years after their arrival in the Islands, the Hawaiians added hundreds of named varietis of taro, sweet potatoes, sugarcane, and other cultivated plants to those they had brought with them from the central Pacific (Krauss 1993).

Thus, Native Hawaiians reinforced the biodiversity that continues to exist in Hawai‘i today through their customary traditional natural resource management practices.

The present analyses of archival documents, oral traditions (oli or chants, mele or songs, and/or hula dances and ha‘i mo‘olelo or storytelling performances), and Hawaiian language sources including books, manuscripts, and newspaper articles, are focused on identifying recorded cultural resources present on the landscape, including: Hawaiian and non-Hawaiian place names; landscape features (ridges, gulches, cinder cones); archaeological features (kuleana parcel walls, house platforms, shrines, heiau [places of worship], etc.); culturally significant areas (viewsheds, unmodified areas where gathering practices and/or rituals were performed); and significant biological, physiological, or natural resources. This research also looks to document the wide range of Hawaiian science that existed within the geographic extent.

2.3 Mo‘olelo ‘Āina: Native Traditions of the Land

Among the most significant sources of native mo‘olelo are the Hawaiian language newspapers which were printed between 1838 and 1948, and the early writings of foreign visitors and residents. Most of the accounts that were submitted to the papers were penned by native residents of areas being described and noted native historians. Over the last 30 years, Kepā Maly has reviewed and compiled an extensive index of articles published in the Hawaiian language newspapers, with particular emphasis on those narratives pertaining to lands, customs, and traditions. Many traditions naming places around Hawai‘i are found in these early writings. Many of these accounts describe native practices, the nature of land use at specific locations, and native mo‘olelo (history, narrative, story). Thus, we are given a means of understanding how people related to their environment and sustained themselves on the land.

2.4 Historic Maps

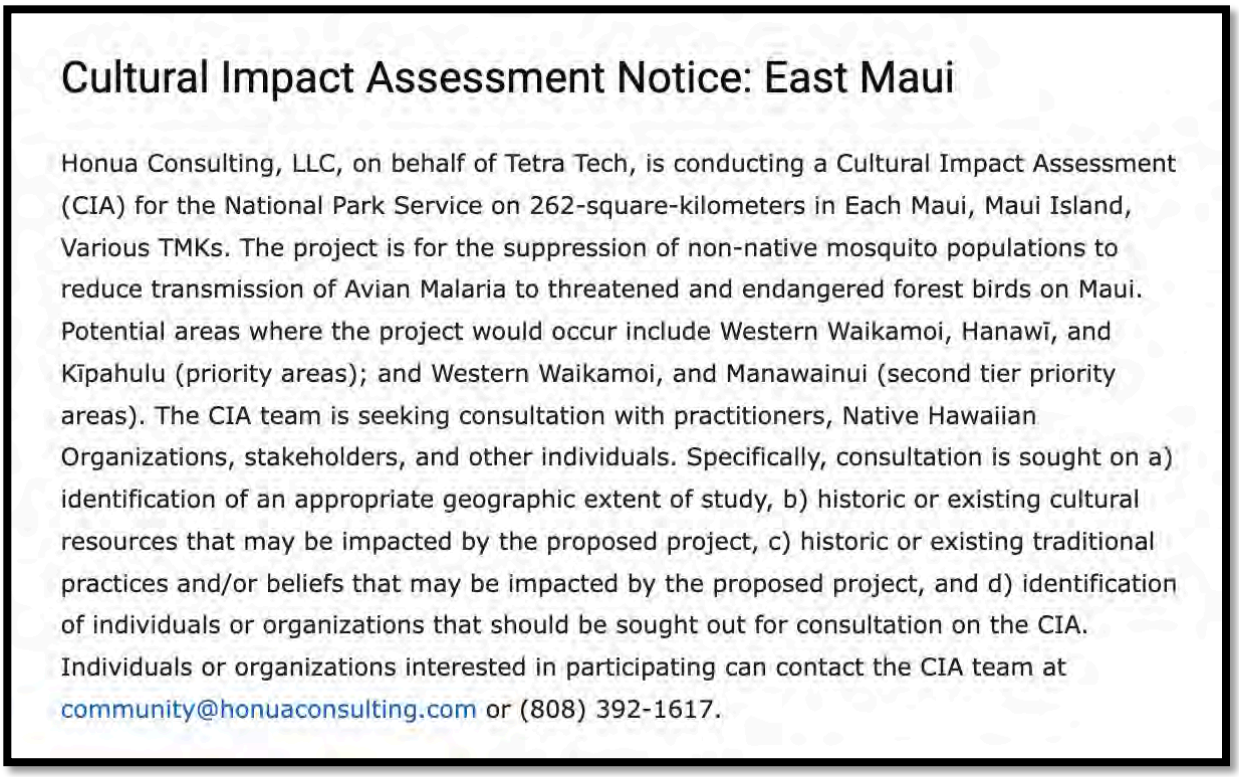
There are also numerous, informative historic maps for the region. Surveyors of the eighteenth and nineteenth centuries were skilled in traversing land areas and capturing important features and resources throughout Hawai‘i’s rich islands. Historic maps were carefully studied, and the features detailed therein were aggregated and categorized to help identify

specific places, names, features, and resources throughout the study area. From these, among other documents, new maps were created that more thoroughly capture the range of resources in the area.

2.5 Ethnographic Methodology

Information from lineal and cultural descendants is instrumental in procuring information about the project area's transformation over time and its changing uses. The present analyses of archival documents, oral traditions (including oli or chants, mele or songs), and/or hula dance), and Hawaiian language sources including books, manuscripts, and newspaper articles, are focused on identifying recorded cultural and archaeological resources present on the landscape, including: Hawaiian and non-Hawaiian place names; landscape features (ridges, gulches, cinder cones); archaeological features (kuleana parcel walls, house platforms, shrines, heiau or places of worship, etc.); culturally significant areas (viewsheds, unmodified areas where gathering practices and/or rituals were performed); and significant biocultural resources. The information gathered through research helped to focus interview questions on specific features and elements within the project area.

Information from lineal and cultural descendants are instrumental in procuring information about the project area's transformation through time and changing uses. A notice was placed in the *Ka Wai Ola*, published by the Office of Hawaiian Affairs (Figure 3). Additionally, letters were sent to area organizations inviting their participation. All the correspondence provided through these processes are included in the appendices.



Cultural Impact Assessment Notice: East Maui

Honua Consulting, LLC, on behalf of Tetra Tech, is conducting a Cultural Impact Assessment (CIA) for the National Park Service on 262-square-kilometers in Each Maui, Maui Island, Various TMKs. The project is for the suppression of non-native mosquito populations to reduce transmission of Avian Malaria to threatened and endangered forest birds on Maui. Potential areas where the project would occur include Western Waikamoi, Hanawī, and Kīpahulu (priority areas); and Western Waikamoi, and Manawainui (second tier priority areas). The CIA team is seeking consultation with practitioners, Native Hawaiian Organizations, stakeholders, and other individuals. Specifically, consultation is sought on a) identification of an appropriate geographic extent of study, b) historic or existing cultural resources that may be impacted by the proposed project, c) historic or existing traditional practices and/or beliefs that may be impacted by the proposed project, and d) identification of individuals or organizations that should be sought out for consultation on the CIA. Individuals or organizations interested in participating can contact the CIA team at community@honuaconsulting.com or (808) 392-1617.

Figure 7. Copy of the public notice placed in the *Ka Wai Ola* in November 2021

3. Historic Background

The purpose of this section is to characterize the Hawaiian cultural landscape within which the project area is located; this includes a description of east Maui's relevant and representative inoa ʻāina (place names), moʻolelo (oral-historical accounts), wahi pana (legendary places), and other natural and cultural resources. A general (ahupuaʻa-wide) summary is followed by a project-area specific discussion.

3.1 Traditional Period

Maui has a unique geography; it is considered to be two islands, joined together by an isthmus. Land divisions on Maui are unlike those on other islands (Sterling 1998). Ancient names for Maui include Ihikapalaumaewa and Kulua (Sterling 1998: 2).

The forested regions of Maui Hikina (East Maui) are made up of several forest reserves and conservation areas including the Makawao Forest Reserve (located in the district of Hāmākualoa), the Koʻolau Forest Reserve, the Waikamoi Preserve (located in the district of Hāmākuapoko), the Hanawī Natural Area Reserve, the Hāna Forest Reserve, the Kīpahulu Valley Biological Preserve, and the Kīpahulu Forest Reserve. These upland regions are situated in the wao akua, distant mountain regions surrounded by wilderness and believed to be inhabited by the gods. They are also situated on the eastern slopes of Haleakalā. These lands form the rich watershed forests of Maui Hikina, collecting rains (ua) and mists (ʻohu) from the koʻolau or windward weather systems.

Abundant rains from rich forests like those in the upper regions of Maui Hikina form hundreds of streams (kahawai) that form large valleys and gulches. These well-watered valleys in Maui Hikina have been home to many endemic life forms, including native birds, and have sustained Native Hawaiian communites for centuries. The wao akua supplies vital natural resources for plant and wildlife. Kepā Maly describes the signifiance of natural resources to Native Hawaiians:

> We find in native traditions and beliefs, that Hawaiians shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything on the land and in the ocean was believed to be alive. Indeed, every form of nature in ancient Hawaiʻi was believed to be a body-form of some god or lesser deity. In the Hawaiian mind, care for each aspect of nature, the kino lau (myriad body-forms) of the elder life forms, was a way of life. This concept is still expressed by Hawaiian kūpuna (elders) through the present day, and passed on in many native families. Also, in this cultural context, anything which damages the native nature of the land, forests, ocean, and kino lau therein, damages the integrity of the whole. Thus caring for, and protecting the land and ocean resources, is a way of life. Furthermore,

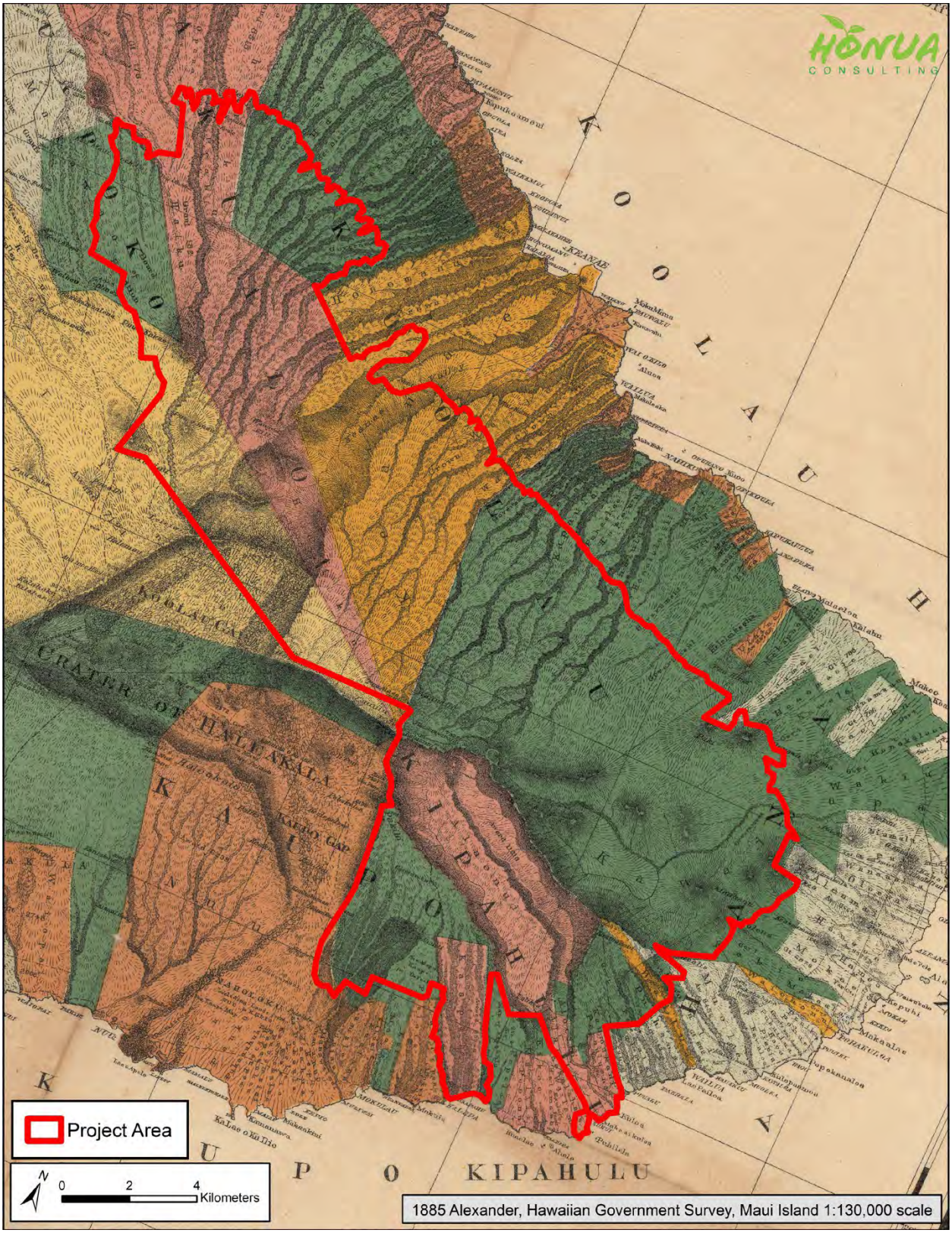
> in the traditional context above referenced, we find that the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the natural landscape itself is a highly valued cultural property. It's protection, and the continued exercise of traditional and customary practices, in a traditional and customary manner, are mandated by native custom, and State and Federal Laws (as those establishing the Maui Hikina Forest and Natural Area Reserves, and the Waikamoi Preserve). Maly, 2006: 3.

In the early 1900s, the Maui Hikina forest and watershed lands were determined to be some of the most significant in Hawai'i and in need of protection. Between 1907 and 1986 several different Forest Reserves, including the Haleakalā National Park, were established to protect the fragile ecosystem and the natural and cultural resources in the vicinity. These forested regions are home to several species of endangered or threatended native birds. Many of Hawai'i's native honeycreepers are restricted to East Maui as their only existing habitat.

Hawaiian mo'okū'auhau (genealogical accounts) reveal that the Hawaiian islands were born from akua (gods) who also birthed the first Hawaiian people. One mo'okū'auhau records that Wākea (the expanse of the sky– father) and Papahānaumoku (Papa—Earth-mother who gave birth to the islands), also called Haumeanuihānauwāwā (Great Haumea—Woman-earth born time and time again), and various akua gave birth to the islands. Maui, the second largest of the islands, was the second-born of these island-children. These same akua were also the parents of Hāloanakalaukapalili (long stalk quaking and trembling leaf). This Hāloa was born as a "shapeless mass" and buried outside the door of his parents' house (cf. Pukui and Elbert, 1981:382), and from his grave grew the very first kalo (taro) plant. When the next child was born to these akua, he was also named Hāloa (the long stalk or breath of life), and he is considered to be the progenitor of the Hawaiian race (cf. David Malo 1951:3, 242-243; Beckwith 1970; Pukui and Korn 1973). It was in this context of kinship that Native Hawaiians interacted with their environment and it is the basis of the Hawaiian system of land use.

There are several mo'olelo (traditional accounts, stories, histories) that discuss the uplands and forested regions of Maui Hikina. Ethnographer and researcher, Kepā Maly, has gathered and translated many traditions from Hawaiian language resources concerning Maui Hikina.


Project Area
0 2 4 Kilometers
1885 Dodge, Hawaiian Government Survey (RM 1269 [in color]) 1:116,000 scale


Project Area
0 2 4 Kilometers
1885 Alexander, Hawaiian Government Survey, Maui Island 1:130,000 scale
KIPAHULU

3.1.1 He Moʻolelo no Kamapuaʻa (1861)

"He Moolelo no Kamapuaa" (A Tradition of Kamapuaʻa) predates the twelfth century. This moʻolelo was submitted to the Hawaiian language newspress, *Ka Hae Hawaii*, in 1861 by G.W. Kahiolo who wrote from Kalihi, Oʻahu. Kamapuaʻa is a Hawaiian kupua (demigod) who could transform into a wide range of forms including a pig and a human form. Kamapuaʻa is associated with agriculture, rain, and the god Lono. The issue published on August 7, 1861 (Helu 7) includes the first written account of Kamapuaʻa's visit to Maui:

> ...Kamapuaʻa's advances towards Pele, having been thwarted, he departed from Kilauea, following Kapo-maʻilele (Pele's sister who had taken her genitals off and thrown them across the land to distract Kamapuaʻa — thus the name, Kapo-of-the-flyinggenitals). It was in this way that Kapo-maʻilele saved Pele from Kamapuaʻa's advances. Traveling across the island of Hawaiʻi, and eating maiʻa (bananas), Kamapuaʻa met with Kapo-maʻilele at Kahuā in Kohala. Kapo-maʻilele then flew across the sea, and returned to her home on Maui, at Wailua-iki. From the heights of Kapaliiuka, Kamapuaʻa looked across the ocean, and decided to follow her. He crossed the channel and landed at Hāmoa, Hāna... He then traveled to Kawaikau which is near the boundary between Koʻolau and Hāna. From there, he traveled to Kaliae, and then arrived at Wailua-iki, where he found the house of Kapo-maʻilele. Looking shoreward, he saw Puoenui, the husband of Kapo, fishing. He then chanted:
>
> Kanikani hia Hikapoloa—e,
> *Hīkapōloa cries out loudly.*
> Ka la o Wailua-iki.
> *The day is at Wailua-iki.*
> Ka lai malino a Kapo i noho ai,
> *Kapo dwells in the calm,*
> A ka wahine a Pueonui,
> *The woman of Pueonui,*
> I noho nanea i ka lai a ke Koolau, aloha.
> *Dwelling with pleasure, in the peace of Koʻolau—aloha.*
>
> Kamapuaʻa then went to the kapa making house (hale akuku), and asked Kapo-maʻilele if they two might sleep together. She agreed, and they did. Now a man saw this and went to tell Pueonui that his wife was sleeping with another man. Pueonui returned to the house in anger, and he struck Kamapuaʻa on the back with a paddle. Kapo got angry, and he struck Kamapuaʻa again. Kapo told him "stop, don't do that, for he is not a man, but is Kamapuaʻa." Hearing this, he was afraid, for he had heard that he was a god and man of power. Kamapuaʻa then went to Hāmākua-loa,

Hāmākua-poko, and on to Wailuku... [Kahiolo in Ka Hae Hawaii, August 7, 1861. Maly, translator]

3.1.1 Inoa ʻĀina

Inoa ʻĀina or place names are critical in understanding how Hawaiians valued and understood their surrounding environment. A selection of place names from the project area are provided below.

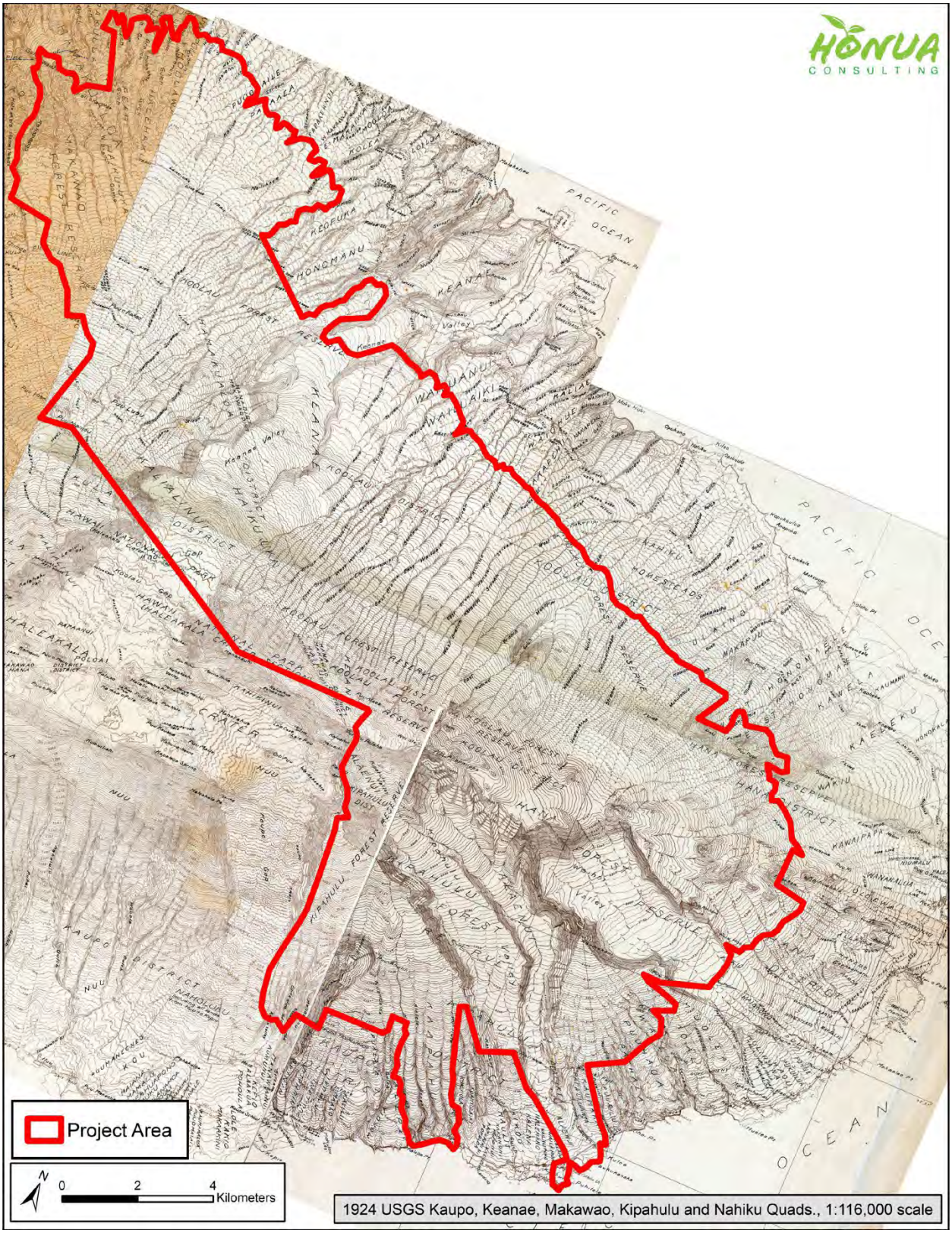
Table 1. Selected inoa ʻāina from the project area.

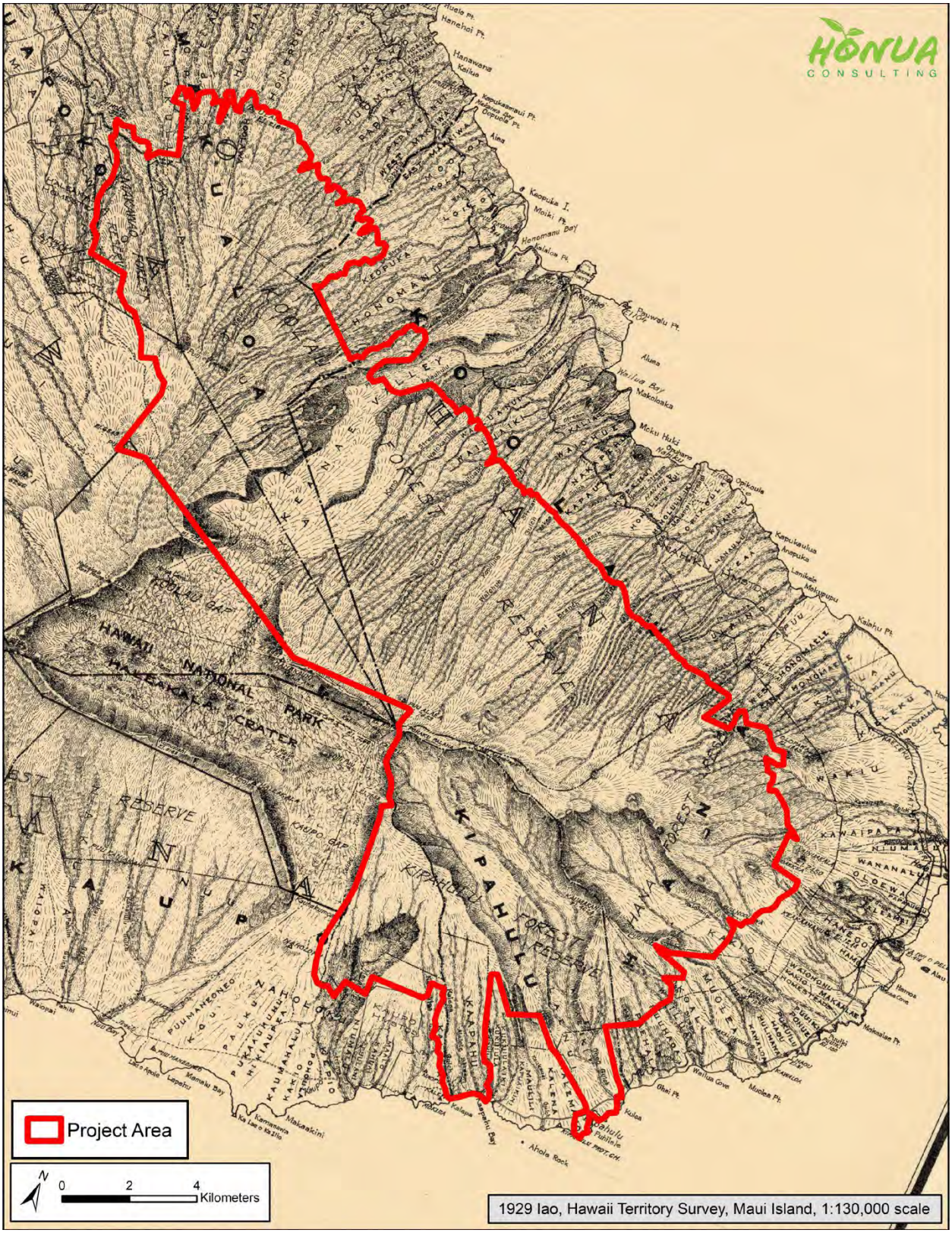
Inoa	Description
Makawao	Derivision of its name. The trade wind which blows from the ocean across the northwestern slope of Haleakala is highly charged with vapor, which is cooled by the cool mountain air, and falls in abundant rains over the region of Makawao. Along the western side of the mountain, about half way to the summit, lay a long line of cumulo stratus clouds, and between this and the nimbus there is but little space. The former lay along the side of the mountain, apparantly immovable, while the latter would advance and recede, now coming very near and coquettishly scattering its shining rain drops beneath the very head of the immovable cumulus, and now retreating as though afraid of its more dignified companion. This the feature of the clouds which gave the place its name, Makawao, “makao” to be afraid, “wao” a cloud.
East Makaiwa	Eleio was universally noted for his great speed who was also known as a messenger for the great king of Maui, called Kakaʻaleneo. When Kakaʻaleneo was ready for his morning meal, he would order Eleio to go to Hana and bring him some awa. On one of his trips to Hana, he met a ghost named, Kaʻahualiʻi in the forest of Oʻopuloa. The ghost asked Eleio to give him some of the awa, and Eleio insulted the ghost by telling him to take the hairs of his body and use it for his awa.

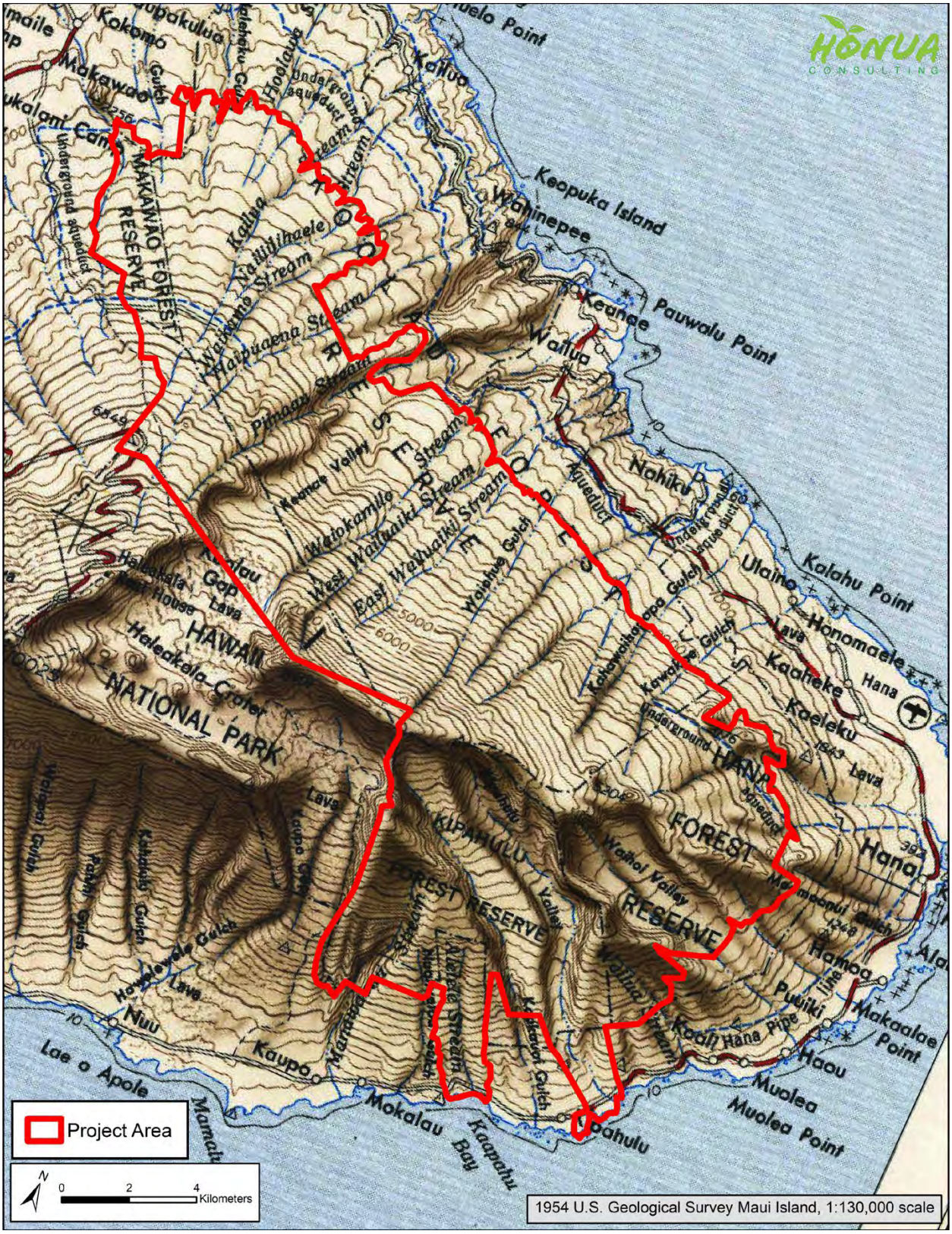
Inoa	Description
Ke‘anae	In times of great famine, ti roots were gathered from the forest in large quantities and steamed in great ovens, then grated, mashed, and mixed with water, and drunk. It is said that there was a famous oven of this sort east of Honolulu at Kaimuki “the tea oven”. At Ke‘anae, there was likewise a great *imu ki,* a pit in the lava to make this famous drink.
Kawaipapa	After the war of Kapalipio, Kamehameha-nui remained ruling chief of Maui. Later in life, He was taken ill at Kawaipapa on a journey about the island, and at Nenewepua in Hana, he ceded his lands and the ruling power to Kahekili who became the ruler of of Maui. Reaching Hamakualoa, Kamehameha-nui died and was laid to rest at Pihana.
Kukui‘ula	The stream where the rugged ridge and valley trail to Kaupo begins, waters several small groups of terraces which are still in use.
Ka‘āpahu	About 1786 with Kahekili on O‘ahu, Kamehameha decided to try and take the districts of Hana and Kīpahulu and sent his younger brother Kalanimalokuloku-i-Kapo‘ikalani who accomplished this mission. As soon as Kalanikupule received tidings of this invasion, he immediately send Kamohomoho with what forces he could muster to drive the invaders out of Maui. The armies met on the Kīpahulu side of the Lelekea gulch, and the battle waged with great fierceness. The Hawai‘i troops were driven back as ar as Maulili, in Kīpahulu, where they were joined by a reinforcement under Kahanaumaikai and the battle continued. But victory rested with the Maui troops, and what were not killed of the Hawaii expedition fled back to Kohala.

3.2 Historic Period

This section describes general land-use patterns and change in East Maui in the historic period, that is, following the disintegration of the traditional kapu system (circa 1820); some comments on how the project area, in particular, was affected by these changes; and historic maps and aerials that illustrate some of these temporal changes.


Project Area
N
0
2
4
Kilometers
1924 USGS Kaupo, Keanae, Makawao, Kipahulu and Nahiku Quads., 1:116,000 scale


Project Area
0 2 4 Kilometers
1929 Iao, Hawaii Territory Survey, Maui Island, 1:130,000 scale


Project Area
0 2 4 Kilometers
1954 U.S. Geological Survey Maui Island, 1:130,000 scale
Keopuka Island
Pauwalu Point
Kalahu Point
Hana
HALEAKALA NATIONAL PARK
KIPAHULU FOREST RESERVE
MAKAWAO FOREST RESERVE
Lae o Apole
Mokalau
Kaupo
Nuu
Waiohue Gulch
Honomaele
Kaaheke
Koeleku
Hamoa
Puuiki
Haou
Muolea
Muolea Point
Makaalae Point

3.2.1 Kahekili and Kalani‘ōpu‘u

In 1776 Kalani‘ōpu‘u (king of Hawai‘i) invaded Maui, and met the warriors of Kahekili in battle on the plain of Kama‘oma‘o. In 1778, Kalani‘ōpu‘u invaded the kingdom of Kahekili again, attacking Kaupō, Kaho‘olawe, and Lāhainā. During these battles the young Kamehameha exhibited his skill on the battlefield as well. Maui’s forces eventually drove Kalani‘ōpu‘u’s army from Maui, and they took Lāna‘i by force. The people and resources of Lāna‘i were abused and overtaxed, and a famine took place on the island. Kalani‘ōpu‘u then set sail to Ko‘olau, Maui, and Kamakau described the events in the following narratives:

> Ka-lani-‘opu‘u decided to go on to Ko‘olau, Maui, where food was abundant. He went to Ka‘anapali and fed his soldiers upon the taro of Honokahua… At Hamakualoa Ka-lani- ‘opu‘u landed and engaged in battle, but Ka-hekili hastened to the aid of his men, and they put up such a fierce fight that Ka-lani-‘opu‘u fled to his canoes. Landing at Ko‘olau he slew the common people and maltreated the captives by urinating into their eyes. Descendants of people so treated are alive today. From Hana, Mahi-hele-lima, commander of the fortress Ka‘uiki, joined forces with Ka-lani-‘opu‘u, and for six months the fighting continued. During this campaign, carried on for half a year, from 1778 to 1779, with fighting at Kaupo, Lahaina, Lanai, Hamakualoa, and Ko‘olau, Kamehameha, as well as his master in warfare, Ke-ku-hau-pi‘o, distinguished himself for skill and bravery in war… [Kamakau 1961:91]

Kamakau also recorded that while the battles were occurring on Maui Captain James Cook and his ships sailed along the coast of Maui Hikina. In Kamakau’s version of the arrival, readers learn that Cook anchored near Ha‘aluea Rock.

> While Ka-lani-‘opu‘u was in Wailua in Ko‘olau, Maui, on the evening of November 19, 1778, Captain Cook’s ship was sighted northeast of Mokuho‘oniki with the prow turned a little to the southeast. It was seen at Kahakuloa, and the news spread over the island, then at Hamakua, and at evening it was seen in Ko‘olau. The night passed, and the next day the ship was anchored at Ha'aluea just below Wailua. When they saw that its appearance exactly fitted the description given by Moho, there was no end of excitement among the people over the strange object. “The tower of Lono! Lono the god of our fathers!” they exclaimed, redoubling their cries at the thought that this was their god Lono who had gone to Kahiki. The men went out in such numbers to visit the ship that it was impossible for all to get on board.
>
> When the canoes returned to shore, Kala‘i-mamahu’ persuaded Kamehameha and one other to remain on board, and that night the ship sailed away taking Kamehameha and his companions and by morning it had disappeared. Ka-lani-‘opu‘u thought that

> Kamehameha must have gone away to Kahiki. He was displeased and ordered Ke-pa‘alani to bring them all back. Ke-pa‘a-lani took six paddlers and a large single canoe supplied with food and water. Puhie declared that within two days and two nights they would sight the ship. Maui disappeared, and Mauna Kea rose before them out of the waves. Kamehameha, looking out, saw a white object on the wave and said to Kala‘imamahu’, “Is that a canoe or only a wave?” “Where?” “Yonder.” As they watched it became clearly a canoe, and Kamehameha guessed that it was Ke-pa‘a-lani come to seek them. But Captain Cook had no intention of carrying them away; he only wanted them to guide him to a good harbor on Hawaii. Captain Cook may have sailed by a map made by the Spaniards, for how else could he have found the proper harbors at Waimea, Mahukona, and Kealakekua? As for Ke-pa‘a-lani he was relieved, for he had already sailed two [page 97] days and nights without sighting the ship. Kamehameha pointed out the canoe to Captain Cook and then pointed toward Maui. Cook would not consent; he pointed to the ship and then to Hawaii. Again Kamehameha pointed to Maui, and the ship turned about and reached Wailua in a single night... [Kamakau 1961:98]

3.2.2 He Mo‘olelo Ka‘ao Hawai‘i no Lauka‘ie‘ie

“He Moolelo Kaao Hawaii no Laukaieie...” (A Hawaiian Tradition of Lauka‘ie‘ie) was published in *Nupepa Ka Oiaio* between January 5th 1894 to September 13th 1895. The mo‘olelo was submitted to the paper by Moses Manu. The following narratives (translated by Maly), have been excerpted from the mo‘olelo, and include an overview of the tradition and the travels of Makanikeoe, one of the main figures in the mo‘olelo. During his travels, Makanikeoe sought out caves, and tunnels that served as underground trails, covering some of the important places and resources in the Ko‘olau-Hāmākua region. Maly summarizes:

> Later in the account, Makanikeoe returned to Maui, and traveled round the island. On his journey, he visited various places at Kahikinui, Kaupō, Kīpahulu, Hāna, Ko‘olau and Hāmākua. Having traveled through Hāna, Makanikeoe:
>
> [November 16, 1894]
>
> ...looked to the uplands and saw many places where kalo was growing. The interesting thing about the kalo at this place was that it appeared to be flying along the edges of the cliffs at Hanawī. Desiring to understand how the kalo could grow along the cliffs in this manner, Makanikeoe climbed up to one of the places where these kalo ‘e‘epa (mysterious formed taro) was growing. It was a large place where the water flowed, and in the distance, he saw a man carrying a single large kalo.

> Makanikeoe then heard a voice calling out, and saw one of the small kalo plants growing along the side of the cliff talking, just as if it were a man. It called out to the large kalo:
>
> Make no ‘oe e kalo nui – Ola no au o kalo iki.”
> (Say there large taro, you are to die –and I, the little taro, will live.)
>
> Makanikeoe chuckled to himself, hearing the words of the little kalo, and he understood the surprising nature of the kalo at this place. These places where the kalo grows on the cliffs may still be seen to this day.
>
> After seeing this kalo that speaks like a man, Makanikeoe then went to the top of the mountain ridge, where he could see the cliff of Lelekea (Kīpahulu) below. He then went down to Kahaleikalalea, where he turned his gaze to the calm sea, and the pond of Waihī, Kīpahulu… [Maly, translator]

3.3 Mosquitoes in Hawai‘i

There is no evidence that mosquitos have any cultural significance. They are not native to the Hawaiian Islands, and since their introduction by foreigners, they have proved to be a devastating menance to the population and ecosystem in Hawai‘i.

According to the U.S. National Library of Medicine, mosquitoes first arrived in Hawaii in 1826, when “European and American ships carry the first mosquitoes to Hawaii, where there are no blood-sucking insects. Although these mosquitoes cannot transmit malaria to humans, they carry avian malaria, which decimates birds native to the Hawaiian Islands. Over the next 150 years, four more mosquito species are introduced” (2021). It also believed that the first introduction of mosquitoes took place on Maui, in Lahaina, when a foreign vessel brought the species into Lahaina Harbor and they spread from there.

Eventually, four more species of mosquitoes would be introduced to the islands, likely again from foreign contact in the islands. They were quickly identified as a serious health concern. There would be various efforts to eradicate, or at least control, mosquitoes in Hawai‘i. Even the effort to use biocontrol to eradicate mosquitoes was not a new concept in Hawai‘i. The first biocontrol efforts were started in the early 1900s, nearly 120 years ago.

Mosquitoes have proven most devastating to native birds, likely contributing to the extinction of many species. The following historic newspaper accounts document previous eradication efforts throughout the Hawaiian Islands.

EXHIBIT 2

ten years. It's something that I've definitely been concerned about and wanted to know more about, so I was aware that there were these Wolbachia mosquitoes.

At first, we didn't know that that's what they were planning to use here, and actually when the information first came out through our network, it was, you know, they're bringing GMO mosquitoes and that's, of course -- you know, I was concerned about that.

And then pretty shortly after that, the State, I think, had presented updated information to let people know it was the Wolbachia mosquitoes, and I was still concerned about that because that's a bacteria and, you know, mosquitoes are a disease vector, and it was something that I wanted to know more about.

Q Do you recall when the State presented the information that you just referenced?

A I'm going to say it was shortly after we were first alerted about it, so either in June or possibly early July, but probably, you know, within a week or two of pushback from the community when they thought it was the generically modified mosquitoes. A lot of people testified. I think that was at a Department of Agriculture board meeting.

Q This would have been in 2022; is that correct?

A Yes, yeah.

Q Did you contact anyone to help better understand the science behind the project?

A Yes. That's actually when I contacted Dr. Pang, which I believe was either in June or July of last year.

Q And why did you contact Dr. Pang?

A Because I know that he's a tropical disease expert and that he knows about mosquito-borne illnesses, and because I respect his opinion, and I know that he stays neutral, and that if I had concerns, that he would either help me not be so concerned about it by explaining that, you know, "No, this is probably okay and this is why," or he would help me to understand what could happen with those concerns. And I just knew that he would be neutral and have the solid background. And he's actually the person on the -- all of the islands that they usually go to for mosquito-borne --

JUDGE TONAKI: Hold on.

MS. STEED: This is both a narrative answer and improper testimony about Dr. Pang's qualifications. He's already been on the stand.

JUDGE TONAKI: Sustained. Calls for a narrative.

BY MR. VANDEVEER:

Q How did you know Dr. Pang?

A I met him when I was working with the Community Workday. They're now called Malama Maui Nui. That's the environmental nonprofit affiliate of Keep America Beautiful. I think around 2009 we met. He's been on their board for many years and we worked on a federal grant together.

Q And did Dr. Pang agree to speak with you as a private citizen about the Wolbachia mosquitoes?

A Yes, he did.

Q Did you ever submit written testimony regarding the birds, not mosquitoes, Wolbachia release plan?

A Yes, I submitted testimony a number of times to the Board of Land and Natural Resources, I believe to the Department of Agriculture as well when we first heard about the project, but definitely to the Board of Land and Natural Resources several times.

Q And were you ever made aware of something called horizontal transmission?

A Yes.

Q And did you testify as to that?

A I did. I included it in my testimonies, yeah.

Q And what was the response to that?

MS. STEED: Objection. Calls for hearsay.

MR. VANDEVEER: I'm sorry. I'll withdraw that

question, your Honor.

JUDGE TONAKI: Thank you.

BY MR. VANDEVEER:

Q What was your concern that you testified about, Ms. Lia?

MR. FRANKEL: Objection, your Honor. Relevance.

JUDGE TONAKI: Overruled.

THE WITNESS: My concern was that they had not studied that at all. It didn't appear to be referenced at all in their draft environmental assessment. And, you know, based on what I had learned about it, it was something that could -- you know, if it hadn't been studied in this particular mosquito, which it doesn't appear that it has because no one has presented that information --

MS. STEED: Objection.

THE WITNESS: -- um.

MS. STEED: Objection. Ms. Lia is not testifying as an expert witness. It's not proper for her to testify as to what has or hasn't been studied.

JUDGE TONAKI: Yeah. Mr. Vandeveer?

MR. VANDEVEER: So --

JUDGE TONAKI: She can testify as to what her testimony was before the --

MR. VANDEVEER: Understood, your Honor.

BY MR. VANDEVEER:

Q If you could, please just answer the question.

A Yeah. So in my testimony, I explained that the bacteria -- the Wolbachia bacteria could transmit horizontally in the environment to other insects, including insect vectors of disease.

Q Did you testify about any --

Sorry. Did you have any concerns about birds being harmed by the project?

A Yes, I did, because I learned during that time period that there was a peer-reviewed study showing that the Wolbachia could cause the mosquitoes to become more capable of transmitting avian malaria, and there was another study showing they could become more capable transmitting West Nile Virus, which not only humans can get but birds can get also.

MS. STEED: Objection. Move to strike that testimony. It was in reference to what birds can and cannot contract. Ms. Lia is not an expert as to avian disease.

JUDGE TONAKI: Overruled. The Court understands that Ms. Lia is not testifying as an expert witness, but testifying as to what she conveyed to the Board in her testimony.

BY MR. VANDEVEER:

Q Ms. Lia, did you testify about any disease research regarding -- or concerning Wolbachia that concerned you?

A The disease research that I just referenced, the avian malaria and the West Nile Virus. There were other studies that I referenced in my testimony that related to some of those concerns as they tied into the horizontal transmission.

Q Did you testify about evolutionary events?

A Yes.

Q How about mosquitoes breeding?

A Yes.

Q How about population replacement?

A Yes.

MS. STEED: Objection. This is leading.

THE WITNESS: Overruled. Go ahead.

BY MR. VANDEVEER:

Q And what were your concerns about the evolutionary events with the project that you testified about?

A Well, so this is in my testimony, but it connects the different issues here, and so it has to do with if the population of the mosquitoes are replaced with this lab strain infected population, we don't know

how much more capable they may be of spreading diseases, including those two specific ones, but others that these culex quinquefasciacitus mosquitoes transmit to humans and birds and other wildlife.

Q Did you testify about wind drift?

A Yes.

Q And what about wind drift concerned you?

A You know, I'm more concerned that no studies have been done and that this -- because this is a biopesticide, which is essentially a microbial pesticide, there's the same issue as there is with pesticides -- is that it can drift on the wind to unintended places, so how that might affect the environment and human health and, you know, just the health of life on the island as a whole.

I also had come to understand that there are issues with, you know, the efficacy of the wind drift affecting the (inaudible) as well, but my concern actually was more about these mosquitoes are going to go places they weren't supposed to go, so that's not really a controlled, contained situation.

Q When you say it wasn't studied, are you referencing in the environmental assessment for this project?

A It was not mentioned at all in the

environmental assessment.

Q From what you learned about the -- well, let me back up.

Have you read the draft environmental assessment for this project?

A Yes.

Q Have you read the final environmental assessment for this project?

A Yes.

Q And from what you learned about the project, are you concerned about any potential negative impacts?

A I'm very concerned about those impacts and several others that were mentioned in my testimonies and comments, and that were not addressed in those environmental assessments, the draft or the final -- or were not adequately addressed. Some of them were not addressed at all, several of them.

Q Can you recall what the ones that weren't addressed at all were?

A I have to think about that. I -- my comment on the draft environmental assessment is eight pages long and there are so many things in there -- yeah, I think specifically some of the studies that were referenced. I think the --

There's an issue about the female mosquitoes

that are accidentally going to be released, and that is not an if, that is something that the agencies have admitted will happen, and that there are no documented figures for that in their environmental assessment, either the draft or the final.

And the EPA guidelines allow for one female for every 250,000 males, which could amount to over 3,000 females released every week on Maui based on those EPA guidelines for this biopesticide that went through a process of emergency exemption approval through the EPA, so that's what we know can happen, is allowed to happen. I would say that's a main one that was not addressed.

It is mentioned in the final environmental assessment as if something -- if females were released -- this is in the Appendix H -- when they do address some of the public's comments, and they basically brush it off and say, "If the population is replaced, no big deal." You know, whether it's just, you know, another mosquito, they don't -- they don't consider these other factors that we're talking about that we don't know how that Wolbachia might affect that mosquito or, you know, how many mosquitoes we're going to have, might we have more than less. There's a lot of things that could happen.

Q From what you learned about the project, are

you concerned that any of the potential effects could be irreversible?

A Definitely. I feel like it's already irreversible because the Wolbachia itself is a living organism that lives on. It's not the same as a mosquito that just has a life span. It can live on in the environment and continue to propagate and find new hosts, and so it's already irreversible because they started releasing them despite our --

MS. STEED: Objection.

JUDGE TONAKI: Overruled.

BY MR. VANDEVEER:

Q You can continue.

A Well, that's my main concern. I mean it's my understanding that they -- they're doing -- probably doing the initial studies where less mosquitoes are being released right now, but it's still irreversible. That bacteria's in the environment and we don't know --

That is a foreign bacteria, and that's another thing that's been misrepresented, so when we talk about things that were not in the environmental assessment, in my research looking at the documents for this project through the EPA applications, different import permits from the agencies, it showed that the public wasn't being shown very specific information, and that can have

to do with the Wolbachia itself, which the EPA emergency exemption application shows that Wolbachia for this project originates from Kuala Lumper in Malaysia. That is foreign --

MS. STEED: Objection.

JUDGE TONAKI: Overruled.

Mr. Vandeveer, go ahead. I'm going to ask you to ask questions.

MR. VANDEVEER: Yes, your Honor.

JUDGE TONAKI: No narratives here.

BY MR. VANDEVEER:

Q Did you share any of the information you learned from what you had read with anyone?

A I shared it with the public from early on last year. I started an e-mailing list that has grown, and I've been sharing it with the public, writing articles, sharing it with media, sharing it through this testimony and public comments, and going to the outreach meetings and publicly asking these questions and presenting this information.

Q You said you wrote an article about it as well?

A I've written several, but I initially wrote an article last year after I had spoken with Dr. Pang that described the science -- the details of the science, his

concerns that he presented to me at that time.

Q And did you share this article with the Department of Land and Natural Resources or the Board of Land and Natural Resources?

A I did. I sent it in as testimony --

(Audio from 1:32 to 1:37 not transcribed)

THE WITNESS: In that document I think it does specify that they are intending to import Wob A, Wob B and wPip4.

BY MR. VANDEVEER:

Q Did you do any other research regarding requests to determine establishment of the Southern (inaudible) mosquito?

A I did. I also did research on those strains to see if they all existed in Hawaii.

Q And what did your research bear out?

MR. FRANKEL: Objection, your Honor. Calls for hearsay. Calls for opinion. Lacks foundation.

JUDGE TONAKI: Sustained.

BY MR. VANDEVEER:

Q As a member of the public, was there any concern that you had regarding the DLNR request to import and establish?

MR. FRANKEL: Objection. Relevance.

JUDGE TONAKI: Overruled.

THE WITNESS: I became especially concerned when I did follow-up research and found that there was a University of Hawaii import request that specified that wPip4 does not exist in Hawaii.

BY MR. VANDEVEER:

Q And why did that concern you?

A Because I had already had the conversation with Dr. Pang about how the different strains are -- can bring a lot of unknown factors in, and that if there's a new strain being brought into the Islands, that we don't know how that might affect the mosquitoes, the -- you know, the wildlife, the other insects that could pick it up horizontally.

And I was very concerned that this had been misrepresented to the public by Birds Not Mosquitoes and their agency partners, because they have repeatedly said that this bacteria already exists here in Hawaii, it's all around us, and the reality is that it's coming from a Mainland lab and sourced from Kuala Lumpur and tied into this project and the importing request is this wPip4 bacteria strain that does not exist on the Islands per their own documents.

Q Did you research the State of Hawaii Department of Agriculture's Emergency Exemption Application for the use of mosquitoes?

A With the EPA? Is that the EPA application we're talking about for emergency?

Yes, I believe that we're talking about -- the Department of Agricultural is the one that applied for the EPA emergency exemption.

MR. VANDEVEER: Your Honor, at this time I'd like to show the witness Exhibit P15, Plaintiffs' Exhibit 15 to refresh her recollection.

JUDGE TONAKI: She hasn't expressed a need to have her recollection refreshed, so --

MR. VANDEVEER: I thought she asked. I'm sorry. Okay.

BY MR. VANDEVEER:

Q So this is the EPA application, exemption application --

MS. STEED: Objection.

MR. VANDEVEER: Allow me to the finish my question with respect. If that's okay, I'll finish my question.

BY MR. VANDEVEER:

Q Did you research the State of Hawaii's Department of Agriculture Emergency Exemption Application for the use of mosquito DXB males as a biopesticide in Hawaii?

A Yes.

Q When did you research that?

A Some time last year within the time of finding out about this project and within a few months after that, probably a couple, three months after that.

Q And is that exemption application -- does it pertain to this project?

A Yes.

Q Did you have any concerns about that application?

A I had a lot of concerns about that application. One of them had to do with -- that's where it specifically mentioned that the bacterial strain was originating from Koala Lumpur in Malaysia and the mosquitoes originating from Palmyra Atoll.

There was also that figure of one female per 250,000 males documented in that document. It showed that the largest project area to date documented in that -- in that particular document was 724 acres whereas the one here on Maui is 64,666 acres. That seemed like an enormous jump to me.

I believe there were a few other things that I can't recollect right now, but those were three main concerns that I had.

MR. FRANKEL: Your Honor, can I ask that you instruct the witness just to answer the question because

that was not the question. I move to strike. Just ask --

JUDGE TONAKI: Overruled.

MR. VANDEVEER: Your Honor, may I show the witness P15 to refresh her recollection as to this report that we're discussing?

MS. STEED: Your Honor, the witness again hasn't expressed a need for her memory to be refreshed.

JUDGE TONAKI: Well, it's an improper use to refresh recollection, Mr. Vandeveer. If you're trying to lay foundation for this -- this document, then yeah, you can show her and ask her foundational questions, but --

MR. VANDEVEER: Okay. If that's --

JUDGE TONAKI: -- she's been testifying about the document and hasn't expressed a need to have her recollection refreshed.

MR. VANDEVEER: Understood, your Honor. If I may --

JUDGE TONAKI: Yes.

MR. VANDEVEER: -- lay a foundation?

Thank you.

THE WITNESS: I just thought of something else that if I'm --

JUDGE TONAKI: You gotta wait for a question.

THE WITNESS: Oh, okay.

BY MR. VANDEVEER:

Q And you can take a minute to look at that if you need to.

A Yeah, I remembered what I wanted to say -- one more thing for sure, but I'll take a look.

Q Is that the document -- is the document before you the emergency exemption application that you were discussing?

A Yes.

MS. STEED: Leading.

JUDGE TONAKI: Overruled.

BY MR. VANDEVEER:

Q Are you familiar with this document?

A Yes, I am.

Q Did you read it in its entirety?

A I did read it in its entirety.

Q And who's the author of the document?

A This comes from the Department of Agriculture State of Hawaii, and it is in conjunction with Verily Life Sciences, one of the mosquito labs for this project.

Q And did you rely on this application for your testimony?

A Testimony to the Board of Land and Natural

Resources?

Q Yes.

A Yes.

MR. VANDEVEER: I'd ask, your Honor, if we can admit Plaintiffs' Exhibit P15 under the Public Record Rule to the hearsay exception.

MR. FRANKEL: Objection. Lacks foundation.

JUDGE TONAKI: Over the objection of Defense, P15 will be received in evidence.

(Plaintiffs' Exhibit 15 was received into evidence)

BY MR. VANDEVEER:

Q Are there any tables or figures in this report in this emergency exemption application that concerned you?

A Yes. I'm specifically focused on Table 2, Timeline of Published Studies Demonstrating Field Efficacy of Insect Incompatibility Technique Using Incompatible Wolbachia Male Releases In Mosquitoes.

JUDGE TONAKI: What page is she referring to, Mr. --

THE WITNESS: It says 18 of 43 at the top.

MR. VANDEVEER: I'm trying to broadcast this again if I may, your Honor.

JUDGE TONAKI: Yes.

MR. VANDEVEER: I'm hoping for better luck this time.

BY MR. VANDEVEER:

Q Okay. So on this Table 2, Ms. Lia, do you see a mosquitoes species plan for use in the project anywhere in this table?

A I do not.

Q You don't see any mosquito species in this table?

MS. STEED: Objection. Asked and answered.

THE WITNESS: Actually, there -- the three mosquito species that are planned for import in connection with this project do include Aedes egypti, but in regards to the culex quinquefasciacitus that is planned for use in this avian malaria project, no, that is not on this chart of published studies demonstrating field efficacy of Insect Incompatibility Technique using Wolbachia.

BY MR. VANDEVEER:

Q So does this information comport with what you -- you understood the BNM was -- the Birds Not Mosquitoes project was saying publicly?

A Not at all.

Q Did it comport with anything that you were reading that they had put out?

A It did not. It actually was counter to the narrative that they presented to the public.

Q Can you explain -- can you explain, did this concern -- did this concern you?

A Yes, very much.

Q Why was that?

A One, because again it appeared that this project was experimental and had never been done before using this culex quinquefasciacitus mosquito and, two, because the information had been misrepresented to the public -- and I will put it nicely as misrepresented to the public.

Q Looking at this same Table 2, what do you see is the largest project area that's documented to date?

A 724 acres.

Q And what project is that for?

A That's in Fresno, California. And through my research I found it to be called the Fresno Debug or Debug Fresno Program.

Q What's the species of mosquito that's listed there for the Fresno project?

A It is the Aedes aegypti.

Q Did you see an EPA expected accidental release rate for females lab-infected mosquitoes in this application?

A Yes, I did.

Q And what was the EPA's expected female release rate?

A One female for every 250,000 males.

Q Was this information concerning to you?

A Very concerning.

Q Why?

A Because I knew that the project area was 64,666 acres and that they would be releasing up to 6,000 mosquitoes per acre up to twice per week, which meant 775,992,000 mosquitoes released weekly, and with that one female for every 250,000 males, that meant over 3,000 females were allowed to be released weekly on Maui for the next 20 years and possibly beyond, based on further documents that I found.

Q And why is that concerning to you?

A Because females bite and breed and spread disease, and because it was misrepresented again to the public that only males would be released. Repeatedly that has been said.

Q Did you research any other websites -- I'm sorry. Did you research any other authorities to confirm the information?

A I went directly to the EPA website to see if there was any updated information and, indeed, it said

on their website one female for every 250,000 males was the expected release rate -- accidental release of females with Wolbachia IIT mosquitoes.

MR. VANDEVEER: Your Honor, I'd like to show the witnesses P16 to lay foundation to admit into evidence. P16.

May I approach?

JUDGE TONAKI: Yes.

BY MR. VANDEVEER:

Q Do you recognize this document?

A Yes, I do.

Q What do you recognize it as?

A This is from the EPA website in reference to emerging mosquito control technologies with a specific section about the Wolbachia mosquitoes.

Q And is it clear to you from this website who the author was?

A I don't know that a name is put to -- usually the federal documents, it generally comes as authored from the agency, so I would say the Environmental Protection Agency is the author of this document.

Q And you said you went to the website. Do you recall what date you went to the website?

A Well, it would have to have been after October 28th, 2022.

Q And why is that?

A That's the date on the Department of Agriculture Emergency Exemption Application to the EPA, and that's what led me to go to the EPA website.

Q And is there a date listed there on the website?

A There was a date -- because I had referenced this on my website. Our organization, Hawaii Unites, compiles all of these documents and I did put a date at the time to show when this was most recently updated. And at this point now it says last updated July 11th, 2023. I think previously I would have had a date closer to the time that I looked at it, but the information is the same.

Q So on review of that document, the information is the same as you would have seen it at the time you researched?

A Yes, it's the same information for that section. There's -- there's other mosquito technologies referenced and I can't say whether those have changed, but that section with the one female for every 250,000 males is the same.

Q And that informed your research that you had done pertaining to the EPA Emergency Exemption Application; Is that correct?

A Yes.

MR. VANDEVEER: Your Honor, I'd like to admit Exhibit P15 as a public record exception to the hearsay rule.

JUDGE TONAKI: Mr. Frankel?

MR. FRANKEL: Objection, your Honor. Lacks foundation. Lacks authenticity. Lacks relevance.

(inaudible whispering)

MR. VANDEVEER: I'm sorry. It's P -- I'm so sorry, P16, that's correct.

JUDGE TONAKI: Over the objection of Defendant, P16 will be received into evidence; however, the copy -- I don't know if it's missing a page, but under the -- there's a heading, "Will this technology adversely affect human health and the environment?" And the last line -- see that page?

MR. VANDEVEER: Yes.

JUDGE TONAKI: The last line says, "The expected accidental release rate of one Wolbachia infected female for" -- and then the next page, "will cause" --

(Inaudible whispering)

JUDGE TONAKI: -- "unreasonable -- adversely effects humans or the environment," so I don't know if there's a missing page.

MS. STEED: Your Honor, respectfully we would reassert our objection as to offer -- offer misstates (inaudible) information.

MR. VANDEVEER: I'm sorry, your Honor. I'll withdraw this document for now.

JUDGE TONAKI: Okay. Yeah.

MS. STEED: Thank you.

JUDGE TONAKI: Okay. So P16 is withdrawn.

BY MR. VANDEVEER:

Q Did you submit any comment to the EPA for the State of Hawaii Department of Agriculture's Emergency Exemption Application?

A Yes, I did.

Q Do you recall when you submitted the comment?

A I believe those comments were due in January of this year, so it would have been in January, some time before the 24th, I think, was the date for that.

Q Do you recall if you received any response to that?

A I received some kind of a confirmation that my comment had been received, but a response, no. But actually in -- when this EPA exemption was approved, they did address the comments, so indirectly I guess there was some response.

Q Do you recall what the response was?

A I don't at this time, but I do have those documents where comments are addressed. I think it probably said something similar to what it says here, which there are a couple of lines missing. I don't know what happened here, but between the two pages where it says, "Likely not to have significant effect on humans."

Q You mentioned earlier that you had read the draft environmental assessment for Maui, correct?

A Yes.

Q The entire draft?

A Yes.

Q Did you see any information about the rate of release of accidental -- I'm sorry, the rate of accidental release of lab-infected female mosquitoes?

A No.

Q Did you see it in the final environmental assessment?

A No.

MR. VANDEVEER: I'd like to enter into evidence -- well, it's already been entered into evidence, your Honor, stipulated Plaintiffs' Exhibit 1, the final environmental impact assessment.

JUDGE TONAKI: Okay.

MR. VANDEVEER: May I approach, your Honor?

JUDGE TONAKI: Yes.

BY MR. VANDEVEER:

Q Just to be clear, we're speaking about -- the questions I'll be asking about the final environmental impact statement that's before you, Plaintiffs' Exhibit Number 1.

A Yes.

Q Upon reading the final environmental impact -- I'm sorry, final environmental assessment, were you able to ascertain the number of male mosquitoes that would be allowed to be released on Maui?

A No.

Q Were you able to calculate the number?

A Based on the environmental assessment, no.

Q Were you able to use the information available to come up with any sort of approximation of the amount of male mosquitoes that would be released?

A By cross referencing their own document here applying for the emergency exemption through the EPA and then again the EPA website, I was able to calculate that over 3,000 females would be allowed to be released on Maui weekly.

Q But again, that number was your calculation based on information, not a total number that was provided in the EA?

A Yes, that's a calculation based on the numbers

provided in the EA for the project area and for the maximum number of mosquitoes to be released per week and how many times per week, and then using the reference of the one in 250,000 to make that calculation myself.

Q And what was the number you came up with for the number of male mosquitoes that would be released in Maui every week?

A 775,992,000 is the high end of what could be released.

Q And what is that based upon?

A That's based upon the 64,666-acre East Maui project area, up to 6,000 mosquitoes released per acre per week up to twice a week.

Q And just to be clear, the total number you came up with is not provided -- the number you just gave is not provided in the EA?

A The 775 million --

Q Correct.

A -- 992,000? No that was not provided as a figure in the EA, no.

Q And you mentioned that you had calculated the number of accidentally released female mosquitoes based upon the emergency application we discussed earlier as well as the EPA website.

What was the number that you came up with for

the project on Maui?

MS. STEED: Objection. Asked and answered.

JUDGE TONAKI: Overruled.

THE WITNESS: It was over 3,000 and for sure it was over 3,100. I'm not positive if it was 3,104, but that feels like what the number may have been, but over 3100 for sure.

BY MR. VANDEVEER:

Q Why is that important?

A Because the females bite and they breed and they spread disease, and because it was misrepresented to the public that only males would be released.

Q Did reading the draft environmental assessment make you feel better about the project?

A The draft environmental assessment, as opposed to the final? No, it made me feel a lot worse about the project, actually.

Q Did the final environmental assessment change your opinion of it?

A Not at all. Actually, again, it made me feel worse that they were not addressing these concerns seriously.

Q Was there anything in the final environmental assessment that made you worry about birds in particular?

A In the final environmental assessment, there are specific things in there talking about the drones and the helicopters, and how they might affect the birds, and that had a lot to do with noise disturbances. There's a chart in there showing that up to 134 drone flights are going to happen per week across that conservation area and the project area as a whole. And they also mentioned that the drones could affect the nesting and roosting of the birds, and the -- I'm trying to think what they called it with the Hawaiian hoary bats -- we're just talking about the birds right now.

The helicopter rotor wash, which is the wind coming down from the helicopter propellers, could affect the birds. It talked about something along the lines of the stress of the noise disturbances with those drones and helicopters, and it also specifically mentioned that it was possible that a drone could hit a flock of birds.

Q And from your reading of the final environmental assessment, were you able to ascertain how long this project would continue?

A Yes, there's a specific line in there where it says likely at least 20 years.

Q And where is that in the final environmental assessment?

A I'll have to think about that. It's in

relation to something specific that I was looking at frequently.

Oh, it has to do with the mosquito -- the packaging for the mosquitoes. They're going to be released in packages, and it was talking about how long, you know, that effect would be happening. I believe it has to do with the packages that would be littering the forest for at least 20 years.

Q So did you have any concerns about the broader environment besides the birds?

A Yeah, I had concerns about not just the mosquitoes and the bacteria, but just the impact of this project with all of these drones and human activity and helicopters and packaging that, you know, is allegedly biodegradable, but they have no information on how long that takes to degrade, and at 134 drone flights a week with -- we don't know how many packages, but at least that many constantly overlapping, there's going to be a constant littering to the forest and --

MS. STEED: Objection. Facts not in evidence as to how frequently the packages are actually going to be released.

JUDGE TONAKI: Sustained.

MS. STEED: Thank you.

BY MR. VANDEVEER:

Q Did you submit a comment on behalf of Hawaii Unites for the draft environmental assessment?

A Yes, I did.

Q And do you recall when you submitted that comment?

A I want to say that was in January as well.

Q And did you state the concerns that we've talked about here today in that comment?

A Yes.

Q Were there any additional concerns that you shared?

A Yes, I shared several pages worth. I think it was an eight-page comment, single-spaced.

Q Do you recall what some of the other concerns were?

A All of the concerns that we've talked about here in my testimony today and additional other concerns, some having to do with things that were discussed specifically in the environmental assessment itself, like wildland fires and effects on the native plants and on the character of the wilderness.

There were a number of things in their chart within the draft environmental assessment that I was also concerned about.

And I also brought up concerns about Native Hawaiian environmental justice because I felt that this project hadn't really taken into account the perspective of that community, and the fact that there would be potential implications to their health since they are living up against the project area, a lot of native Hawaiians. And they hunt, you know, they use the resources there for feeding their families and I was concerned about that.

Q Did your comment on the draft environmental assessment include a request that an environmental impact statement be completed for the project?

A Yes, it did.

Q Did you submit written testimony for the Board of Land and Natural Resources' meeting that took place on March 10th of this year?

A Yes, I did.

Q Did you also submit oral testimony via Zoom for that meeting?

A Yes, I did.

Q Did you state some of these same concerns that you've discussed today from your environmental -- I'm sorry, from your comments on the draft EA in that meeting?

A Yes.

Q Including the need for an environmental impact statement?

A Yes.

Q Were your concerns addressed at that meeting?

A No, they were not.

Q Were the concerns documented in your comment adequately addressed in the final environmental assessment?

MR. FRANKEL: Objection. Calls for legal conclusion.

JUDGE TONAKI: Overruled.

THE WITNESS: No, they were not.

BY MR. VANDEVEER:

Q Looking at Appendix X of that document, Exhibit P1, I'll try to pull it up here as well.

A Did you say Appendix X?

Q Yes, it would be the very end of the document.

A I didn't think it went that far, but okay. What is the title of that appendix?

Q Responses to Substantive Public Comments.

A Okay. I think that's Appendix H, actually.

Q I'm sorry. Did I -- I'm sorry. That's what I meant, Exhibit H, not X. Okay.

JUDGE TONAKI: What page?

MR. VANDEVEER: It's going to go from pages --

THE WITNESS: I got it. I found it.

BY MR. VANDEVEER:

Q And this is the PDF page 260 to 276, and it's up on the screen now.

Yeah, I'm not going to touch it.

Okay. Ms. Lia, can you tell -- can you tell where your comment was responded to in this section Appendix X, Responses To Substantive Comments On Environmental Assessment?

MS. STEED: Objection, Appendix H.

BY MR. VANDEVEER:

Q I'm so sorry, Appendix H.

A Oh, I can't really tell because they appear to have mixed comments together and summarized them, and nothing is identified here, so no.

Q Was the full text of your comment or any full text of your comment included in Appendix H?

A No.

Q Was your name included as a commenter under the topic heading of any of the issues you raised in Appendix H?

A No, it was not.

Q Did you feel that you -- that your comments clearly received a substantive response in this final environmental assessment?

A No, I did not.

Q And how did that make you feel?

A I felt that the public participation process was not being honored, and I felt that our concerns were not being taken seriously, and I felt very much that this decision to do this project had been pre-decided and that they were working the documents around that decision that had already been made, and I felt there hadn't been enough study.

Q Okay, is it okay -- Judge, can we take a brief recess? Is that okay?

JUDGE TONAKI: Yes, take a ten-minute recess.

MR. VANDEVEER: Thank you.

THE BAILIFF: All rise. The Court is in recess.

(Recess was taken)

THE BAILIFF: All rise. This Court is reconvened. You may be seated.

JUDGE TONAKI: Back on the record in Hawaii Unites versus the DLNR.

Ms. Lia is still on the -- may the record reflect the presence of parties and counsel, and Ms. Lia is still on the witness stand.

Mr. Vandeveer, continue.

MR. VANDEVEER: Thank you, your Honor.

BY MR. VANDEVEER:

Q Ms. Lia, we were talking about Appendix H to the final environmental assessment plan for the Maui Wolbachia mosquito experiment.

Did you expect to see your name in the comment section, Appendix H?

A I'm not sure at the time that I expected -- I knew what to expect at all from that response process. I learned later that it should have been in there, it appears, but no, at the time I did not know what to expect.

Q Did you see the names of any of the members of Hawaii Unites in this comment section?

A No.

Q Turning to concern number 20 in this appendix, earlier you mentioned that you had commented on the mosquito packaging for the project area; is that correct?

A Yes.

Q And can you read the response here under concern number 20, just the first paragraph if you would? I'm sorry. Just a moment.

Just a moment, please.

That's right, the first paragraph if you would.

A It says, "Although the final design has not been decided upon, agency and private partners are committed to designing release packaging that is suitably biodegradable and will maintain biosecurity protocols; however, until a final product is designed, specific to K rates or other relevant variables are not known, as strict biosecurity protocols will be followed, the release packets present no risk to the environment, although many thousands of release packets would be dropped across the project area throughout the duration of the project. The small packets would be spread diffusely and the biodegradable material would decompose quickly, thus the impact to the environment would be negligible."

Q In the impact mitigation section of this document -- this is not Appendix H any more -- do you -- from your reading of this document, did you see any mitigation protocols for horizontal transfer?

A No. No, I did not.

Q Did you see any of the literature that you referenced earlier in your comments included in the full environmental impact assessment?

A Not the literature itself. I believe I was able to find reference to one article just in a citation, which I assume is one of the articles that I

submitted, but no, the articles themselves, no, and no actual reference to the text of the articles.

Q Did you attend -- attend any Birds Not Mosquitoes public outreach events to ask questions?

A Yes, I did.

Q And did you receive answers to your questions?

A I did receive answers to my questions, yes.

Q So they addressed your concerns?

A Not adequately, but they did make an attempt to answer the questions as best they could, being that it wasn't -- many times it wasn't the scientists representing the project, and other times we were not able to interact; it was via Zoom and questions were read and responded to, but no, I did not feel that my questions were adequately responded to at any of those meetings.

Q And do you feel like your questions were adequately responded to in this final environmental assessment?

A No, I don't.

Q At this point do you have any additional concerns since the environmental assessment came out, the final?

A Yeah, I have several concerns with additional documents that we've uncovered connected to the project

and the bigger project as a whole.

Q Can you describe those?

A One of the main concerns that I have now is that we recently have un -- I want to say uncovered but it's the public document so, you know, it was out there, but it was not presented to the public until just recently -- found out that the Department of Land and Natural Resources already has a lab that's been funded to build out the insect area to mass produce these Wolbachia mosquitoes which, to me, is another conflict of interest tied to the same agencies. You know, the agency that proposed the project, their board voted it through and it turns out they're benefiting through this lab that, it says in the document, wants to do this in perpetuity, so forever.

And it also talks about advancing into generically modified PGSIT, Precision Guided Sterile Insect Technique crisper (sic) technology with the mosquitoes, and they want to produce those in the lab as well.

There are a few other issues in that document that were of concern, but those were the main ones.

JUDGE TONAKI: I'm sorry. Ms. Lia, can you keep your voice up, please?

THE WITNESS: Louder?

JUDGE TONAKI: Yes, a little louder.

THE WITNESS: Yes.

BY MR. VANDEVEER:

Q Based on your review of the final environmental assessment, was this laboratory that you just described mentioned in that document?

A It was not mentioned in that document, no. There was reference to potentially -- if there was a lab here on the Islands, they could expedite the process of something to do with the -- it was very vaguely mentioned that if there was a lab on the Islands, but no, the Department of Land and Natural Resources lab with insectary mass-producing these mosquitoes was absolutely not mentioned in that document.

Q Ms. Lia, do you feel that this project will significantly impact the environment of your home?

A Very much. That's why I have committed hours of my life for the last year to make sure that it's done right.

MR. VANDEVEER: Thank you, your Honor. No further questions at this time.

JUDGE TONAKI: Ms. Steed, cross-exam?

MS. STEED: Yes. Thank you, your Honor. Just a few questions.

We're going to project exhibits so --

MR. FRANKEL: Okay.

MS. STEED: -- yeah.

MR. VANDEVEER: And she has a copy of the -- you're talking about 1?

MS. STEED: Yeah. Yeah, Exhibit 1. I just want to pull it up for everyone in the gallery.

(inaudible whispering)

CROSS-EXAMINATION

BY MS. STEED:

Q Okay. Ms. Lia, do you still have Plaintiffs' Exhibit 1 in front of you?

A Yes.

Q Okay.

A Yeah.

Q I am on PDF page 260 where it begins with the concerns.

Do you see where I'm at?

A Yeah.

Q Okay.

A Yes.

Q Okay. And I'm looking at concern number 1.

Do you agree that concern number 1 was about whether or not an environmental impact statement should have been prepared?

A Yes.

Q Okay. Now I'm looking at -- same page, I'm looking at comment number 2.

Do you agree that comment number 2 was about the concern of potential impacts to public health and safety?

A Yes.

Q I'm now on PDF page 261. I'm looking at concern 4.

Do you agree that concern 4 addressed genetically modified organisms or bio-engineered organisms?

A Yes, but that was not one of my concerns.

Q But just to clarify, you testified earlier that that had been a concern raised in June of 2022?

A Before the Birds Not Mosquitoes agencies presented the information about the Wolbachia mosquitoes, that had been a concern in the community. There was a misperception.

Q Thank you --

A Yeah.

Q -- Ms. Lia.

Okay. Okay. I am now on page 263 looking at concern 7.

Do you agree that concern 7 was about whether

or not alternatives were adequately addressed?

A Could you repeat the question, please?

Q Do you agree that concern 7 was about whether or not alternatives were adequately addressed?

A Yes.

Q Okay. I'm now on PDF page 265 looking at concern 9.

Do you agree that concern 9 was about whether or not there had been sufficient time to study the proposed action?

A I don't believe it's worded specifically that way.

Q Do you understand it to have a different meaning?

A I would say that it specifically says there had been insufficient study of the proposed action, and then it says it would be a rash decision, which you could reference as a timeframe, but the theme of the comment appears to be about the insufficient study of the proposed action.

Q Okay. Do you agree that comment concern 9 addressed whether or not there was insufficient study of the proposed action?

A Whether the topic is addressing that as opposed to whether it has been addressed in the --

Q Whether that is the topic of concern.

A That is the topic, yes.

Q Thank you.

I'm now on PDF page 266. I'm looking at concern 10.

Would you agree that concern 10 addresses the concern raised that the Wolbachia bacteria would be a foreign introduction into the environment?

A Yes, that's what the concern --

Q Yes?

A -- topic appears to be, yes.

Q And on the same page looking at concern 11, do you agree the concern 11 addressed concerns raised that the proposed project would be an experiment?

A That is the topic, yes.

Q And now PDF page 267, I'm looking at concern 12.

Do you agree that concern 12 was addressing the concerns raised about female mosquitoes potentially being released?

A Could you repeat that question?

Q Do you agree that concern 12 was about the concerns raised over female mosquitoes potentially being released?

A The topic is about some concerns related to

female mosquitoes being released, not all concerns, but it is --

Q Do you agree that concern 12 was about concerns raised over females being released?

A I would agree that it is related to some concerns about female mosquitoes being released, some of the concerns that were expressed by commenters.

Q Okay. Do you agree on page -- PDF page 268 that concern 13 addresses concerns raised about the risk of increasing transmission of certain diseases?

A Yes, that's the topic.

Q And on PDF page 269 looking at concern 14, do you agree that concern 14 addresses the concerns raised that the Wolbachia would infect other insect species with Wolbachia via horizontal transfer?

A That is the topic, yes.

Q And on PDF page 270 looking at concern 15, do you agree that concern 15 addressed concerns raised about horizontal gene transfer from the mosquitoes being released?

A It addresses horizontal gene transfer, but in regards to any information that I would have brought concerns up, I don't think it's accurate, so I'm not sure how to answer that question.

Q My question is just, you know, in looking at

concern 15, regardless if -- if you -- regardless of whether or not it adequately addresses it, do you agree that it addresses the concern of horizontal gene transfer?

A It appears to be addressing horizontal gene transfer as a concern.

Q Okay. And looking on page -- PDF page 271 concern 16, do you agree that concern 16 is addressing the concerns raised over Native Hawaiian concerns?

A Yes, I would agree that's the topic.

Q Okay. Now I'm on page 274 looking at concern 20.

Do you agree that concern 20 is about the environmental effects of dropping mosquito packaging in the project area?

A Yes, that's the topic.

Q Okay. And going back up to PDF page 273, looking at concern 17, do you agree that concern 17 is about concerns that there was additional literature to be reviewed?

A Could you state that again?

Q Sure. Would you agree that concern 17 is about whether or not additional literature was reviewed by the agency?

A I would say that appears to be the topic, yes.

Q Okay. And on that same page looking at concern 18, do you agree that concern 18 addresses the concerns raised over wildland fires potentially ignited by drones and helicopters?

A That is the topic yes.

Q And looking on PDF page 275 at concern 23, do you agree that that concern addresses -- that that -- that addresses the concern raised that there would be an adverse impact under the no action alternative to visitors at the wilderness?

A That appears to be the topic.

Q Okay.

A I'm not familiar with this.

Q I'll withdraw --

A This is -- yeah, I'm not --

Q Okay. That's fine. I'll withdraw the question.

A Okay.

Q PDF page 275, looking at concern 24, do you agree that it addresses the concern that there could be unanticipated outcomes and that a monitoring and response plan will be implemented?

A It doesn't address those concerns because there is no plan, but that appears to be the topic.

Q Would you agree that that's the topic of

concern in --

A That is the topic, yes.

Q Okay. Now, Ms. Lia, previously in your testimony, is it correct that you testified that you recreate in the Makawao Forest Reserve area; is that correct?

A Yes.

Q Now, when you're recreating in the Makawao Forest area, have you ever seen honeycreepers?

A I think I have in the past. I'm not a bird expert so I don't know that I would know specifically if it was a honeycreeper or some type of finch maybe, but I think I likely have.

Q Do you -- so you wouldn't know the identity though?

A At this point, I might. I might. But, you know, in the past, I can't say I would have known specifically if it was a honeycreeper.

Q Do you have a favorite honeycreeper?

A I'm going to say the i'iwi is the one that I -- actually I do think I have seen the i'iwi in Hosmer's Grove previously, so that probably would be a favorite, based on the fact that that's one I'm familiar with.

Q And why is the i'iwi your favorite

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAIʻI

HAWAII UNITES, a 501(c)(3) nonprofit corporation; Tina Lia, an individual, Plaintiffs, vs. BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAIʻI, and DEPARTMENT OF LAND AND NATURAL RESOURCES, STATE OF HAWAIʻI, Defendants, and AMERICAN BIRD CONSERVANCY, Defendant-Intervenor.	CIVIL NO. 1CCV-23-0000594 NOTICE OF HEARING MOTION

NOTICE OF HEARING MOTION

NOTICE IS HEREBY GIVEN that DEFENDANT STATE OF HAWAII'S MOTION FOR SUMMARY JUDGMENT shall come on for hearing on January 17, 2024 at 9:00 a.m. before the Hon. John M. Tonaki, Judge of the above-entitled court, in his courtroom at 777 Punchbowl Street, Courtroom 17, Honolulu, HI 96813, or as soon thereafter as counsel may be heard.

DATED: Honolulu, Hawaiʻi, December 22, 2023.

/s/ Miranda C. Steed .
JULIE H. CHINA
DANICA L. SWENSON
MIRANDA C. STEED
Deputy Attorneys General

Attorneys for Defendant

BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAIʻI AND DEPARTMENT OF LAND AND NATURAL RESOURCES, STATE OF HAWAIʻI

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAI'I

HAWAII UNITES, a 501(c)(3) nonprofit corporation; Tina Lia, an individual, Plaintiffs, vs. BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAI'I, and DEPARTMENT OF LAND AND NATURAL RESOURCES, STATE OF HAWAI'I, Defendants, and AMERICAN BIRD CONSERVANCY, Defendant-Intervenor.	CIVIL NO. 1CCV-23-0000594 (Environmental Court) CERTIFICATE OF SERVICE

I. CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and accurate copy of the foregoing document was duly served upon the person(s) listed below by electronic service or by depositing the same in the United States Mail, postage prepaid, on December 22, 2023:

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AMERICAN BIRD CONSERVANCY

DATED: Honolulu, Hawai‘i, December 22, 2023.

/s/ Miranda C. Steed .
JULIE H. CHINA
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