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To: Scott Glenn, Director
Office of Environmental Quality Control

From: Suzanne D. Case, Chairperson
Department of Land and Natural Resources

Subject: Final Environmental Assessment (FEA) for Conservation District Use Application (CDUA) HA-3798 for the Proposed Establishment of a National Ecological Observatory Network (NEON) Field Study Site at the Pu'u Maka'ala Natural Area Reserve Located Within the Upper Waiākea and Ola'a Forest Reserves, Island of Hawai'i, TMKs: (3) 1-8-012:003; 1-9-001:001; 2-4-008:009, 019 & 025

The Department of Land and Natural Resources has reviewed the FEA for the subject project and has determined a Finding of No Significant Impact (FONSI). Please be advised, however, that this finding does not constitute approval of the proposal.

The Draft EA was published in the May 23, 2017 edition of *The Environmental Notice*. Comments on the Draft EA were sought from relevant agencies and the public, and were included in the Final EA. The FEA has been prepared pursuant to Chapter 343, Hawai'i Revised Statutes and Chapter 11-200, Hawai'i Administrative Rules. Please publish this notice in OEQC's upcoming August 8, 2017 edition of *The Environmental Notice.*

We have enclosed one (1) hard copy of the FEA and OEQC publication form, as well as one (1) CD with a pdf file of the Final EA and the OEQC publication form in word document format for publication purposes.

Please contact Tiger Mills of our Office of Conservation and Coastal Lands at 587-0382 should you have any questions.

Attachments: *FEA, OEQC Pub Form, 1 CD*

18-033

APPLICANT
PUBLICATION FORM

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AND COASTAL LANDS
2017 JUL 13 A 10:21
DEPT OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

Project Name:	Domain 20 Field Site for the National Ecological Observatory Network
Project Short Name:	NEON Domain 20 Field Site
HRS §343-5 Trigger(s):	Use of State lands and use within land classified as Conservation District
Island(s):	Hawaii
Judicial District(s):	South Hilo
TMK(s):	(3)2-4-008:009, (3)2-4-008:025 (por.), (3)1-9-001:001 (por.), (3)1-8-012:003 (por.), and (3)2-4-008:019 (por.)
Permit(s)/Approval(s):	Endangered Species Act Section 7 and HRS Chapter 195D Compliance, National Historic Preservation Act Section 106 and HRS Chapter 6E Compliance, Conservation District Use Permit, Natural Area Reserve System (NARS) Special Use Permit, Community Noise Permit, County Plan Approval
Approving Agency:	Department of Land and Natural Resources
Contact Name, Email, Telephone, Address	Tiger Mills 1151 Punchbowl St., Room 131 Honolulu, HI 96813 (808)587-0382 kimberly.mills@hawaii.gov
Applicant:	National Science Foundation
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Consultant:	CH2M
Contact Name, Email, Telephone, Address	Lisa Kettley 1132 Bishop Street, Suite 1100 Honolulu, HI 96813 (808)440-0275 lisa.kettley@ch2m.com

Status (select one)	**Submittal Requirements**
____ DEA-AFNSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
__X_ FEA-FONSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
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____ FEIS Acceptance Determination	The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
____ FEIS Statutory Acceptance	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
____ Supplemental EIS Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.
____ Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____ Other	Contact the OEQC if your action is not one of the above items.

Project Summary
Provide a description of the proposed action and purpose and need in 200 words or less.

The National Ecological Observatory Network (NEON) is a continental-scale ecological observation facility sponsored by the National Science Foundation (NSF) and operated by Battelle Memorial Institute. It is designed to gather and synthesize data needed to study the impacts of climate change, land use change and invasive species on natural resources and biodiversity. NSF is proposing to establish a NEON field study site within the Pu'u Maka'ala Natural Area Reserve (NAR) on the eastern side of Hawai'i Island. The proposed field study site would provide data for NEON's Pacific Tropical domain (Domain 20), and would be the only site representing this domain for the continental-wide network. Similar to other NEON core sites, the Domain 20 site in Hawai'i would include a standard set of scientific infrastructure and equipment to collect abiotic, biological, biophysical, biogeochemical, and land use data. The proposed scientific infrastructure and equipment would include a tower, a panelized modular enclosure (i.e. instrument hut), an array of soil plots with soil sensors, a precipitation gauge, electrical equipment, and a suite of distributed terrestrial sampling protocols. The site would be operated for 30 years, and the resulting data would be made freely available to the scientific community and general public through the online NEON portal.

FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT

Domain 20 Field Site for the National Ecological Observatory Network for the National Science Foundation

Puʻu Makaʻala Natural Area Reserve
South Hilo District, Hawaiʻi Island, Hawaiʻi

Prepared for

National Science Foundation

July 2017

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\+ *Indicates information required to comply with Hawai‘i Revised Statutes (HRS) Chapter 343.*

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1 Introduction

The National Ecological Observatory Network (NEON) is a continental-scale ecological observation facility sponsored by the National Science Foundation (NSF) and operated by Battelle Memorial Institute (Battelle).[1] It is designed to gather and synthesize data needed to study the impacts of climate change, land use change, and invasive species on natural resources and biodiversity. NSF is proposing to establish a NEON field study site within the Puʻu Makaʻala Natural Area Reserve (NAR) on the eastern side of Hawaiʻi Island, part of the statewide Natural Area Reserves System (NARS). The proposed field study site would provide data for NEON's Pacific Tropical domain (Domain 20), and would be the only site representing this domain for the continental-wide network.

As a federal agency, NSF is subject to the requirements of the National Environmental Policy Act (NEPA) and its implementing regulations (40 *Code of Federal Regulations* [CFR] Part 1500 through Part 1508), which require federal agencies to assess the environmental effects of their proposed actions before making decisions. NSF is also subject to its agency-specific regulations implementing NEPA at 45 CFR Part 640. Similarly, Hawaii Revised Statutes (HRS) Chapter 343 and its implementing rules (Hawaii Administrative Rules [HAR] 11-200) require environmental review for projects that include certain regulatory triggers; in the case of this proposed project, the triggers for compliance with HRS Chapter 343 include the use of State lands and use within land classified as Conservation District. The purpose of both NEPA and HRS Chapter 343 is to inform decision-makers and the public of the likely environmental effects of a proposed action and its alternatives, and to allow for public comment.

HRS Chapter 343-5(f) states that "*[w]henever an action is subject to both the National Environmental Policy Act of 1969… and the requirements of [HRS Chapter 343], the [Office of Environmental Quality Control (OEQC)] and agencies shall cooperate with federal agencies to the fullest extent possible to reduce duplication between federal and state requirements. Such cooperation, to the fullest extent possible, shall include joint environmental impact statements with concurrent public review and processing at both levels of government. Where federal law has environmental impact statement requirements in addition to but not in conflict with [Chapter 343, HRS], the [OEQC] and agencies shall cooperate in fulfilling these requirements so that one document shall comply with all applicable laws.*"

Based on these requirements, this environmental assessment (EA) evaluates the anticipated environmental impacts associated with construction and operation of the proposed NEON Domain 20 field study site at Puʻu Makaʻala NAR, in compliance with both NEPA and HRS Chapter 343. NSF is the lead agency for purposes of NEPA compliance; the State of Hawaiʻi Department of Land and Natural Resources (DLNR) is the approving agency responsible for compliance with HRS Chapter 343.

1.1 Background and History

1.1.1 Overview of the National Ecological Observatory Network

For nearly two decades, the ecological sciences research community has called for the national research and observation capability needed to promote understanding of the biosphere (Long Term Ecological Research [LTER], 1990; American Institute of Biological Sciences [AIBS], 2003; NEON, 2006). Two reports published by the National Research Council (NRC), *Grand Challenges in Environmental Science* (2001) and *NEON: Addressing the Nation's Environmental Challenges* (2003), identified "Grand Environmental Challenges" and the associated research questions that were deemed critically important to address now, cannot be

[1] The prior awardee was NEON, Inc. The new awardee is Battelle Memorial Institute.

addressed with existing research infrastructure, and require environmental measurements on a regional to continental scale.

To provide the basis to respond to these critical research questions, NEON was developed as a continental-scale ecological observation facility, comprised of a network of long-term scientific infrastructure deployments to collect high-quality, standardized data. The design divides the continental United States, Alaska, Hawai'i, and Puerto Rico into 20 domains, with each domain representing a specific range of eco-climatic conditions, thereby encompassing the full range of environmental variability. Within each domain, infrastructure is deployed to field study sites strategically selected to represent different regions of vegetation, landforms, climate, and ecosystem performance. Data collection methods are standardized across the field study sites and include *in situ* instrument measurements, field sampling, and airborne remote sensing. This network of deployments forms a fully integrated continental-scale research platform. Under this system, measurement of a variable over time in all 20 domains facilitates understanding of the quantity, changes in, and spatial heterogeneity of that variable at a continental scale. Given the time required to observe changes in some ecological parameters, NEON is designed to have a 30-year operational lifespan. Overall, this platform enables scientists to analyze, understand, and forecast the nature and pace of biological change at scales ranging from local to continental. It also includes a framework for researchers to apply new research capabilities, subject to approval by the NEON managing organization.

1.1.2 Background and History

A thorough process was conducted to identify, evaluate, and select sites for deployment of NEON infrastructure within each of the 20 domains. The NEON project team established site criteria and a detailed selection and review process (involving research community workshops, Blue Ribbon committees, and NRC and NSF merit reviews). Specific site criteria for field study sites include (1) a "wildland" area comprised of undeveloped, natural land representing the dominant vegetation and soil type for that domain, (2) contiguous habitat over an area large enough to implement the sampling protocols, (3) areas subject to minimal disturbance (i.e., not pristine, but still high quality habitat), (4) adequate soil depth to implement sampling protocols, (5) site accessibility, and (6) proximity to an existing power supply.

In October 2006, the NEON project team announced a request for information (RFI) inviting members of the ecological research community to submit ideas about (1) potential field study sites and (2) specific research projects they would conduct using NEON data. The NEON project team then evaluated the potential field study sites identified in the RFI responses. Each potential site was visited to evaluate its overall viability; those found to be viable were further reviewed to assess scientific suitability, practicality, and environmental conditions. Through this process, both proposed core and relocatable field study sites[2] were selected in each domain. The potential environmental and socioeconomic impacts that would result from implementation of the NEON sites nationwide was assessed, as presented in the *National Ecological Observatory Network (NEON) Environmental Assessment* (NSF, 2009). NSF found that NEON would have no significant impact on the environment, with site-specific agency consultation needs identified and implementation of avoidance and minimization measures.

Based on the delineation of the eco-climatic domains for NEON, Domain 20 was defined as "Pacific Tropical," with the Hawaiian Islands comprising the entire domain. Through the site selection process, as detailed in the 2009 NEON EA, the location of the core field study site identified for Domain 20 was within the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest (which is comprised of Laupāhoehoe NAR and Hilo Forest Reserve lands), located in the North Hilo District on Hawai'i Island. This area is managed by the DLNR Division of Forestry and Wildlife (DOFAW) and the U.S. Forest Service (USFS)

[2] Core sites are designed to collect data from minimally managed "wildland" areas for the full 30-year lifetime of the NEON project. Relocatable sites are designed to collect data for approximately 10 years and are sited in areas suitable to address land use, invasive species and urban effects. The infrastructure requirements are generally the same, except the relocatable sites include a secondary precipitation gauge (as opposed to a double-fenced intercomparison reference [DFIR] precipitation gauge).

for protection of natural resources. Subsequent to issuance of the 2009 NEON EA, the proposed Laupāhoehoe site was determined to be unsuitable because of challenges implementing the design. In addition, the two proposed relocatable field study sites were eliminated from the scope because of (1) a reduction in the overall scope of NEON and (2) changes to the plant community that altered the ability to answer intended scientific questions.

To identify a suitable replacement for the Domain 20 core field study site, the NEON project team worked closely with the ecological research community (i.e., those that responded to the original RFI) and DOFAW and NARS staff to review other similar areas that would meet the site criteria. The first replacement site identified by these entities was located within the Upper Waiakea Forest Reserve. Over the course of more than a year, this site was reviewed in direct coordination with DOFAW and NARS staff and other stakeholders; this process involved multiple site visits, detailed site evaluation, and ongoing stakeholder meetings. Eventually, however, because of concerns about conflicts with existing uses, DOFAW and NARS staff recommended that NSF reject the Upper Waiakea Forest Reserve site and, instead, identified Pu‘u Maka‘ala NAR as a possible location. Again, an iterative process involving multiple site visits and site evaluations was conducted in coordination with DOFAW and NARS staff. Eleven possible sites within the NAR were initially considered, one of which was unanimously identified as the most suitable replacement site. Additional information regarding the replacement sites that were considered is provided in Section 2.

1.2 Project Location

The proposed Domain 20 core field study site is within the Pu‘u Maka‘ala NAR, which is located on the northeastern slopes of Mauna Loa, in the South Hilo District, approximately 19 miles (30 kilometers) southwest of the town of Hilo (see Figure 1). Pu‘u Maka‘ala NAR is approximately 18,730 acres in size, and is managed by DOFAW for the protection of unique natural resources. It is bordered by the Upper Waiakea Forest Reserve on the north and east, the ‘Ōla‘a Forest Reserve on the east, the ‘Ōla‘a Tract of Hawai‘i Volcanoes National Park to the south, and private property to the west (Kamehameha Schools), southwest, and southeast (various agricultural parcels). The Kūlani Correctional Facility, which occupies approximately 280 acres, is located within an interior portion of the NAR. Stainback Highway provides access from Māmalahoa Highway (State Route 11) to the eastern edge of Pu‘u Maka‘ala NAR and the Kūlani Correctional Facility. A series of existing unimproved roads provide limited access within the NAR.

The proposed Domain 20 field study site would be located in the western portion of the NAR, with the proposed scientific infrastructure located approximately 1 mile (1.7 kilometers) northwest of the Kūlani Correctional Facility (see Figure 2). The infrastructure would occupy approximately 0.2 acre and would be located entirely within tax map key (TMK) (3)2-4-008:009. Terrestrial sampling plots, with a total footprint of approximately 630 acres, would be distributed throughout approximately 11,660 acres of the surrounding NAR property; this area includes the following TMKs: (3)2-4-008:009, (3)2-4-008:025 (por.), (3)1-9-001:001 (por.), (3)1-8-012:003 (por.), and (3)2-4-008:019 (por.). Specific dimensions of the project components are further discussed in Section 2.2.

1.3 Purpose and Need

1.3.1 Need for Action

The nation’s Grand Challenges in environmental science, which were reviewed by the NRC, the International Geosphere-Biosphere Programme, the Millennium Ecosystem Assessment, Diversitas, and the U.S. Climate Change Science Program, identify tasks within the environmental science field requiring additional research to yield scientific and practical information for the future. Three challenges were identified as causes of change in continental-scale ecology that could be addressed by a continental-scale observatory system: climate change, land use change, and invasive species.

NEON was developed in response to the Grand Challenges, and is the first ecological observatory network designed to test and develop ecological theory by detecting and forecasting ecological change at a continental-scale over multiple decades. It will establish and sustain the scientific infrastructure needed to address critical questions about land use and climate changes on ecological systems and to evaluate the impacts of those changes on the environment and human culture.

Based on comprehensive planning and design efforts completed to date, sites in many of the other 19 eco-climatic domains are currently either under construction or are complete. The target is for the entire network of field study sites to be fully operational by 2018. However, as discussed previously, the NEON project team determined that it is not feasible to construct the core field study site for the Pacific Tropical domain (Domain 20, represented by the Hawaiian Islands) at Laupāhoehoe NAR, the location that was originally selected for implementation. To complete the continental-scale network and dataset representing the full spectrum of environmental variability across the United States, Alaska, Hawai'i, and Puerto Rico, construction and operation of a core field study site that meets the NEON site criteria is needed to represent Domain 20.

1.3.2 Project Purpose

The purpose of the proposed project is to construct and operate a core field study site for Domain 20 as part of NEON. A uniform and standardized design across the network of sites is essential to informing the science, testing the hypotheses, and conducting research at a continental scale. Similar to other NEON core sites, the proposed Domain 20 site in Hawai'i would include a standard set of scientific infrastructure and equipment to collect abiotic, biological, biophysical, biogeochemical, and land use data. The proposed scientific infrastructure and equipment would include one tower, a panelized modular enclosure (referred to as an instrument hut), an array of soil plots with soil sensors, a soil horizon pit, a precipitation gauge, electrical equipment, and a suite of distributed terrestrial sampling protocols. The site would be operated for 30 years, with data collection and streaming to the online NEON portal starting in 2018. Such data would be made freely available to the scientific community and general public for use in analyzing ecological conditions in the Hawaiian Islands and would be comparable to data collected across the continental United States, Puerto Rico, and Alaska.

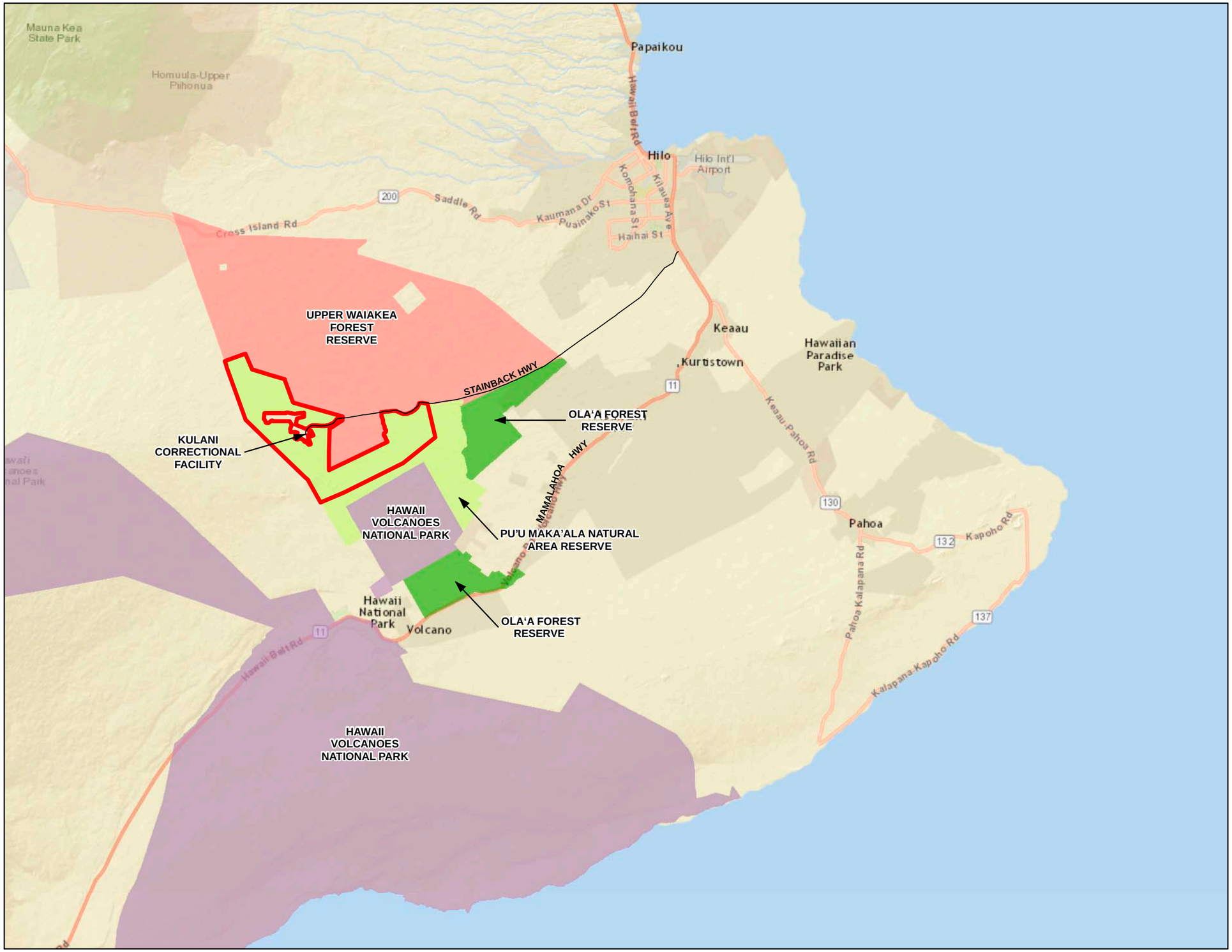
1.4 Regulatory Setting

In addition to NEPA and HRS Chapter 343, there are other federal, state, and local regulations that must be considered in the planning process. The regulations most relevant to the analysis presented herein are summarized below. The agencies and authorities responsible for administering these regulations are noted, where applicable. NSF is carrying out its compliance with these regulations in parallel with the NEPA and HRS Chapter 343 process; additional information on the compliance process is provided in Section 5.

1.4.1 Federal Regulations

1.4.1.1 National Environmental Policy Act

The proposed project would be funded by NSF; this federal funding subjects the project to the environmental review requirements of NEPA, prescribed under 40 CFR Parts 1500 – 1508 (Council on Environmental Quality [CEQ]). NEPA requires federal agencies to incorporate environmental considerations in their planning and decision-making process through a systematic interdisciplinary approach. Specifically, federal agencies are to prepare detailed statements that assess the environmental impact of and alternatives to federal actions that could significantly affect the environment. As the lead federal agency, NSF is responsible for compliance with NEPA documentation and processing requirements, as provided in both the CEQ NEPA regulations and NSF's NEPA implementing regulations at 45 CFR Part 640. This Final EA has been prepared pursuant to these requirements.



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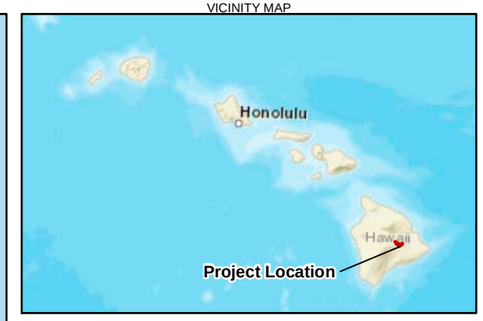

LEGEND

- Project Location
- Hawaii Volcanoes National Park
- Olaa Forest Reserve
- Pu'u Maka'ala Natural Area Reserve
- Upper Waiakea Forest Reserve

N

0 2.5 5
Miles

Figure 1
Project Location
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

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1.4.1.2 National Historic Preservation Act

The National Historic Preservation Act of 1966 (NHPA), as amended (54 United States Code [U.S.C.] 300101, *et seq*.), recognizes the nation's historic heritage and establishes a national policy for the preservation of historic properties as well as the National Register of Historic Places (NRHP). Section 106 of the NHPA (54 U.S.C. 306108) requires that federal agencies consider the effects of their projects on significant historic properties.

The implementing regulations for the NHPA are found in the Protection of Historic Properties (36 CFR Part 800), which defines historic properties as any prehistoric or historic district, site, building, structure, or object that is included in, or eligible for inclusion in, the NRHP (54 U.S.C. 302101). In the case of this proposed project, use of federal funds establishes the need for Section 106 compliance. The purpose of the Section 106 consultation process is to evaluate the potential for effects on existing historic properties, if any, resulting from the proposed project.

The Section 106 review process encompasses a good faith effort to ascertain the existence and location of historic properties near and within the proposed project site, establishing an Area of Potential Effects (APE) for the proposed project, identifying whether the proposed project may adversely affect historic properties that are listed or are eligible for listing in the NRHP, and, if so, developing ways to avoid, minimize, or mitigate those adverse effects. The resolution of any adverse effects is typically memorialized in a Memorandum of Agreement (MOA) created through consultation with the State Historic Preservation Officer (SHPO), Advisory Council on Historic Preservation (ACHP) (if it chooses to participate), and any consulting government agencies, community associations, and Native Hawaiian organizations (NHOs).

1.4.1.3 Endangered Species Act

The Endangered Species Act of 1973 (16 U.S.C. 1531–1544) (ESA) provides for the protection and conservation of threatened and endangered species (listed species) of animals and plants, and the ecosystems on which listed species depend. The ESA prohibits federal agencies from funding, authorizing, or carrying out actions likely to jeopardize the existence of listed species through direct taking or through the destruction or adverse modification of critical habitat designated for these species under the ESA. Section 7 of the ESA requires consultation with the United States Fish and Wildlife Service (USFWS) when any listed species under its jurisdiction may be affected by a proposed action.

1.4.2 State Regulations

1.4.2.1 HRS Chapter 343

HRS Chapter 343 is designed to "establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations." The regulations identify nine specific activities that trigger the need for compliance. In the case of this proposed project, there are two activities that are triggers for compliance with HRS Chapter 343: (1) use of state lands and (2) use of land within the Conservation District. In addition to the other resources addressed in the environmental review process, HRS Chapter 343 includes a requirement to consider the effects of a proposed action on cultural practices. This Final EA has been prepared in compliance with HRS Chapter 343; it is considered an applicant action, with DLNR as the approving agency.

1.4.2.2 HRS Chapter 6E

HRS Chapter 6E establishes a comprehensive historic preservation program that is intended to preserve, restore and maintain historic and cultural properties. The regulations are implemented by the State Historic Preservation Division (SHPD) (which is administered by the SHPO), and require review of any project that is funded or permitted by the State. This process is the state counterpart to the NHPA Section 106 requirement to identify historic properties potentially affected by a proposed project, and can be an

additional avenue of information gathering for fulfilling the Section 106 consultation mandate. The implementing rules for the historic property review process are contained in HAR 13-275; these rules apply to "all state or county agencies funding or directly undertaking a project, or having a project undertaken on lands under its ownership or control which may affect historic properties."

1.4.2.3 HRS Chapter 195D

Any species of aquatic life, wildlife, or land plant that has been determined to be threatened or endangered species pursuant to the ESA is also considered to be threatened or endangered under the state law, and subject to the conditions of HRS Chapter 195D-4. These regulations specify that take of any threatened or endangered species within the state is unlawful, except as provided in subsections (f), (g), and (j), which allows for consultation with the Endangered Species Recovery Committee and issuance of incidental take licenses.

1.5 Agency Coordination and Public Participation

Stakeholder engagement has been conducted to comprehensively address NSF policies, as well as to comply with specific regulatory requirements relating to public involvement and agency consultation. In particular, NEPA and HRS Chapter 343 require the opportunity for public participation as part of the environmental review process. All agencies, organizations, and members of the public having a potential interest in the proposed project are urged to participate. Consideration of the views of interested persons promotes open communication and enables better decision-making. In addition, consultation is required for other federal regulations, including NHPA Section 106 and ESA Section 7. In particular, NHPA Section 106 requires consultation with interested parties and NHOs as part of a federal agency's consideration of the effects of their proposed undertaking on historic properties.

The following sections summarize the efforts conducted to date (since issuance of the 2009 NEON EA) relative to agency coordination and public participation. These efforts will continue through completion of the NEPA, HRS Chapter 343 and other regulatory compliance processes.

1.5.1 Agency Coordination and Consultation

Coordination and consultation has been conducted with federal, state, and local agencies as part of the NEPA, HRS Chapter 343, and other applicable regulatory compliance processes. Both formal and informal coordination has occurred with various agencies to ensure full disclosure and adequate opportunity for input. These efforts included but were not limited to the meetings and correspondence listed in Table 1. Details regarding the consultation process undertaken for specific regulatory compliance requirements are provided in Section 5.2.

1.5.2 Stakeholder Involvement and Public Disclosure

In addition to agency coordination and consultation, outreach to the public and other stakeholders has been conducted to help identify potential issues and concerns. Stakeholders engaged to date include adjacent landowners, community members, NHOs, cultural practitioners, elected officials, and other members of the public. Public and stakeholder engagement efforts (since issuance of the 2009 NEON EA) included pre-assessment scoping and distribution of the Draft EA for public review. The following sections summarize these efforts; meetings conducted with key stakeholders are listed in Table 1.

TABLE 1
Agency/Stakeholder Coordination and Consultation

Date	Agency/Stakeholder	Purpose
March 26, 2010	SHPD	NHPA Section 106 consultation letter sent to SHPD (Laupāhoehoe site)
June 1, 2010	USFWS	ESA Section 7 letter sent to USFWS seeking concurrence with effect determination (Laupāhoehoe site)
June 29, 2010	USFWS	ESA Section 7 letter from USFWS concurring with effect determination (Laupāhoehoe site)
December 9-11, 2014	DOFAW and scientific community	Series of presentations to multiple groups and stakeholders providing an overview of the proposed project, the scope of work to be performed, and scientific aspects of project; stakeholder comments and input were also sought (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
December 10, 2014	General public, U.S. Geological Survey (USGS), Hawai‘i Volcanoes National Park, USFS and University of Hawai‘i Chancellor’s Office	Presentation of proposed project, as noted above (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
December 11, 2014	State legislators	Presentation of proposed project overview (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
December 12, 2014	Board of Land and Natural Resources (BLNR)	Supported DOFAW presentation to BLNR for the approval in concept for a potential long-term direct lease and permit. Correspondence from BLNR providing approval in concept for a potential long-term direct lease and permit for use of state land was received December 12, 2014 (Upper Waiakea site)
February 27, 2015	Pacific Islands Climate Change Cooperative (PICCC)	Presentation of proposed project, as noted above (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
July 8-9, 2015	Hawai‘i Ecosystem Meeting	Presentation of proposed project, as noted above (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
July 12-16, 2015	Association for Tropical Biology and Conservation (ATBC)	Presentation of proposed project, as noted above (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
August 10-14, 2015	Hawai‘i Conservation Conference	Presentation of proposed project, as noted above (Upper Waiakea site and Pu‘u Wa‘awa‘a relocatable sites [later descoped])
December 16, 2015	USFWS	ESA Section 7 correspondence from USFWS providing species list (Upper Waiakea site)
March 23, 2016	DOFAW/NARS	Conference call to discuss NEON infrastructure and field study site requirements
May 12 – 13, 2016	DOFAW/NARS, ecological researchers (i.e., those that responded to the original RFI)	Site visit with DOFAW/NARS staff to evaluate potential sites within Pu‘u Maka‘ala NAR
July 19, 2016	DLNR Office of Conservation and Coastal Lands (OCCL)	Correspondence requesting input on the Conservation District permitting requirements (Pu‘u Maka‘ala NAR site)
July 23, 2016	Approximately 200 agencies and stakeholders (see complete list in Appendix A)	Scoping letter for NEPA and HRS Chapter 343 EA and identification of consulting parties for NHPA Section 106 (Pu‘u Maka‘ala NAR site)
September 22, 2016	OCCL, DOFAW/NARS	Meeting to discuss HRS Chapter 343 compliance and Conservation District and NARS permitting requirements (Pu‘u Maka‘ala NAR site)
October 25, 2016	USFWS	Meeting to discuss the ESA Section 7 consultation process (Pu‘u Maka‘ala NAR site)

TABLE 1
Agency/Stakeholder Coordination and Consultation

Date	Agency/Stakeholder	Purpose
October 26, 2016	DOFAW/NARS, USFWS, OCCL, ʻAlalā Project, Rapid *ʻOhiʻa* Death Working Group (USFS), Three Mountain Alliance, Legacy Land Commission	Meeting to provide proposed project overview and discuss stakeholder issues to inform ESA compliance (Puʻu Makaʻala NAR site)
October 26, 2016	NHPA Section 106 potential consulting parties	Meeting to provide proposed project overview and obtain consulting party input on historic properties and cultural practices (Puʻu Makaʻala NAR site)
October 27, 2016	OEQC	Meeting to provide proposed project overview and obtain consulting party input on HRS Chapter 343 compliance (Puʻu Makaʻala NAR site)
December 7, 2016	SHPO/SHPD and potential Consulting Parties	Letter initiating Section 106 consultation with SHPO/SHPD (Puʻu Makaʻala NAR site)
January 23, 2017	DOFAW/NARS, USFWS, OCCL, ʻAlalā Project, Rapid *ʻOhiʻa* Death Working Group (USFS), Three Mountain Alliance, Legacy Land Commission	Email to participants of October 26, 2016 meeting containing meeting minutes, revisions to terrestrial sampling protocols and proposed mitigation measures developed in response to concerns raised at meeting (Puʻu Makaʻala NAR site)
January 24, 2017	ʻAlalā Working Group	Meeting to provide proposed project overview and discuss stakeholder issues to inform ESA compliance (Puʻu Makaʻala NAR site)
April 26, 2017	USFWS	Conference call to obtain input from USFWS on information regarding listed species and preliminary effects analysis
May 23, 2017	USFWS	Meeting to discuss information regarding listed species and preliminary effects analysis
May 25, 2017	Public Meeting	Public meeting to provide information and allow for public participation with respect to the NEPA and HRS Chapter 343 process. The meeting also included a summary of NSF's assessment of effects to cultural resources, which was conducted per NHPA Section 106 and HRS Chapter 6E-8; consulting parties were invited to attend and consult with NSF's Federal Preservation Officer on historic properties and cultural resources
June 29, 2017	Public Hearing	Public hearing as part of the Conservation District Use Permit application process

1.5.2.1 Scoping for Environmental Assessment

A wide variety of agencies, organizations, and potentially interested individuals were contacted before preparation of the Draft EA through the formal scoping process. They received a scoping letter containing preliminary project information and were asked to provide comments and related information for consideration in preparing the Draft EA. Scoping letters were distributed by mail to more than 200 agencies, organizations, and individuals; a total of 11 responses were received. Nearly all of the comments (10 of the 11) were provided by federal, state, or local agencies, with input relating to specific permit requirements and suggestions on information that should be contained in the Draft EA. One comment was provided by an adjacent landowner, asking to be removed from the project stakeholder list. The comments received were considered and reflected in the Draft EA.

Additional information on the scoping comments is provided in Section 5.2.1. A detailed scoping report, including a copy of the scoping letter, comments received, and responses to those comments is contained in Appendix A.

1.5.2.2 Distribution of the Draft Environmental Assessment for Public Review

Pursuant to the requirements of NEPA and HRS Chapter 343, the Draft EA was distributed for a minimum 30-day public review period. As required by HRS Chapter 343 and HAR 11-200-3, the OEQC notifies the public when a Draft EA is available for review in its bimonthly bulletin, the OEQC *Environmental Notice*. OEQC officially announced the availability of the Draft EA on May 23, 2017, which initiated the 30-day review and comment period under HRS Chapter 343. However, to provide additional time for public and stakeholder review, NSF's comment period under NEPA began on May 9, 2017, when the Draft EA was posted on the NSF NEON Program website (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13440). The public comment period under both NEPA and HRS Chapter 343 ended on the same date, June 22, 2017.

Notice of the public review period was provided to the project stakeholder list; the distribution list is provided in Appendix B. As indicated in the notice, an electronic copy of the Draft EA was posted to OEQC's EA and environmental impact statement (EIS) online library (http://oeqc.doh.hawaii.gov/default.aspx) and the NSF NEON Program website (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13440). In addition, both a hard copy and electronic copy (on CD) were provided to the following libraries:

- Hilo Public Library (300 Waianuenue Avenue, Hilo, HI 96720)
- Keaau Public and School Library (16-571 Keaau Pahoa Road, Keaau, HI 96749)
- Mountain View Public and School Library (18-1235 Volcano Highway, Mountain View, HI 96771)
- Edwin H. Mookini Library, University of Hawai'i at Hilo (200 W Kawili Street, Hilo, HI 96720)
- Hawai'i State Library (478 S King Street, Honolulu, HI 96813)

During the public comment period, NSF accepted written comments on the Draft EA either via electronic or hard-copy mail (postmarked on or before June 22, 2017).

NSF also held a public meeting to provide additional opportunity for public participation with respect to the NEPA and HRS Chapter 343 process. The meeting was held on May 25, 2017, at the DOFAW Hawai'i Branch Office (19 E. Kawili Street, Hilo, HI 96720) from 5:30 to 7:30 pm. An informational presentation on the proposed project and the environmental compliance process was provided by NSF. Informational boards were also available for viewing and handouts were made available to meeting attendees. In addition to addressing NEPA and HRS Chapter 343 requirements, the meeting also included a summary of NSF's assessment of effects to cultural resources, which was conducted per NHPA Section 106 and HRS Chapter 6E-8; consulting parties were invited to attend and consult with NSF's Federal Preservation Officer on historic properties and cultural resources. A total of 11 persons signed in at the meeting.

A total of 13 comments were received during the public comment period, as further discussed in Section 5.2.2. These comments have been reviewed and considered in completing the NEPA and HRS Chapter 343 processes, and are reflected in the revisions to this Final EA as appropriate.

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2 Description of Proposed Action and Alternatives

This section presents information regarding the proposed project, as well as alternatives that were considered. The alternatives that were considered but not carried forward are discussed in Section 2.1. The proposed project is described in Section 2.2. The No Action Alternative is presented in Section 2.3.

As described in Section 1.3, uniform infrastructure and standardized data collection methods are required to achieve the overall NEON objectives. Some modifications have been made to tailor the infrastructure and sampling protocols to the local ecology and site-specific conditions. However, alternatives based on fundamentally different technologies, scientific infrastructure and equipment, sampling protocols, and implementation timing and schedule were not considered, as these would not be consistent with NEON's standardized approach, and therefore, would not meet the project's purpose and need.

A range of locations were considered for the Domain 20 field study site as part of the identification and selection process summarized in Section 1.1. This process included input from the ecological research community and other stakeholders, and an in-depth evaluation of scientific data collection needs, constructability and impacts to sensitive resources. Given the substantial screening of alternative sites over the course of this process and the site suitability requirements for NEON, only a single alternative has been identified as viable for consideration (in addition to the No Action alternative). The proposed project described in Section 2.2 will be the preferred alternative.

2.1 Alternatives Considered But Not Carried Forward

As summarized in Section 1.1, the location originally selected for the Domain 20 core field study site was within the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest. However, this location was subsequently determined to be unsuitable because of challenges implementing the design. Potential replacement sites were subsequently identified within the Upper Waiakea Forest Reserve and at multiple locations within Pu'u Maka'ala NAR. The following sections describe the alternative sites that were considered but were not carried forward.

2.1.1 Laupāhoehoe Forest

The original location identified for the Domain 20 core field study site was within the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest, located on the eastern flanks of Mauna Kea Volcano in the North Hilo District on Hawai'i Island. The Hawai'i Experimental Tropical Forest is an overlying management designation intended to facilitate cooperative management of research and education activities by DOFAW and USFS. The land within the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest is made up of the Laupāhoehoe NAR and the Laupāhoehoe Section of the Hilo Forest Reserve, both of which are managed by DOFAW. This location was identified based on a proposal prepared by an interdisciplinary team of more than 80 researchers representing the University of Hawai'i, USFS, USGS, National Park Service (NPS), and DLNR, in response to the NEON RFI process.

The potential impacts associated with deployment of the NEON infrastructure and data collection in the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest were assessed as part of the 2009 NEON EA (NSF, 2009). The EA concluded that with additional agency coordination and implementation of best management practices (BMPs), implementation of NEON at this site (as well as at sites within the other domains) would result in no significant adverse impacts to the natural or human environment.

Subsequent to issuance of the 2009 EA, the Laupāhoehoe site was found to be unsuitable because of logistical challenges in implementing the design. At the time the site selection and evaluation process was

completed, it was believed that the power requirements for the core site infrastructure could be met through supplemental power sources, as no power is available onsite. However, through the detailed design process, it was determined that the power requirements were more substantial, and would require a dedicated electrical line to the site. The lack of access to power and the need to bring in an electrical line over a long distance prevented this location from being further pursued as a viable core field study site.

2.1.2 Upper Waiakea Forest Reserve

Following dismissal of the Laupāhoehoe site, the NEON project team coordinated with the ecological research community (including those that responded to the original RFI) and DOFAW staff to identify a suitable replacement site. Through this effort, the Upper Waiakea Forest Reserve was recommended for consideration based on the known site conditions and NEON project requirements. In particular, this area was considered to be a good match with the site selection criteria, as it consists of an expansive area of high-quality forested habitat that is representative of Domain 20, and includes readily available site access and proximity to power. Detailed evaluation of site conditions and scientific suitability, as well as stakeholder outreach was conducted over the course of more than a year.

Through this process and based on input from DOFAW staff, it was determined that the forest reserve is heavily used by the public for hunting. In the interest of minimizing potential conflicts with recreational use by the local community, DOFAW staff recommended the site instead be located within the boundary of a NAR, where there is less visitation by the public and hunting is not allowed. Based on the potential for the Domain 20 core site to be incompatible with ongoing hunting activities, the Upper Waiakea Forest Reserve site was dismissed from further consideration.

2.1.3 Various Sites Within Pu‘u Maka‘ala Natural Area Reserve

Subsequent to the dismissal of the Upper Waiakea Forest Reserve site and at the recommendation of DOFAW staff, the NEON project team reviewed multiple sites within the Pu‘u Maka‘ala NAR. An iterative process involving multiple site visits and site evaluations was conducted in coordination with DOFAW and NARS staff. The objective of this effort was to identify the site that best meets the scientific requirements for NEON, while balancing land use and management goals regarding sensitive resources within the NAR. In total, 11 possible sites were initially identified within Pu‘u Maka‘ala NAR based on the NEON requirements and high-level information regarding site conditions. The suitability of these sites was then reviewed in coordination with DOFAW and NARS staff, incorporating their more intimate knowledge of site conditions and the NAR management goals. Of the 11 sites initially identified, 3 were carried forward for further consideration; the remainder were dismissed as they either would not meet the NEON requirements or would not be consistent with NAR management goals. The 3 remaining sites (Sites 7, 10, and 11) were evaluated in the field with DOFAW and NARS staff; after evaluation, the following sites were dropped from further consideration:

- **Site 7:** Based on a field investigation, the soils were found to be too shallow to collect the data to meet the NEON scientific requirements. In addition, it was determined that construction and operation of the scientific infrastructure could conflict with existing recreational activities associated with a public access trail in the NAR. Furthermore, the proximity of Stainback Highway was identified as a concern, because vehicle emissions could affect carbon dioxide (CO_2) concentration and flux measurements collected at the tower.
- **Site 10:** It was determined that construction and operation of the core field study site in this location would not be consistent with the management goals for Pu‘u Maka‘ala NAR and the required terrestrial sampling activities would not be authorized, based on the type and quality of the habitat. Furthermore, it was determined that project-related activities could conflict with existing recreational activities in this area.

2.2 Proposed Action

The proposed project involves construction and operation of the Domain 20 core field study site within Pu‘u Maka‘ala NAR, as part of the continental-scale network of long-term ecological infrastructure deployments for NEON. Per the designations used to evaluate possible sites within Pu‘u Maka‘ala NAR (as discussed in Section 2.1.3), the proposed infrastructure would be located at Site 11. As shown in Figure 2, this site is located in the northwestern portion of the NAR, approximately 1.7 kilometers (1 mile) northwest of the Kūlani Correctional Facility. Terrestrial sampling protocols would be conducted within distributed sampling plots located in the surrounding areas within Pu‘u Maka‘ala NAR. This site was selected as the proposed location for Domain 20 because it was determined to be the best fit based on the NEON scientific requirements and Pu‘u Maka‘ala NAR management goals. Overall, the purpose of the proposed project aligns with the underlying mission of the NARS, which includes providing a baseline against which environmental changes can be measured (HRS Chapter 195-1). Site-specific characteristics that make the selected location highly suitable for construction and operation of the Domain 20 core field study site include the following:

- The forest in this area is highly representative of the dominant vegetation and soil types across the Hawaiian Islands. It is relatively high-quality, intact habitat with very little development, which meets the NEON criteria for a “wildland” area. However, the scientific infrastructure would be within an area that has been subject to some degree of disturbance, such that it would not affect otherwise pristine forest habitat. The site includes adequate ground and canopy openings such that the tower and instrument hut can be installed with a very minimal amount of vegetation clearing and trimming. In addition, former pastureland located adjacent to the forested area would allow for the precipitation gauge to be proximate to the tower without impacting native species.
- The soils are deeper than those encountered at alternative sites, which provides better opportunity to implement NEON’s proposed soil protocols and installation of soil sensors.
- The site is readily accessible by existing access roads, but does not overlap with any trails or other recreational resources. The area does not support hunting (as it is located within ungulate fencing), and given its proximity to the Kūlani Correctional Facility, the site is rarely (if ever) accessed by the public.
- Existing electrical lines are located reasonably close to the proposed site, thus minimizing the distance of the proposed power run.

As a core field study site in NEON, the proposed project includes deployment of standardized infrastructure and equipment, as well as terrestrial sampling and data collection consistent with NEON protocols. The following sections details these project components, including the associated construction, operations and maintenance, and site closure activities.

2.2.1 Project Components

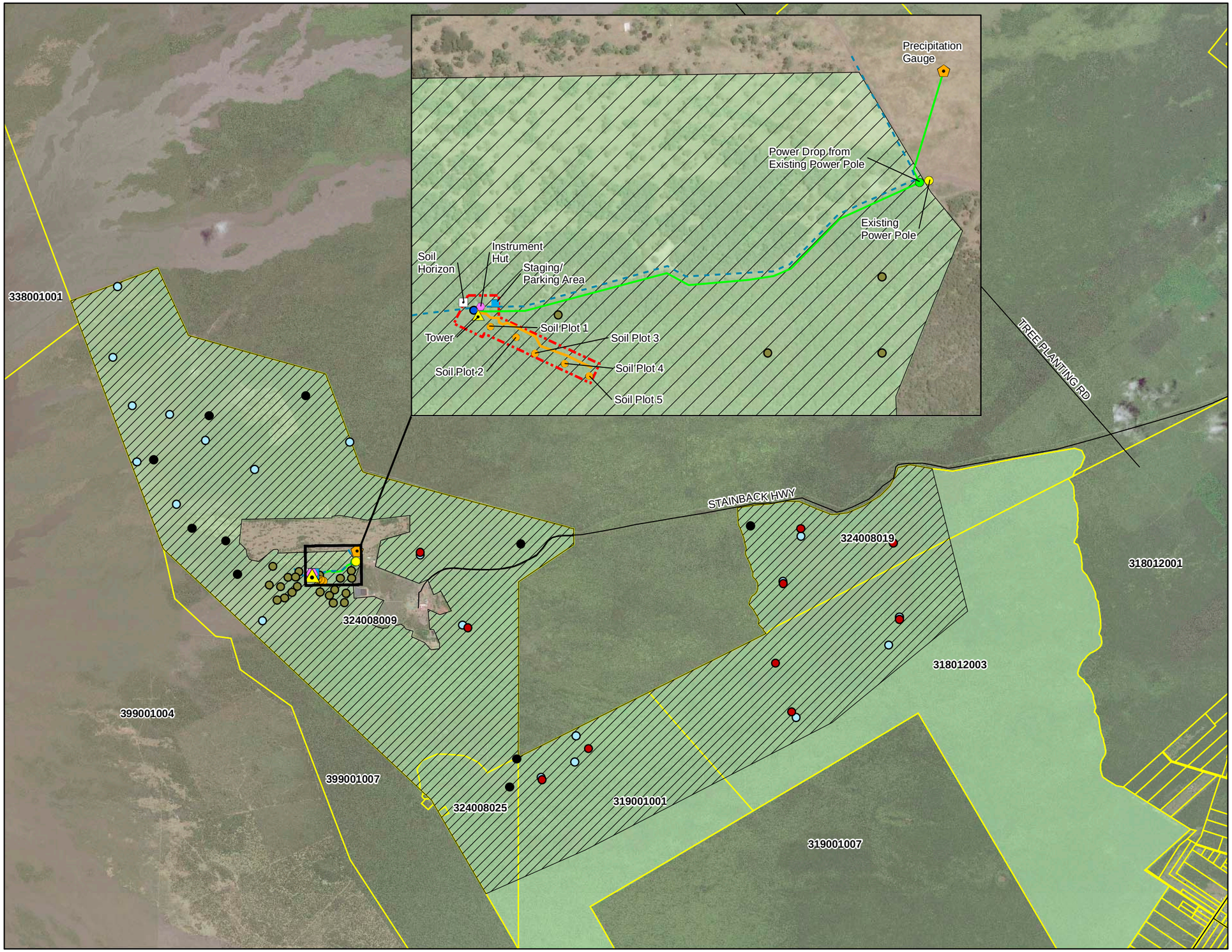
2.2.1.1 Core Site Infrastructure and Equipment

Similar to other NEON core field study sites, the Domain 20 site would be fully instrumented with standardized infrastructure and equipment designed to collect abiotic, biological, biophysical, biogeochemical, and land use data. The following infrastructure and equipment would be deployed to the site; all proposed infrastructure would be located adjacent to existing roads, and no new roads would be required for access to or within the site.

- **Research Tower:** The site would include a single-scaffold lattice tower, which would support an array of equipment and sensors to collect data on atmospheric conditions, climate, canopy microclimate, and solar radiation. A heating, ventilation and air conditioning (HVAC) unit used to cool the auxiliary equipment would also be mounted on the tower. The tower would extend approximately 33 feet

(10 meters) above the forest canopy and would be approximately 105 feet (32 meters) tall. It would be constructed on a concrete foundation pad (approximately 6.5 feet square). Four guy wires would be installed to stabilize the tower. An approximately 8-foot-wide access route to the guy anchor locations would be used during guy anchor installation. This path would be identified in coordination with NARS staff to be least impactful. The wires would attach toward the top of the tower (but below the canopy top, to minimize the potential for bird strikes), and would extend approximately 24 meters from the tower base. Minor vegetation trimming would likely be required to maintain proper clearance around the guy wires. The guy wires would be fitted with bird flight diverters to increase the visibility of the guy wires for forest birds. A schematic of the proposed tower is provided in Figure 3.

- **Instrument Hut:** The instrument hut would be a prefabricated module that would house gas analyzers, data recording equipment, and communications and control hardware. It would be mounted on a buried concrete foundation (approximately 9 feet wide by 22 feet long), and would have a raised boardwalk (46 inches wide) installed around the perimeter with a 10-foot-long ramp to facilitate equipment delivery. The instrument hut would include a climate control system with an HVAC unit; a small drainage trench would be installed to collect condensation generated by this system.
- **Soil Horizon Pit:** A 6-foot by 6-foot pit would be temporarily excavated to a depth of 7 feet (or as deep as reasonably possible based on substrate conditions and depth to bedrock) to allow for soil characterization and analysis of soil horizons. The pit would be properly stabilized, covered with plywood, and surrounded with construction fencing for safety purposes. The excavated materials would be stockpiled onsite, and once characterization and analysis activities have been completed, the pit would be backfilled. An approximately 3-foot-wide access path to the soil pit would be used during soil pit excavation and evaluation. These activities would all occur during the construction phase.
- **Soil Array:** The soil array would include a series of five sequential soil plots. Each plot would be 5 meters (16.4 feet) square, and would include a network of in-ground soil sensors. The sensors would be installed using minimally intrusive methods, as the goal is to maintain undisturbed native soil for research purposes. Polyvinyl chloride (PVC) conduit with power and communication lines would be routed to each plot (in conjunction with the walkway described immediately below); device posts and metal arbors would be installed at the edge of each plot to support the power and communications equipment needed to operate the soil sensors.
- **Walkways:** Designated walkways would be installed from the access road to the proposed infrastructure within forested habitat to provide a focused point of access and minimize the potential extent of disturbance from repeated visits for maintenance or data collection. The walkways would be approximately 2 feet wide and would consist of flexible honeycomb paver mats designed to reduce soil compaction.
- **Precipitation Gauge:** The precipitation gauge would be a double-fenced intercomparison reference (DFIR) system. The gauge would be mounted to a pipe installed with a 2-foot-diameter concrete foundation. Two concentric octagonal fences (each between 5 and 6 feet high) would be installed around the gauge, with diameters of approximately 13 feet and 26 feet, respectively. Clearing of woody vegetation is typically needed within and surrounding the fenced area to preclude interference with the gauge. However, to minimize impacts to native vegetation, the gauge would be located in a former pastureland dominated by grass species, such that no woody vegetation clearing or trimming would be expected to be required. Depending on the extent of vegetation growth in the future, some degree of routine vegetation trimming may be needed to prevent interference with the gauge.
- **Electrical Equipment:** Power would be obtained from an existing electrical line located at the edge of the Kūlani Correctional Facility property. Secondary power service would extend from an existing pole on this line to a meter socket and transfer switch, which would be owned and used by the local utility to deliver electricity.



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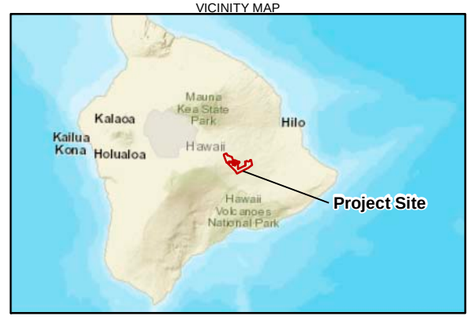

LEGEND

- Precipitation Gauge
- Tower
- Instrument Hut
- Staging/Parking Area
- Soil Horizon
- Soil Array
- Existing Power Pole
- Power Drop from Existing Power Pole
- On-grade Electrical Conduit
- Honeycomb Walkway
- Existing Access Road
- Extent of Potential Construction Activities
- Extent of Potential Terrestrial Sampling
- Tax Map Key (TMK)
- Pu'u Maka'ala Natural Area Reserve

Proposed Sampling Plots and Grids

- Tower Plot (Center Point)
- Distributed Plot (Center Point)
- Bird Grid (Center Point)
- Phenology Transect (Center Point)
- Mosquito Point

NOTE: It is possible that individual plot or grid locations may be adjusted within the limits of the proposed project area. Any adjustment in plot or grid location would be coordinated with DOFAW/NARS.

Aerial Source: NAIP, 2016

N

0 0.5 1
Miles

Figure 2
Pu'u Maka'ala (Domain 20) Core Tower and Sampling Site
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

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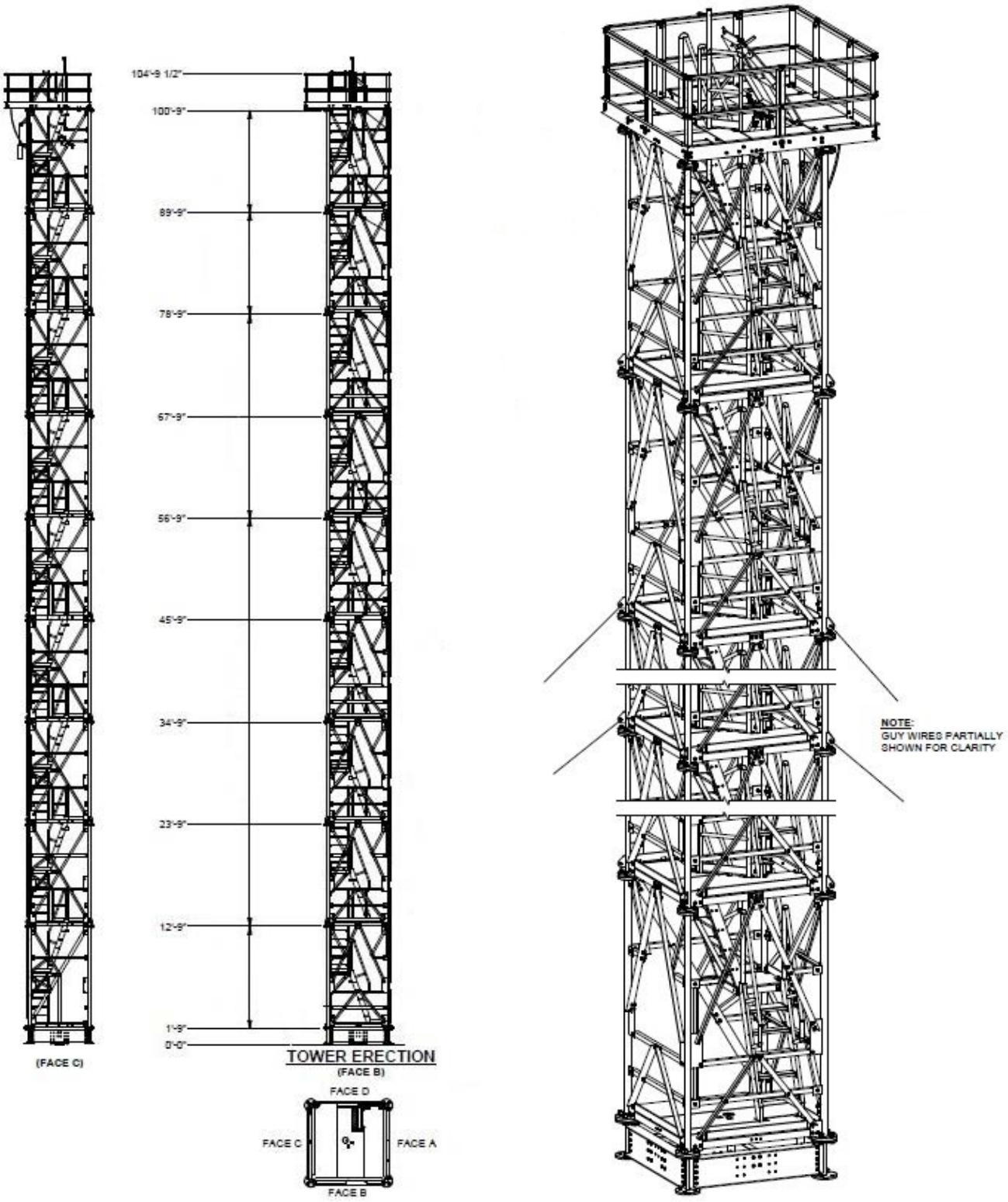

FIGURE 3
Schematic Diagram of Proposed Research Tower

An auxiliary portal would be installed adjacent to the transfer switch. It would consist of a step-up transformer and communication pedestal, and would serve the research tower and instrument hut. It would also include a plug for a generator, which would only be brought onsite and used in the case of a long-term electrical system outage. The auxiliary portal would be pad-mounted, with the fiberglass pad (approximately 8 feet by 2 feet) installed at existing grade. A second portal (approximately 3 feet by 3 feet) would be installed to serve the precipitation gauge; this portal would include a small HVAC system. From the portals, on-grade electrical and communication lines (contained within PVC conduit) would be laid along an existing fence line to the instrument hut (approximately 2,520 linear feet), and through former pastureland to the precipitation gauge (approximately 600 linear feet).

The conduit would be installed above ground and kept in place using fiberglass uni-strut supports, placed at regular intervals and staked into the ground. In a single location, the conduit would be trenched (and capped with concrete) across the existing access road.

- **Staging/Parking Area:** A staging/parking area would be installed near the research tower and instrument hut to provide for parking and staging of equipment during construction, and continued parking through the operations phase. The staging/parking area would be approximately 40 feet by 40 feet, and would consist of approximately 6 inches of base course underlain by geotextile fabric.

The location of the proposed infrastructure is shown in Figure 2. The approximate dimensions of the proposed infrastructure and equipment is listed in Table 2. A schematic diagram of the proposed research tower is provided in Figure 3. Photographs showing similar infrastructure and equipment at other NEON field study sites are provided in Figure 4.

TABLE 2
Summary of Core Site Infrastructure and Equipment

Project Component	Dimension of Infrastructure/Equipment (feet)	Approximate Footprint (ft^2)
Research Tower	6.5 x 6.5; 105 tall	42.5
Anchors for Guy Wires	5 x 1 bars anchoring 30-foot-deep 2-inch pipes (for each of 4 anchors)	20
Instrument Hut	9 x 22	198
Boardwalk (Instrument Hut and to Tower)	(26 x 3) + (20 x 4) + (6 x 3)	176
Soil Horizon Pit	6 x 6	36
Soil Array	16.4 x 16.4 (for each of 5 plots)	1,345
Honeycomb Walkway	705 x 2	1,410
Precipitation Gauge	26 x 26	676
Auxiliary Portals	8 x 2; 5 tall (for tower and instrument hut) 3 x 3; 4.5 tall (for precipitation gauge)	25
Electrical and Communication Conduit	3,120 x 1 (instrument hut and precipitation gauge); 865 x 1 (soil arrays)	3,985
Staging/Parking Area	40 x 40	1,600
Terrestrial Sampling	None	None
TOTAL EXTENT OF DISTURBANCE	---	**9,514**

Note:
ft^2 = square feet



Figure 4a. Representative Photograph of Tower and Instrument Hut *(Central Plains Experimental Range [CPER], Central Plains Domain)*





Figure 4b. Representative Photographs of Tower *(Delta Junction, Tiaga Domain)* **and Tower Construction Process** *(Smithsonian Conservation Biology Institute [SCBI], Northeast Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 4c. Representative Photographs of Tower, Instrument Hut and Soil Array *(CPER, Central Plains Domain)* **and Tower and Instrument Hut** *(Ordway Swisher Biological Station, Southeast Domain)*



Figure 4d. Representative Photograph of Instrument Hut *(Jones Ecological Research Center, Southeast Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 4e. Representative Photographs of Walkway, Electrical Conduit and Device Post (left) and Arbors Supplying Power to Soil Plots (right) *(Oak Ridge National Laboratory [ORNL], Appalachian & Cumberland Plateau Domain)*



Figure 4f. Representative Photographs of Soil Sensor Equipment *(CPER, Central Plains Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 4g. Representative Photograph of DFIR Precipitation Gauge with On-Grade Conduit and Device Post *(Niwot Ridge, Southern Rockies & Colorado Plateau Domain)*



Figure 4h. Representative Photograph of DFIR Precipitation Gauge and Device Post *(Santa Rita Experimental Range, Desert Southwest Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites

Before installation of any infrastructure or equipment, the limits of the construction area would be delineated to prevent movement into non-construction areas. Overall, it is estimated that the construction area would encompass no more than 0.5 acre. Temporary construction fencing would be installed to demarcate active work areas within the construction limits (i.e., areas immediately surrounding the proposed infrastructure or equipment), as appropriate.

All construction activities would be conducted during daylight hours and no night work would be performed. Workers would travel to and from the proposed project site together to minimize the number of vehicles accessing Pu‘u Maka‘ala NAR. Vehicle use would be strictly limited to the existing access road or proposed staging/parking area, except where essential for installation of infrastructure. No new access roads would be constructed, but the existing access road may be improved to accommodate short-term use by construction vehicles (e.g., when laying gravel in localized areas). Equipment and materials would be hand-carried to areas beyond the access road (e.g., the soil plots), as needed.

Preparation for construction, installation of infrastructure, and construction acceptance is expected to require from 5 to 6 months, and installation and calibration of equipment is expected to require an additional approximate 1 to 2 months. Subject to environmental clearance and permitting, it is currently anticipated that construction would start in fall 2017, with operation of the site starting in spring 2018.

2.2.1.2 Long-Term Terrestrial Sampling

Following construction and over the course of the 30-year operational period for NEON, a suite of terrestrial sampling protocols would be implemented on a routine basis. Sampling would occur at designated plots and grids established in locations throughout the surrounding lands of Pu‘u Maka‘ala NAR. Based on stakeholder concerns, the density and total footprint of sampling plots and grids was substantially reduced from the levels implemented at other NEON field study sites to the minimum level needed to ensure scientific viability of the proposed project. Up to 62 plots or grids would be distributed over approximately 11,660 acres of the NAR. In total, the plots and grids would cover approximately 630 acres, with sampling activities occurring in only a portion of each plot or grid. The sampling plots and grids would include the following:

- **Tower Plots:** Approximately 20 plots; 16 plots, each measuring 20 by 20 meters, and 4 plots, each measuring 40 by 40 meters
- **Distributed Plots:** Approximately 20 plots, each measuring 40 by 40 meters
- **Bird Grids:** Approximately 10 grids, each measuring 500 by 500 meters
- **Phenology Transect:** One transect measuring 800 meters
- **Mosquito Points:** Approximately 10 plots, each measuring 0.5 by 0.5 meter

The potential locations of the sampling plots and grids are shown in Figure 2. The locations as shown were vetted with DOFAW/NARS staff and reflect the current understanding of existing and future planned research or monitoring activities in Pu‘u Maka‘ala NAR, and an effort to minimize redundancy or excessive activity in any given location. It is possible that the plot and grid locations may be adjusted within the limits of the proposed project area before construction, based on additional stakeholder input. Once the proposed project is operational, the goal would be to keep the plot and grid locations fixed to maximize data integrity. However, there is some degree of flexibility to move individual plots or grids in response to an unanticipated impact or changed conditions within the NAR. Any such decision would be made in direct coordination with DOFAW/NARS staff.

The sampling plots and grids would be established at the same time the scientific equipment is installed and calibrated. This effort would include (1) NEON technicians visiting each plot to confirm the scientific validity of the location and (2) permanent markers being placed at a fixed sample point or at the ends of a sample transect. Permanent markers would consist of rebar or survey caps (or similar marking device approved by NARS staff) driven into the ground. If the plot or grid were to be relocated during implementation of the proposed project, the original marker(s) would be removed and new permanent marker(s) would be placed.

Over the 30-year operational period, research technicians would visit each sampling plot and grid on a routine basis, as needed to conduct the prescribed sampling activities. The sampling protocols are consistent with the standardized requirements for NEON, but have been tailored as appropriate based on the local ecology and site-specific conditions. The sampling protocols are designed to be passive, with minimal ground disturbance. Certain sampling protocols require placement of sampling equipment (e.g., pitfall traps and mosquito traps). The list of sampling activities, as well as the associated protocols and required equipment, are listed in Table 3.

Table 3 also lists the sampling frequency, duration, and timing for each of the sampling protocols. Similar to the determination of plot and grid location, the timing for sampling activities is designed to avoid or minimize impacts, including activities during sensitive periods (e.g., applicable nesting seasons), to the extent possible. In addition, to further minimize disturbance, sampling visits would be combined where possible to minimize the number of times researchers are at the site. It is currently expected that three full-time staff (one domain manager and two research technicians) would be needed to conduct the sampling and other operational requirements. The staff would be supplemented with up to eight temporary technicians during peak sampling periods.

The sampling data collected from the site would be reviewed, synthesized, and packaged by the NEON project team. The resulting data set would be uploaded to an online portal, where it would be made freely available to the scientific community and general public as part of the continental NEON data set. The Domain 20 data would also be transferred directly to DOFAW and NARS staff to assist with management of the site.

2.2.1.3 Aerial Observations

In addition to the terrestrial sampling effort, an aerial flight would be conducted on an annual basis. The aerial flight would use a small aircraft outfitted with remote sensing equipment (including a hyperspectral imager, Light Detection and Ranging [LiDAR] sensor, and high-resolution camera). The typical flight height would be approximately 3,281 feet (1,000 meters) above ground level (AGL), but would vary based on topography. Data collected from the flight would provide detailed spatial information on the structure and biogeochemical properties of vegetation, and would also facilitate the development of algorithms for scaling up site-specific data.

TABLE 3
Summary of Proposed Terrestrial Sampling Protocols

Type of Sampling	Description of Proposed Field Sampling Activity		Equipment Installed	Plot/Grid Location	Sampling Season	Frequency	Duration of Each Event	Number of Visits to Each Plot per Event	Number of Technicians per Visit
Soil sampling	Three composite soil samples (approximately 300 g each) would be collected at each plot. Each sample would be generated from 1-3 soil cores within a 50-cm radius of the target sampling location. Cores would range between 3.5 and 11 cm, with typical maximum depth of 30 cm or refusal. Holes will be backfilled at NARS' direction. For baseline characterization, 1 composite soil sample consisting of up to 9 soil cores would be collected per plot in a single event and remaining events would be cancelled.	Soil baseline characterization	None	Combination of tower and distributed plots (10)	October-December	1 event only (replaces soil microbe/ biogeochemistry sampling in first year)	4-5 days (2-3 plots a day)	1	2-3
		Soil microbes and soil biogeochemistry[1]	None	Tower plots (4); Distributed plots (6)	October, December/ January, April	3 events per year	4-5 days (2-3 plots a day)	1	2
		Soil biogeochemistry: N transformations	Temporary installation of three 35-cm- x 5-cm-diameter PVC tubes, buried such that 5 cm remain above the soil; removed after end of 2-week incubation.	Tower plots (4); Distributed plots (6)	October, December/ January, April	3 events per year, every 5 years	2 weeks (1 initial sampling day, with a second sampling day 2 weeks after the first)	2	2
Plant diversity	Observations of species presence and cover (at 1 m^2) will be made in 400-m^2, multi-scale plots. Observations within these plots are made at eight 1- and 10-m^2 subplots. Vouchers of a subset of representative plant species (approximately 20 per year) will be collected.		None	Tower plots (20)	November-December	1 event only (initial sampling)	10-20 days (1-2 plots per day)	1	4
				Tower plots (3)	November-December	1 event per year	2-3 days (1-2 plots per day)	1	2
				Distributed plots (20)	November-December	1 event per year	10-20 days (1-2 plots per day)	1	2
Litterfall and fine woody debris	Litter (non-living plant material) will be collected from basket-like traps and from paired ground traps for woody material <2 cm in diameter, arrayed in 20-m x 20-m plots.		One 0.5-m^2 PVC elevated trap per plot (0.8 m off the ground), and one 1.5-m^2 ground trap per plot	Tower plots (20)	Year-round	Elevated traps: 26 events per year; Ground traps: One event per year	1 day (20 plots per day)	1	2
Belowground fine root biomass	Two soil cores (7.62 cm in diameter, 30 cm deep) will be extracted from each plot to measure fine root live and dead biomass; holes will be backfilled at NARS direction.		None	Tower plots (20)	December	1 event every 5 years	5-10 days (2-4 plots per day)	1	2
Vegetation structure	Measurements such as height and diameter at breast height of woody individuals will be measured. No collection will be made (unless diagnostic plant part is needed to facilitate species identification).		Aluminum tags hung around woody vegetation with loose wire (no nails would be used)	Tower plots (20)	October-December	1 event per year	10-20 days (0.5-1 day per plot)	1	2
				Distributed plots (20)	October-December	1 event every 3 years	20 days (1 plot per plot)	1	2
Coarse downed wood (tally)	Nondestructive tally measurements will be made along three 200-m transects originating from within each plot.		Log tags	Tower plots (20)	October-December	1 event every 3 years	20 days (1 plot per day)	1	2
				Distributed plots (20)	October-December	1 event every 3 years	20 days (1 plot per day)	1	2
Coarse downed wood (density)	Disks (5-10 cm width) will be cut from downed logs using a chainsaw or hand-powered bucksaw. A total of 100-200 disks will be cut; the final number will depend on the number of taxa and the number of decay classes encountered.		Log tags	Area surrounding tower	October-December	2 events total: once in first 3 years, again 5-6 years later	20 days (1 plot per day)	1	2
				Distributed plots (20)	October-December	2 events total: once in first 3 years, again 5-6 years later	20 days (1 plot per day)	1	2
Canopy foliar biogeochemistry	Sunlit leaves of dominant species will be harvested using a pruning pole or remote-controlled, unmanned aerial vehicle equipped for collecting leaves. If these methods are not feasible, a licensed arborist would be contracted to climb to the canopy to collect the samples.		None	Tower plots (4)	December	1 event every 5 years	2 days (2-3 plots per day)	1	2
				Distributed plots (10)	December	1 event every 5 years	3-5 days (2-3 plots per day)	1	2
Leaf area index	Digital hemispherical photographs of understory and overstory vegetation will be taken at multiple points within each plot.		None	Tower plots (3)	Year-round	1 event every 2 weeks	1 day (3 plots per day)	1	2
				Distributed plots (20)	December	1 event every 3 years	10 days (2 plots per day)	1	2
Herbaceous biomass	Herbaceous material will be clip harvested from one 0.2-m (0.1-m x 2-m) area.		None	Tower plots (20)	November-December	1 event per year	5-10 days (2-4 plots per day)	1	2
Plant phenology	Phenological status and transitions of plant species will be monitored and recorded. Initially, up to 30 individuals of 3 species will be monitored. Over subsequent years, fewer individuals of 20 species will be monitored.		Aluminum tags wrapped around woody vegetation with loose wire; markers inserted in ground for herbaceous vegetation	Phenology transect (1); along easily accessible road	Year-round	1 event every 2 weeks	1 day (1 transect per day)	1	2
Ground beetles	Four pitfall traps at each plot will be deployed and checked at 2-week intervals to capture and describe the diversity and abundance of ground beetles.		Four pitfall traps per plot; each trap consists of a cup buried flush with the ground, filled with a preservative, and shaded by a flat cover	Distributed plots (10)	October-April	13 events per year	1 day every 2 weeks	1	2
Mosquitoes	CO_2 traps will be deployed for 2 nights (approximately 40 consecutive hours) per sampling event; captured mosquitoes will be retrieved from the trap on three occasions (first morning, second evening, and second morning).		Trap consisting of small insulated cooler (loaded with CO_2 pellets), rain cover, a fan (with 6-volt battery), and catch cup; trap will be hung from a tree or post	Mosquito points (10), each within 35 m of road	Year-round	1 event per month (12 events per year)	2 days	4	2
Breeding land birds	Bird abundance and diversity data will be collected using binoculars and laser rangefinder; point counts will be conducted for a total of 10 minutes per location		None	Bird grids (10)	February-March	1 event every three years	5-10 days (1-2 grids per day)	1	2

Notes:
[1] Soil biogeochemistry analyses will be conducted on a subset of soil collection every 3 years.
[2] Timing will be determined in consultation with site host.
cm = centimeter
g = gram
m = meter
m^2 = square meter

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2.2.1.4 Infrastructure and Equipment Maintenance

Long-term operation of the proposed project requires ongoing maintenance to ensure the infrastructure and equipment are in optimal working order and remain properly calibrated. Standard maintenance activities would be planned to occur approximately every 2 weeks, with one larger maintenance event conducted annually. In addition, emergency repairs would be conducted as needed. The maintenance activities, and their frequency and duration, are summarized in Table 4.

TABLE 4
Summary of Proposed Maintenance Activities

Maintenance Event	Activities to be Conducted	Frequency	Duration of Each Event	Number of Technicians
Standard maintenance of tower sensors	Preventative maintenance including inspecting and cleaning sensors, calibration of non-hazardous CO_2 gas cylinders stored in the hut and troubleshooting/ repairing sensors and systems.	One event every two weeks	2 days	2
Annual maintenance of tower and soil array	Instruments will be removed from the tower and soil array annually and replaced with recently recalibrated instruments.	One event per year	5 days	2-3
Emergency repairs	Emergency repairs to the tower or soil array sensors and infrastructure in the event damage is caused by weather or other unforeseen factor.	As needed	As needed	To be determined

2.2.2 Standard Operating Procedures

Management of Pu‘u Maka‘ala NAR is focused on preserving natural communities of flora and fauna in as unmodified a state as possible. Similarly, avoidance and minimization of impacts to natural resources is fundamental to the long-term success of the proposed project, as the project is intended to assist in detection of natural changes in native ecosystems. To meet the proposed project needs and to maintain consistency with the NAR management goals, the NEON project team considers natural resource protection and impact avoidance and minimization to be paramount.

Furthermore, the NEON project team understands that there are other research and monitoring efforts that are either ongoing or planned within the NAR. Given that the purpose of the proposed project is to improve and contribute to research capabilities, the NEON project team is equally focused on minimizing the potential for overlap or interference with other research and monitoring efforts.

To this end, implementation of the proposed project within Pu‘u Maka‘ala NAR would be governed by standard operating procedures (SOPs) designed to avoid or minimize impacts and promote collaboration with NARS staff and other researchers, while maximizing the scientific integrity and benefit of the project. The following SOPs are based on NEON’s standardized protocols, as well as input received from DOFAW and NARS staff and other stakeholders to date. These will be developed in more detail as part of a Project Work Plan; this plan will be subject to DOFAW and NARS approval (with a request for review and input from USFWS) before implementation of the proposed project, and, if approved, would continue to be refined over the lifetime of the proposed project.

- **Communication Procedures:** All activities within Pu‘u Maka‘ala NAR would be coordinated directly with the NARS Specialist.[3] Frequent and clear communication between the NARS Specialist and the NEON domain manager would be key to successful project implementation, natural resource protection, and coordination with other research and monitoring activities. The NEON domain manager would provide the anticipated schedule for onsite NEON activities in writing to the NARS Specialist (e.g., via email) at a frequency requested by DOFAW and NARS staff, to facilitate coordination in timing or location of NEON activities with other work within the NAR. NEON project management staff would also participate in relevant stakeholder meetings to provide information about NEON activities and gather information about other projects' activities to ensure appropriate coordination and minimize possible conflicts with other stakeholders. In addition, NEON would provide a summary annual report that describes the previous year's activities, as requested by DOFAW.
- **Staff Training:** All onsite staff for the proposed project, including the domain manager and any research technicians or maintenance personnel, would receive adequate training before starting work within the NAR, with refresher training provided as needed. This training would address the specific procedures for decontamination, and would also include information related to identification of sensitive species and their habitat, response protocols if threatened or endangered species are encountered, and other relevant conditions of the project permits.
- **Decontamination Procedures:** Key management objectives for Pu‘u Maka‘ala NAR include control of non-native species and disease. Issues of particular concern include the potential introduction and spread of invasive species and Rapid *‘Ōhi‘a* Death. Decontamination procedures, consistent with those recommended by the resource agencies and used by DOFAW and NARS staff, would be implemented throughout the construction and operation phases of the proposed project. Any future changes in decontamination procedures, including those adopted by DOFAW or those recommended by the resource agencies, would be incorporated into the proposed project as appropriate.
- **Site Access and Route Planning:** Long-term terrestrial sampling would be conducted in a manner that limits potential disturbance to natural resources to the extent possible. Specifically, all activities would incorporate the following approach:
  - The overall number of visits to the site would be minimized by combining activities to the extent possible.
  - Site visits would be coordinated with NARS staff to reduce impacts during periods when federally listed threatened and endangered species, proposed species, candidate species for listing, and other species of concern are most vulnerable to disturbance.
  - A detailed plan to avoid, work around, and protect federally listed threatened and endangered species, proposed species, candidate species for listing, and other species of concern would be developed and updated as part of the Project Work Plan, as needed.
  - The routes taken throughout the NAR (including to each sampling location) would be developed in coordination with DOFAW and NARS staff. These routes may be varied over time to disperse impact of foot travel, or may follow the same path to concentrate impacts, depending on the specific locations and based on guidance received from DOFAW and NARS staff.

[3] The NARS Specialist is the person in charge of all natural area reserves and NARS staff affiliated with the Hawaii Island Branch.

  - Observations that require the most frequent visits (e.g., litter, plant phenology, or mosquitoes; see Table 3) would be placed in proximity to roads to reduce foot traffic across the site.

- **Ongoing Impact Assessment and Adaptive Mitigation:** Implementation of the proposed project would incorporate BMPs and other impact avoidance and minimization measures that reflect current best practices and knowledge of site conditions; these are discussed throughout Section 4 of this document. Consistent with the procedures implemented at all NEON project sites, the domain manager would be responsible for continuously tracking project activities to ensure the efficacy of these measures, and to detect and address unanticipated environmental impacts. This effort would include monitoring parking areas, access routes and sampling locations for disturbance to vegetation and wildlife, as well as the introduction and establishment of invasive species. If it is determined, either through this effort or based on input from DOFAW and NARS staff, that project implementation is resulting in unanticipated environmental impact, any associated project activities would be temporarily halted. In coordination with the NARS Specialist, the domain manager would assess the effectiveness of relevant BMPs or other avoidance and minimization measures, and would make any necessary adjustments to adequately address the impact. This effort could also include adjustments to individual sampling plot or grid locations. Additional SOPs would be adopted as needed. Over time, consistent monitoring and evaluation of long-term sampling is expected to result in increased understanding of impacts and subsequent iterations in the approaches to mitigation.
- **Vegetation Trimming**: The proposed project has been designed to minimize the need for vegetation clearing/trimming, consistent with the overall objective of monitoring natural processes. However, a minimal amount of trimming may be needed to maintain clearance around the project infrastructure (e.g., along the guy wires for the tower). Any vegetation clearing or trimming would first be approved by (1) the NEON science team to make sure it is necessary for scientific purposes, (2) the permitting team to make sure the action is acceptable per the permit conditions and complies with seasonal restrictions related to listed species (e.g., bat-pupping and bird-breeding seasons), and (3) the NARS staff to make sure it is consistent with site management objectives. A qualified arborist with specific knowledge of the target species and site conditions would be engaged, as needed.
- **Collection of Listed Plant Species**: The proposed infrastructure and terrestrial sampling plots have been sited to avoid any known occurrences of protected plant species. Terrestrial sampling activities would not include collection or harvest of protected plant species. If it is subsequently determined that collection or harvest of a species that is federally or state listed (or is proposed for listing) is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate permits from the USFWS (Section 10 Scientific Collection Permit) and DOFAW prior to any such collection.
- **Stakeholder and Community Engagement:** Consistent with the overall project objectives, the NEON project team is committed to ongoing engagement with the ecological research community and other project stakeholders, as needed to maximize project success. The purpose of these efforts would be to (1) maintain coordination with other relevant activities, (2) keep project stakeholders apprised of the project status, and (3) contribute to the local community's knowledge of ecological conditions within the project site. Stakeholder and community engagement efforts are expected to include NEON participation in relevant stakeholder meetings, development and maintenance of a project website, and delivery of data to DOFAW, NARS, and other local stakeholders.

In addition to these SOPs, NEON would also incorporate other general BMPs designed to avoid or minimize environmental impacts. These measures are detailed throughout Section 4, and are summarized in Section 7.1.

2.2.3 Project Duration and Site Closure

NEON is projected to operate for 30 years. The exact nature of site closure at the end of the operational period would be based on the interests of DOFAW, as the site host. If requested, it is possible that some or all of the infrastructure or equipment may be retained onsite. The specific decommissioning and closure plans are undefined at this time. However, for the purposes of this EA, it is assumed that all sampling infrastructure (including the tower and instrument hut) would be removed (subject to available funds), but below-grade material (such as the tower foundation) would be left in place. All boardwalk materials, and electrical equipment (including power lines and conduits) would be removed.

Any materials removed during these processes would be reused, recycled, or properly disposed at an approved location. All disturbed ground would be stabilized with biodegradable materials and revegetated with species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Compacted soil would be loosened and aerated before revegetation. Revegetation activities would be coordinated with DOFAW and NARS staff, as appropriate.

2.3 No Action Alternative

Because CEQ regulations for implementing NEPA require consideration of the No Action Alternative (40 CFR 1502.14(d)), a No Action Alternative is evaluated in this EA. The No Action Alternative would not satisfy the need for action. Inclusion of the No Action Alternative serves as a benchmark for evaluating the potential effects of the proposed project.

Under the No Action Alteration, NEON research infrastructure and equipment would not be deployed to the site within Pu‘u Maka‘ala NAR to represent Domain 20. Abiotic, biological, biophysical, biogeochemical, and land use data would not be collected or made available to the ecological sciences research community. Implementation of the No Action Alternative would eliminate the opportunity to study ecosystem responses and changes at the local scale in Hawai‘i as part of NEON. In addition, it would preclude integration of data from the Pacific Tropical domain into the continental-wide dataset, thus reducing the potential for broad-scale analysis and the overall integrity of NEON.

3 Affected Environment

This section provides an overview of the existing physical, biological, economic, and social conditions at the proposed project site. In compliance with NEPA and HRS Chapter 343, the description of the affected environment focuses on those resources and conditions potentially impacted by the proposed project.

3.1 Climate

3.1.1 Existing Conditions

Hawai‘i’s subtropical climate is governed by easterly trade winds that regulate weather patterns as part of the North Pacific high-pressure anticyclone. The ‘Pacific High,’ and with it the trade wind zone, moves north and south with the sun, so that it reaches its northernmost position in the summer. This brings the heart of the trade winds across Hawai‘i during the period from May through September, resulting in trade winds that are prevalent 80 to 95 percent of this time. From October through April, the trade winds move to the south, resulting in decreased frequency of the trade winds (commonly referred to as southerly or “Kona” conditions).

Along with the Pacific anticyclone, Hawai‘i’s latitude and the surrounding ocean have a moderating influence on climate. The climate on Hawai‘i Island is further influenced by the topography, which creates a series of microclimates. Given the elevation of over 5,000 feet above mean sea level, the average minimum and maximum daily temperatures in the proposed project area are approximately 55 and 65 degrees Fahrenheit, respectively (State of Hawai‘i, Department of Accounting and General Services [DAGS] and Department of Public Safety [DPS], 2013). Mean annual rainfall, as documented at the nearby Kūlani Camp Station, is approximately 105 inches (Giambelluca et al, 2013). Condensation from low-elevation clouds (fog drip) contributes additional moisture at higher elevations (DOFAW, 2013a).

3.1.2 Climate Change

Greenhouse gases (including CO_2, methane [CH_4], and nitrous oxide [N_2O]) are chemical compounds that are emitted as a result of natural processes and human activities. Greenhouse gases trap heat in the atmosphere, thus affecting the earth’s temperature. Scientific evidence indicates a trend of increasing global temperatures (i.e., global warming) and other related climatic changes over the past century due to an increase in global greenhouse gas emissions.

Table 5 provides a summary of CO_2 emissions in Hawai‘i for 2011 through 2013, which are the most recent data available. CO_2 emissions represent approximately 80 percent of total greenhouse gas emissions and therefore are used as a primary indicator for regional greenhouse gas emissions. The largest source of CO_2 and overall greenhouse gas emissions is fossil fuel combustion; the transportation sector is the largest contributor to greenhouse gas emissions.

A broad spectrum of climate change impacts has been investigated and described for Hawai‘i, including rising surface air temperature, decreasing quantity of total annual precipitation, increasing intensity of storm events, increasing hurricane wind speeds, rising sea levels, increasing ocean temperature, and increasing ocean acidification (Fletcher, 2010; U.S. Fish and Wildlife Service [USFWS], 2011).

TABLE 5
Carbon Dioxide Emissions from Fossil Fuel Consumption in Hawai'i (2011-2013) (in million metric tons)

Sector	2011	2012	2013
Residential Sector	0.1	0.1	0.1
Commercial Sector	0.3	0.3	0.3
Industrial Sector	1.6	1.6	1.5
Transportation Sector	9.9	9.7	9.6
Electric Power Sector	7.4	7.1	6.8
TOTAL	**19.3**	**18.7**	**18.2**

Source: U.S. Energy Information Administration (USEIA), 2016

Climate change factors that are anticipated within Pu'u Maka'ala NAR include increased air temperatures and altered rainfall patterns and quantities. These are expected to lead to changes in habitat structure and composition, increased distribution and abundance of invasive species, and associated declines in native species (DOFAW, 2013a).

3.2 Land Use and Recreation

Land use is typically defined to reflect either natural or human activities that occur, or could occur, at a given location. Land use in Hawai'i is generally controlled by state land use and county zoning designations. Under HRS Chapter 205-2, the State Land Use Commission has the authority to designate all land within the state as one of four districts—urban, rural, agricultural, or conservation—based on the general activities and uses of the land. Land use is also regulated by the various counties through zoning boundaries, within which development standards are specified for various activities. In general, regulation of land use within the conservation district is conducted by the state; regulation of the other districts is generally delegated to the counties. In addition to the zoning boundaries, there are overlay zones that are subject to further regulation. In particular, the Special Management Area (SMA), a designated area extending inland from the shoreline (ranging from 100 yards to several miles in width), is regulated by the County under the Hawai'i Coastal Zone Management (CZM) program.

3.2.1 Existing Conditions

The proposed project falls entirely within the boundaries of Pu'u Maka'ala NAR, which encompasses a total of approximately 18,730 acres.[4] Historically, this area was primarily comprised of forest reserve lands, with some portions used for cattle ranching or in association with Kūlani Correctional Facility. However, this area is now actively managed by DOFAW and NARS for protection of unique natural resources. Current land uses are generally based on the objectives and allowed activities, as set forth in the Pu'u Maka'ala NAR Management Plan (DOFAW, 2013b) and NARS rules (HAR Chapter 13-209). Public access is allowed in the majority of Pu'u Maka'ala NAR for recreational and cultural uses. There are five specified access points to the NAR: four along Stainback Highway (with the uppermost point located near the boundary of the NAR near Kūlani), and one at the end of Wright Road (near the southwestern tip of the NAR). Current public use of Pu'u Maka'ala primarily includes hiking, bird watching, and hunting (DOFAW, 2013a). The proposed project would be located in an area that is only accessible to the public

[4] It is understood that DOFAW is seeking to extend Pu'u Maka'ala NAR to include an additional 342 acres of land that are currently associated with Kulani Correctional Facility; this includes the proposed location for the precipitation gauge. This process is underway, and DOFAW has been granted a management right-of-entry (DOFAW, 2014).

by foot. However, the proposed infrastructure is within an area protected by ungulate fencing such that hunting is not allowed. Based on observations by NARS staff, recreational use in the vicinity of the proposed infrastructure location is minimal to none (personal communication, N. Agorastos, NAR Specialist, September 20, 2016).

The Kūlani Correctional Facility, which occupies approximately 280 acres, is located within an interior portion of the Pu‘u Maka‘ala NAR. This facility is a minimum security prison that houses approximately 200 inmates and 96 staff. The infrastructure for the facility occupies approximately 56 acres, and includes structures and equipment to support vocational programs, such as an automotive shop and agricultural and horticultural facilities. The correctional facility was reopened in 2014, following an approximately 5-year interlude during which time the site was used by the U.S. Department of Defense for a program serving at-risk youth (DAGS and DPS, 2013).

The areas surrounding Pu‘u Maka‘ala NAR (and the proposed project site) are comprised of the Upper Waiakea Forest Reserve to the north and east, the ‘Ōla‘a Forest Reserve on the east, the ‘Ōla‘a Tract of Hawai‘i Volcano National Park to the south, and private property to the west (Kamehameha Schools), southwest, and southeast (multiple agricultural parcels). The general extent and proximity of these adjacent areas is shown in Figure 1. These contiguous areas are managed, in coordination with Pu‘u Maka‘ala, as part of the Three Mountain Alliance. The Three Mountain Alliance is a public-private partnership of landowners and agencies with the objective of land management and conservation at the landscape scale.

3.2.2 Zoning and Land Use Designations

The proposed project site, along with the rest of Pu‘u Maka‘ala NAR, falls entirely within the state Conservation District (with the proposed infrastructure in the general and resource subzones, and some of the sampling plots extending out into the protective subzone). Regulation of land use in the Conservation District is within the jurisdiction of the state. There is no county zoning designation provided for areas within the Conservation District; however, it is understood the project will require plan approval from the County of Hawaii. The proposed project site is not within the SMA or any other special zoning district.

3.3 Geology, Topography and Soils

3.3.1 Existing Conditions

Hawai‘i Island was created by five separate shield volcanoes that erupted somewhat sequentially. These are (from oldest to youngest) Kohala, Mauna Kea, Hualalai, Mauna Loa, and Kilauea. Pu‘u Maka‘ala NAR is located on the eastern, windward slopes of Mauna Loa. Elevations within Pu‘u Maka‘ala NAR range from 2,800 to 6,229 feet (853 to 1,899 meters (DOFAW, 2013b). The proposed infrastructure would be at an elevation of approximately 5,500 feet.

Seven different ages of lava flows from Mauna Loa have been mapped in Pu‘u Maka‘ala NAR, with relatively recent flows (1942) ranging up to those approximately 10,000 years old. Lava substrates include cinder, ash, *pāhoehoe* and *‘a‘ā*. Several cinder cones serve as prominent landmarks for this region, including Kūlani Cone, Pu‘u Kipu, Pu‘u Maka‘ala, and Na Lua Mahoe. The Kūlani portion of the NAR has experienced the most recent flows and is the most vulnerable to volcanic activity, as it is downslope of potential eruption sites on the northeast rift zone.

The different types and ages of lava flows contribute to a diverse range of soils in this area. Approximately 25 soil types have been mapped within Pu‘u Maka‘ala NAR by the Natural Resources

Conservation Service (NRCS). The most extensive soils within the NAR are the Ekeuiki-Pekailio complex; these primarily occur in the central portion of the site and are deep soils formed in volcanic ash deposited over *ʻaʻā* lava. Other prominent soil types, particularly in the southern and central portions of the NAR include deep, moderately well drained soils formed in volcanic ash (Hao medial loam); thin, well drained soils formed in organic material and ash overlying *ʻaʻā* lava (Kiloa extremely cobbly highly decomposed plant material); and deep, well drained soils formed in volcanic ash deposited over cinders (Kūlani mucky loam). The proposed NEON infrastructure would generally be located in an area with thin, well-drained soils formed over *ʻaʻā* lava (Lalaau very cobbly plant material) (NRCS, 2016).

3.3.2 Seismicity

In Hawaiʻi, seismicity is associated with volcanism and earth movement along faults; earthquakes are typically more concentrated in volcanically active areas, with 95 percent of the earthquakes on Hawaiʻi Island resulting from volcanism (Fletcher et al., 2002). The majority of the seismicity is related to the movement of magma within Kīlauea or Mauna Loa volcanoes. Thousands of earthquakes are documented on the island, although most are too small to be noticed; a total of 14 earthquakes with magnitude 6 or greater have occurred since 1868 (Heliker, 1991). Given the extensive history of seismicity on Hawaiʻi Island, the entire island is within the Uniform Building Code seismic zone 4, which is the highest possible rating.

3.4 Water Resources

This section addresses water resources, including both surface and groundwater features, and the quality of those waters.

3.4.1 Waters of the U.S., Including Wetlands

Waters of the U.S. are generally defined to include traditionally navigable waters (including lakes, rivers and streams) and their tributaries, as well as wetlands adjacent to such waters.

The presence of waters of the U.S., including wetlands, within the proposed project site was evaluated through desktop analyses of the USGS National Hydrography Dataset (USGS, 2016), USFWS National Wetlands Inventory mapping (USFWS, 2016), and information contained in the Puʻu Makaʻala NAR Management Plan (DOFAW, 2013b). Based on this information, no lakes, rivers or streams are known to occur within Puʻu Makaʻala NAR, as is common in young volcanic landscapes.

A variety of wetland features, including bogs, seeps and ephemeral pools occur throughout the NAR (DOFAW, 2013b). No wetland features are present within or immediately proximate to the proposed infrastructure or terrestrial sampling plots.

3.4.2 Groundwater

Groundwater in this region is generally either basal or perched (DAGS, 2002). The proposed project would be located within the Keaau hydrologic unit, which is part of the Northeast Mauna Loa aquifer sector. The sustainable yield of this hydrologic unit is 395 million gallons per day, with existing water use less than 5 percent of this amount (Commission on Water Resource Management [CWRM], 2008). No portion of Hawaiʻi Island has been designated as a groundwater management area (CWRM, 2005).

3.5 Biological Resources

This section describes the biological resources found at the proposed project site, which include plants and wildlife, threatened and endangered species, and migratory birds. Biological resources are

protected under both federal and state laws, including the ESA and HRS Chapter 195D. The ESA requires federal agencies to ensure their actions do not jeopardize the continued existence of any federal listed endangered or threatened species; Section 7 of the ESA requires consultation with USFWS regarding any action that may affect a listed species. The status of the ESA Section 7 consultation process is addressed in Section 5.2.

3.5.1 General Setting

The proposed project is located within Pu‘u Maka‘ala NAR, which was established to protect valuable native forest and associated plant and wildlife species. The habitat within Pu‘u Maka‘ala NAR represents some of the highest quality wet and mesic native forest on Hawai‘i Island. It provides an important link between lower elevation forest within Hawai‘i Volcano National Park and higher elevation areas of the Kilauea, Keauhou, and Upper Waiakea forests, which collectively support a range of ‘ōhi‘a (*Metrosideros polymorpha*) and *koa* (*Acacia koa*) forest types (DOFAW, 2013b).

The ‘ōhi‘a and *koa* forests within Pu‘u Maka‘ala NAR provide important habitat for some of Hawai‘i’s rarest birds, as well as several rare plants, as further discussed in Section 3.5.5. These species are particularly vulnerable to damage from feral ungulates (hooved animals such as pigs, goats, and sheep), which damage forests by trampling, uprooting, and eating native plants. Fencing has been found to be the most effective method to protect native forests from the threat of ungulates, while still allowing for public access (DOFAW, 2016a). Most of Pu‘u Maka‘ala NAR, including the entire project area, is protected by ungulate fencing.

3.5.2 Vegetation

There are three general vegetation zones within Pu‘u Maka‘ala NAR. These are generally based on elevation and moisture regime, and comprise one or more vegetation communities, as follows:

- **Lowland Wet**: The lowland wet zone generally occurs in the lower elevations of the NAR, below approximately 3,280 feet (1,000 meters). *‘Ōhi‘a* Lowland Wet Forest is the predominant vegetation community within this zone.
- **Montane Wet**: Areas above the lowland wet zone (approximately 3,280 feet [1,000 meters]) transition to the montane wet zone, which contains three native plant communities: *‘Ōhi‘a/Hāpu‘u* Montane Wet Forest, *Koa/‘Ōh‘ia* Montane Wet Forest, and *Carex alligata* Montane Wet Grassland.
- **Montane Mesic**: The upper-most elevations in the northwestern portion of the NAR are within the montane mesic zone, which contains three native plant communities: *Koa/‘Ōhi‘a* Montane Mesic Forest, *‘Ōhi‘a* Montane Mesic Forest, and *‘Ōhi‘a* Woodland (DOFAW, 2013b).

The infrastructure associated with the proposed NEON field study site would be located within *Koa/‘Ōhi‘a* Montane Mesic Forest, with the exception of the precipitation gauge, which would be located in former pastureland dominated by non-native grass species. The terrestrial sampling plots/grids would be distributed across the various montane wet and montane mesic forest vegetation communities, particularly *‘Ōhi‘a/Hāpu‘u* Montane Wet Forest.

‘Ōhi‘a/Hāpu‘u Montane Wet Forest is the most extensive of the vegetation communities within the NAR. In addition to *‘ōhi‘a* and *hāpu‘u* (*hāpu‘u pulu* [*Cibotium glaucum*], *hāpu‘u ‘i‘i* [*C. menziesii*] and *meu* [*C. chamissoi*]), other native species in this habitat include ‘*ōlapa* (*Cheirodendron trigynum*), *kāwa‘u* (*Ilex anomala*), *pilo* (*Coprosma* spp.), and *kōlea* (*Myrsine lessertiana*). Understory species include *Pneumatopteris sandwichensis*, *hō‘i‘o* (*Diplazium sandwichianum*), *‘ama‘u* (*Sadleria* spp.), *Dryopteris* spp., *uluhe* (*Dicranopteris linearis*), *kanawao* (*Broussaisia arguta*), *‘ōhā wai* (*Clermontia* spp.), *ha‘iwale* (*Cyrtandra* spp.), *hāhā* (*Cyanea* spp.), *maile* (*Alyxia oliviformis*), *ālani* (*Melicope* spp.), and ‘*ōhelo*

(*Vaccinium* spp.). The other wet and montane forest vegetation communities include a similar mix of species, but vary in terms of the density and diversity of the sub-dominant and understory species. Although *ʻōhiʻa* remains dominant, these vegetation types support less *hāpuʻu* and generally are less diverse. In addition, native trees and shrubs may be more prevalent in the understory, particularly in the mesic forest communities. A prominent feature of both the *Koa/ʻŌhʻia* Montane Wet Forest and *Koa/ʻŌhiʻa* Montane Mesic Forest are large stature *koa* trees, ranging up to 120 feet in height.

Overall, more than 160 endemic vascular plant and fern species occur within Puʻu Makaʻala; a detailed listing of known vegetation species is provided in the Puʻu Makaʻala NAR Management Plan (DOFAW, 2013b). Several of these species are federally and state listed as threatened or endangered, and in some cases, critical habitat has been designated within the NAR. Threatened and endangered species and critical habitat are further discussed in Section 3.5.5.

3.5.3 Wetlands

Puʻu Makaʻala NAR supports a variety of wetland types, including bogs, seeps and ephemeral pools (DOFAW, 2013b). None of the proposed infrastructure or terrestrial sampling plots would occur within or in the immediate vicinity of wetland habitat.

3.5.4 Wildlife

The native forest in Puʻu Makaʻala NAR provides valuable habitat for a variety of native species, particularly forest birds. These include seven species of honeycreeper (*ʻakiapōlāʻau* [*Hemignathus munroi*], Hawaiʻi ʻ*amakihi* [*Hemignathus virens*], ʻ*apapane* [*Himatione sanguinea*], *alawi* [*Loxops mana*], Hawaiʻi *ʻākepa* [*Loxops coccineus*], *ʻōʻū* [*Psittirostra psittacea*]*,* and *ʻiʻiwi* [*Vestiaria coccinea*]). Five of these species are listed as endangered, as further discussed in Section 3.5.5. The Kūlani portion of the NAR supports some of the highest densities of these species on Hawaiʻi Island (DOFAW, 2013b).

Puʻu Makaʻala NAR also provides habitat for the endangered Hawaiian hawk or *ʻio* (*Buteo solitarius*) and the Hawaiian goose or *nēnē* (*Branta sandvicensis*). Endangered seabird species, including the Hawaiian petrel or *ʻuaʻu* (*Pterodroma sandwichensis*) and the band-rumped storm petrel or *ʻakēʻakē* (*Oceanodroma castro*) may fly over the NAR while travelling between the ocean and nesting areas on the upper, eastern slopes of Mauna Loa. Although the species is not historically known from this location, there are plans to introduce the endangered Hawaiian crow or *ʻalalā* (*Corvus hawaiiensis*) within the NAR. These endangered species are further discussed in Section 3.5.5.

Non-endangered native bird species that occur within Puʻu Makaʻala NAR include *apapane* (*Himatione sanguinea*), *amakihi* (*Hemignathus virens*), *ʻelepaio* (*Chasiempis sandwichensis*), *ʻomaʻo* or Hawaiian thrush (*Phaeornis obscurus*), Hawaiian owl or *pueo* (*Asio flammeus sandwichensis*), and Pacific golden-plover or *kōlea* (*Pluvialis fulva*). These species are year-round residents and are protected by the Migratory Bird Treaty Act (MBTA). Non-native birds that commonly occur include Japanese white-eye (*Zosterops japonicus*), red-billed leoithrix (*Leiothrix lutea*), northern cardinal (*Cardinalis cardinalis*), and kalij pheasant (*Lophura leucomelanos).*

Hawaiʻi's only endemic land mammal, the endangered Hawaiian hoary bat or *ʻōpeʻapeʻa* (*Lasiurus cinereus semotus*), is known to occur in the NAR, as further discussed in Section 3.5.5.

A wide variety of invertebrate species have been documented within the NAR, including insects, spiders and snails. These include three species of picture wing flies (*Drosophila* spp.), three endemic genera of leaf hoppers (*Leialoha*, *Nesodyne*, and *Nesothoe*), and three species of endemic damselfly (*Megalagrion hawaiiense*, *Megalagrion calliphya,* and *Megalagrion koelense*) (DOFAW, 2013b).

3.5.5 Listed Species and Critical Habitat

As noted above, the high quality and expansive tracts of *koa* and *ʻōhiʻa* forest in the NAR and surrounding areas provides important habitat for some of Hawaiʻi's rarest birds, plants, and other species. Many of these have been federally listed as threatened or endangered and as such, are afforded protection under the ESA. HRS Chapter 195D-4 specifies that any species designated to be endangered or threatened pursuant to the ESA shall also be designated under state law. DLNR may also designate additional species that are not federally listed.

To identify federally and state-listed species that could occur in the NAR, input was requested from USFWS, DOFAW, and other knowledgeable entities. In addition, the Puʻu Makaʻala NAR Management Plan was specifically reviewed for information pertaining to threatened and endangered species occurrence. The resulting list of federally and state-listed species that are known (or were historically known) to occur or otherwise may occur within Puʻu Makaʻala NAR, and therefore may be present within the project area, is provided in Table 6.

As indicated in Table 6, critical habitat has been designated within Puʻu Makaʻala NAR for multiple plant species, as well as for the picture-wing fly (*Drosophila mulli*). The extent of critical habitat is illustrated in Figure 5.

TABLE 6
Federally and State-listed Species Potentially Occurring at Puʻu Makaʻala NAR

Species Name	Status	Range or Habitat Requirements	Critical Habitat in Project Area	Potential to Occur in Project Area
Plants				
Mauna Loa (*Kaʻu*) silversword *Argyroxiphium kauense*	Endangered (F,S)	Moist openings and boggy areas in wet *ʻōhiʻa* forests, and on lava with sparse soil in mesic shrubby *ʻōhiʻa* forests; occurs in Kūlani portion of NAR (USFWS, 1996 and 2015a; DOFAW, 2010).	Yes (northwestern portion of NAR)	Known to occur (outplanted); some sampling plots would be in critical habitat
ʻōhā wai *Clermontia lindseyana*	Endangered (F,S)	Mesic *ʻōhiʻa* and *koa* forests on leeward slopes of Haleakalā, Mauna Kea and Mauna Loa; occurs in Kūlani portion of NAR (USFWS, 1996; DOFAW, 2010).	Yes (northwestern portion of NAR	Known to occur (outplanted); infrastructure and some sampling plots would be in critical habitat
ʻōhā wai *Clermontia peleana*	Endangered (F,S)	Grows epiphytically in montane wet forests; outplanted in Kūlani portion of NAR (USFWS, 1996 and 2015b).	No	Known to occur (outplanted)
hāhā *Cyanea copelandii ssp. copelandii*	Endangered, Possibly Extinct (F,S)	Montane wet forest dominated by *hāpuʻu*, elevation 2,200-2,900 feet (USFWS, 1996 and 2012a).	No	Unlikely; believed to be extinct
ʻakūʻakū *Cyanea platyphylla*	Endangered (F,S)	Lowland and montane wet forests dominated by *koa* and *ʻōhiʻa*; elevation 390-3,000 feet (USFWS, 2012b; DOFAW, 2016b).	No	May occur

TABLE 6
Federally and State-listed Species Potentially Occurring at Pu‘u Maka‘ala NAR

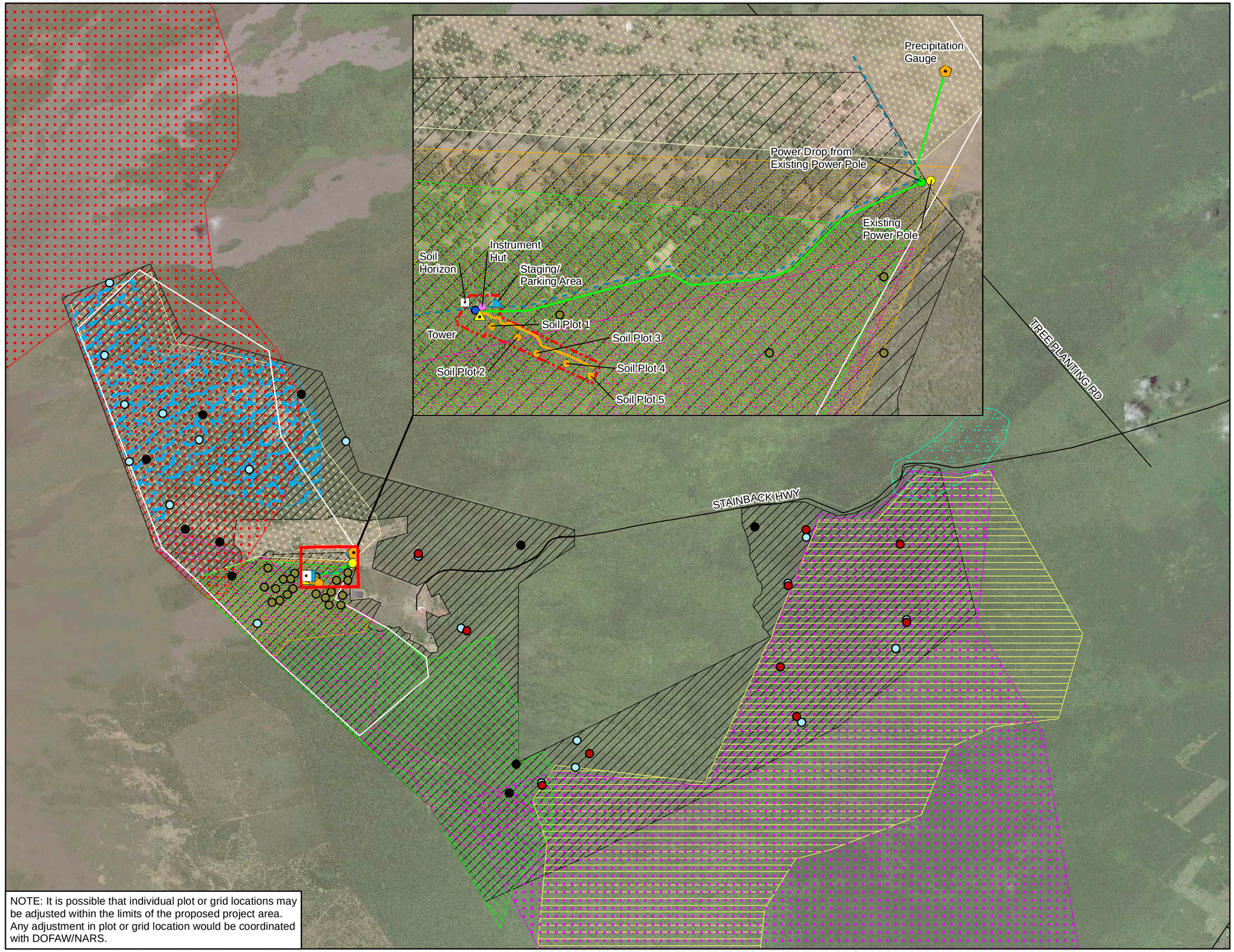
Species Name	Status	Range or Habitat Requirements	Critical Habitat in Project Area	Potential to Occur in Project Area
hāhā *Cyanea shipmanii*	Endangered (F,S)	Montane mesic forest dominated by *‘ōhi‘a* on windward slopes; elevation 5,400-6,200 feet; outplanted in Kūlani portion of NAR (USFWS, 1996; DOFAW, 2010).	Yes (northwestern portion of NAR)	Known to occur (outplanted); some sampling plots would be in critical habitat
hāhā *Cyanea stictophylla*	Endangered (F,S)	Grows epiphytically or in moss; lowland to montane, mesic to wet forest dominated by *koa* and *‘ōhi‘a* at elevations of 3,500-6,400 feet; outplanted in Kūlani portion of NAR (USFWS, 1996 and 2012c; DOFAW, 2010).	Yes (western portion of NAR)	Known to occur (outplanted); some infrastructure and sampling plots would be in critical habitat
‘akū *Cyanea tritomantha*	Endangered (F,S)	Lowland wet, montane wet, and wet cliff ecosystems; one population known within Pu‘u Maka‘ala (USFWS, 2013a).	No	Known to occur
ha‘iwale *Cyrtandra giffardii*	Endangered (F,S)	Wet montane forest dominated by *hāpu‘u*; elevation 2,400-4,900 feet; previously known to occur in Kūlani portion of NAR (USFWS, 1996 and 2012d; DOFAW, 2010).	Yes (southern portion of NAR)	May occur; some sampling plots would be in critical habitat
ha‘iwale *Cyrtandra tintinnabula*	Endangered (F,S)	Lowland wet forest dominated by dense *koa*, *‘ōhi‘a* and *hāpu‘u*; elevation 2,100-3,400 feet (USFWS, 1996 and 2012e).	No	May occur
nānū *Gardenia remyi*	Endangered (F,S)	Mesic to wet forest on Kauai, Molokai, Maui and Hawai‘i Island; elevation 190-2,500 feet (USFWS, 2013b).	No	May occur
‘ohe *Joinvillea ascendens* ssp. *ascendens*	Endangered (F,S)	Wet to mesic *‘ōhi‘a-koa* lowland and montane forests and along intermittent streams; elevation 1,000-4,300 feet (USFWS, 2013b).	No	May occur
No common name *Phyllostegia floribunda*	Endangered (F,S)	Lowland wet, montane mesic, and montane wet habitat; one occurrence known in wild (plus outplanting) in Pu‘u Maka‘ala NAR (USFWS, 2013a).	No	Known to occur
kīponapona *Phyllostegia racemosa*	Endangered (F,S)	Mesic to wet *‘ōhi‘a-koa* forests on the windward slopes of Mauna Kea and Mauna Loa; elevation 2,300-6,350 feet; outplanted in Kūlani portion of NAR (USFWS, 2012f; DOFAW, 2010).	Yes (western portion of NAR)	Known to occur; infrastructure and some sampling plots would be in critical habitat
No common name *Phyllostegia velutina*	Endangered (F,S)	Montane mesic and dry forests to montane wet forests; occurs in Kūlani portion of NAR (USFWS, 2012g; DOFAW, 2010).	Yes (western portion of NAR)	Known to occur; infrastructure and some sampling plots would be in critical habitat

TABLE 6
Federally and State-listed Species Potentially Occurring at Pu‘u Maka‘ala NAR

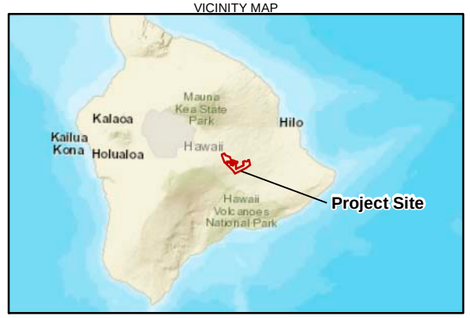
Species Name	Status	Range or Habitat Requirements	Critical Habitat in Project Area	Potential to Occur in Project Area
Kuahiwi laukahi *Plantago hawaiiensis*	Endangered (F,S)	Dry shrubland habitats on the leeward side of Hawaii Island; elevation 5,198 and 8,243 feet. Periodic water flow may be required (Belfield and Pratt, 2002).	Yes (northwestern portion of NAR)	May occur; some sampling plots would be in critical habitat
‘ānunu *Sicyos alba*	Endangered (F,S)	Montane wet forest dominated by *‘ōhi‘a* and *hāpu‘u*; elevation 3,270-5,072 feet; one known occurrence at Pu‘u Maka‘ala (USFWS, 2012h).	Yes (southern portion of NAR)	Known to occur; some sampling plots would be in critical habitat
Hawaiian vetch *Vicia menziesii*	Endangered (F,S)	Wet to mesic *‘ōhi‘a-koa* forest; elevation 1570-5640 feet; outplanted in Kūlani portion of NAR (USFWS, 2012i; DOFAW, 2010).	No	Known to occur
Ferns				
palai la‘aū *Adenophorus periens*	Endangered (F,S)	Grows epiphytically in lowland wet and wet cliff ecosystems (USFWS, 2010).	No	May occur
No common name *Asplenium fragile* var. *insulare*	Endangered (F,S)	Grows in lava tubes, pits, deep cracks, and lava tree molds in montane wet, mesic, and dry forest habitats (USFWS, 1988).	No	May occur
Birds				
nēnē, Hawaiian goose *Branta sandvicensis*	Endangered (F,S)	Frequents scrubland, grassland, golf courses, sparsely vegetated slopes, and open lowland country. Their current distribution has been highly influenced by captive-bred releases into the wild. Known to occur in Kūlani portion of NAR (DOFAW, 2010).	No	Known to occur
‘*io*, Hawaiian hawk *Buteo solitarius*	Endangered (F,S)	Needs native forest to nest; but able to use a broad range of habitats for foraging, including forests dominated by native and introduced vegetation; elevation from sea level to 6,500 feet; known to occur in Kūlani portion of NAR (DOFAW, 2010).	No	Known to occur
‘akiapōlā‘au *Hemignathus munroi*	Endangered (F,S)	Montane mesic and wet forest dominated by *koa* and *‘ōhi‘a*; predominantly at elevations above 4000 feet with lower numbers of mosquitos; known to occur in Kūlani portion of NAR (USFWS, 2006a; DOFAW, 2010).	No	Known to occur
Hawai‘i ‘*ākepa* *Loxops coccineus*	Endangered (F,S)	Old-growth *‘ōhi‘a* or *‘ōhi‘a*/*koa* forest, with nesting in cavities of large trees; known to occur in Kūlani portion of NAR (USFWS, 2006a; DOFAW, 2010).	No	Known to occur
alawi *Loxops mana*	Endangered (F,S)	Upper elevation *‘ōhi‘a* and *‘ōhi‘a*/*koa* forests on the windward coast, at elevations above 2200 feet; known to occur in Kūlani portion of NAR (DOFAW, 2010).	No	Known to occur

TABLE 6
Federally and State-listed Species Potentially Occurring at Pu‘u Maka‘ala NAR

Species Name	Status	Range or Habitat Requirements	Critical Habitat in Project Area	Potential to Occur in Project Area
‘ō‘ū *Psittirostra psittacea*	Endangered (F,S)	Mid-elevation (3,000-5,000 feet]) mesic and wet *‘ōhi‘a* forests; may be extinct (last detected in 1989) (USFWS, 1996).	No	Species is believed to be extinct
‘i‘iwi, scarlet honeycreeper *Vestiaria coccinea*	Proposed Threatened (F)	Montane mesic and wet forest dominated by *koa* and *‘ōhi‘a*; predominantly at elevations above 4000 feet with lower numbers of mosquitos; known to occur in Kūlani portion of NAR (DOFAW, 2010).	No	Known to occur
‘alalā, Hawaiian crow *Corvus hawaiiensis*	Endangered (F,S)	Upland *‘ōhi‘a* or *‘ōhi‘a-koa* forests on Hualalai and Mauna Loa; elevation 3000-6000 feet; currently extinct, but captive bred birds will be released within Pu‘u Maka‘ala starting in late 2016 (DOFAW, 2016c).	No	May occur (depending on the location of future releases of captive bred birds)
‘akē‘akē, band-rumped storm petrel *Oceanodroma castro*	Endangered (F,S)	Known to nest on Hawai‘i Island in burrows and crevices in high elevation lava fields, which are visited after dark. When not at nest locations, it forages on the open ocean.	No	Species may fly over site while travelling between upland nest sites and the ocean
‘ua‘u or Hawaiian petrel *Pterodroma sandwichensis*	Endangered (F,S)	Nest in burrows, primarily in remote montane locations, along large rock outcrops, under cinder cones, under old lichen-covered lava, or in soil beneath dense vegetation.	No	Species may fly over site while travelling between upland nest sites and the ocean
Newell’s shearwater *Puffinus newelli*	Threatened (F,S)	Nests in burrows under ferns on forested mountain slopes; needs an open downhill flight path. Burrows are used year after year, usually by the same pair of birds.	No	Species may fly over site while travelling between upland nest sites and the ocean
Mammals				
‘ōpe‘ape‘a, Hawaiian hoary bat *Lasiurus cinereus semotus*	Endangered (F,S)	Roosts in a variety of native and non-native vegetation from 3-29 feet above ground level; rarely observed using lava tubes, cracks in rocks, or manmade structures for roosting. Water courses and edges appear to be important foraging areas; known to occur in Kūlani portion of NAR (DOFAW, 2010).	No	Known to occur
Invertebrates				
Picture-wing fly *Drosophila mulli*	Threatened (F,S)	Restricted to the island of Hawai‘i; historically known from three locations, 3,200-4,000 feet in elevation. Adult flies are found on the leaf undersides of *loulu* (*Pritchardia beccariana*) (USFWS, 2006b).	Yes (in far eastern tip of NAR)	Known to occur (but not recorded since 2000)



VICINITY MAP



LEGEND

- Precipitation Gauge
- Tower
- Instrument Hut
- Staging/Parking
- Soil Horizon
- Soil Array
- Existing Power Pole
- Power Drop from Existing Power Pole
- On-grade Electrical Conduit
- Honeycomb Walkway
- Existing Access
- Extent of Potential Construction
- Extent of Potential Terrestrial Sampling

Critical Habitat

- Argyroxiphium kauense
- Clermontia lindseyana
- Cyanea shipmanii
- Cyanea stictophylla
- Cyrtandra giffardii
- Drosophila mulli
- Phyllostegia racemosa
- Phyllostegia velutina
- Plantago hawaiiensis
- Sicyos albus

Proposed Sampling Plots and Grids

- Tower Plot (Center Point)
- Distributed Plot (Center Point)
- Bird Grid (Center Point)
- Phenology Transect (Center Point)
- Mosquito Point

Aerial Source: NAIP, 2016

N

0 0.5 1
Miles

NOTE: It is possible that individual plot or grid locations may be adjusted within the limits of the proposed project area. Any adjustment in plot or grid location would be coordinated with DOFAW/NARS.

Figure 5
Critical Habitat
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

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The ʻAlalā Project

Historically known from dry and mesic forests in the western and southern portions of Hawaiʻi Island, *ʻalalā* has been extinct in the wild for approximately 15 years. The ʻAlalā Project is a joint effort by DOFAW, USFWS, and San Diego Zoo Global to reintroduce *ʻalalā* to the wild and establish a self-sustaining population. Puʻu Makaʻala NAR was selected as the primary site for release of the captive raised birds. Although the species did not historically occur in this location, it was known to be present in nearby areas, including Hawaiʻi Volcanoes National Park, as recently as 1983. Puʻu Makaʻala was selected as the release site because the high quality forest habitat and the protection provided by ungulate fencing.

The first release occurred in December 2016; however, three of the birds did not survive and the remaining birds were taken back into captivity. Twelve birds are planned to be released at a new, undisclosed location within the NAR in late summer or early fall 2017. Similar releases are anticipated to occur annually for the next 5 years, depending on the success and survival of the released birds. Following each release, there will be a team of onsite biologists providing supplemental feeding, conducting ongoing predator control, monitoring life history, and conducting nest searches for approximately 5 years.

3.5.6 Invasive Species

Invasive species are widely recognized as a significant threat to native species and habitat in Hawaiʻi. Given the prevalence of native species in Puʻu Makaʻala NAR, invasive species are considered to be a severe threat, and are actively managed by NARS staff through implementation of their management plan.

Invasive plant species are problematic because they readily disperse over long distances and can easily establish and rapidly spread in undisturbed habitats, thus displacing native species across broad tracts of land. These changes can lead to a loss of species diversity, loss of habitat for native fauna, and long-term changes in ecosystem function. High priority invasive weeds (i.e., species that are considered to be particularly problematic because of their ability to spread or modify natural habitat) currently present in Puʻu Makaʻala NAR include strawberry guava (*Psidium cattleianum*), banana *poka* (*Passiflora tarminiana*), himalayan raspberry (*Rubus ellipticus*), cane tibouchina (*Tibouchina herbacea*), *kāhili* ginger (*Hedychium gardnerianum*), palm grass (*Setaria palmifolia*), Australian tree fern (*Sphaeropteris cooperi*), clidemia or Koster's curse (*Clidemia hirta*), tropical ash (*Fraxinus uhdei*), and silver-leaf cotoneaster (*Cotoneaster pannosus*). Other species that have not been identified in the NAR, but are of serious concern in adjacent areas include miconia (*Miconia calvescens*) and night-blooming jasmine (*Cestrum nocturnum*) (DOFAW, 2013a).

A variety of invasive animal species also pose threats to biodiversity and the natural ecosystem in this region. Particularly problematic species include feral pigs, rats (*Rattus* spp.), mice (*Mus musculus*), cats (*Felis catus*), and mongoose (*Herpestes auropunctatus*). These species are known to compete with or consume native species (particularly native bird species). The NAR has also been invaded by non-native birds (e.g., Japanese white-eye, northern cardinal, and others). Other invasive species that threaten the native ecosystem and are known from this region include Jackson's chameleon (*Chamelaeleo jacksonii*), coqui frog (*Eleutherodactylus coqui*), and a variety of invertebrate species, including fire ants (*Wassmania auropunctata*). Feral goats and feral mouflon sheep are invasive species that are prevalent just outside the NAR border.

The proposed NEON infrastructure would be located in an area that is actively managed to preclude invasive species, particularly feral pigs, cats, mongoose, rats and mice. No priority weed species are known to occur in this area.

Rapid ʻŌhiʻa Death

Rapid *ʻŌhiʻa* Death is a newly identified disease, associated with the fungus *Ceratocystis fimbriata*, which is killing mature *ʻōhiʻa* trees. It has killed hundreds of thousands of trees in the South Hilo, Puna, Kau, and Kona districts of Hawaiʻi Island, and has the potential to affect *ʻōhiʻa* forests statewide. The fungus attacks the vascular system of the tree, causing the crown of the tree to turn yellow then brown in a matter of days or weeks. The fungus lives in the sapwood of infected trees and can persist for more than a year after a tree is cut. The fungus can be spread through movement of infected wood or soil, as well as on clothing, gear and equipment. There is no known cure for this disease (University of Hawaiʻi, College of Tropical Agriculture and Human Resources [CTAHR], 2016).

In an effort to prevent the spread of the disease, the Rapid *ʻŌhiʻa* Death Working Group (comprising agencies, land managers, and researchers) has established recommended measures for work in affected or potentially affected areas. These include avoiding movement or transport of *ʻōhiʻa* wood, cleaning tools used to cut *ʻōhiʻa*, cleaning gear and clothing/shoes before and after entering the forest, and washing vehicles that are taken off-road. In addition, the Hawaiʻi Board of Agriculture has approved a quarantine on intrastate movement of *ʻōhiʻa* and *ʻōhiʻa* products.

3.6 Archaeological, Architectural, and Cultural Resources

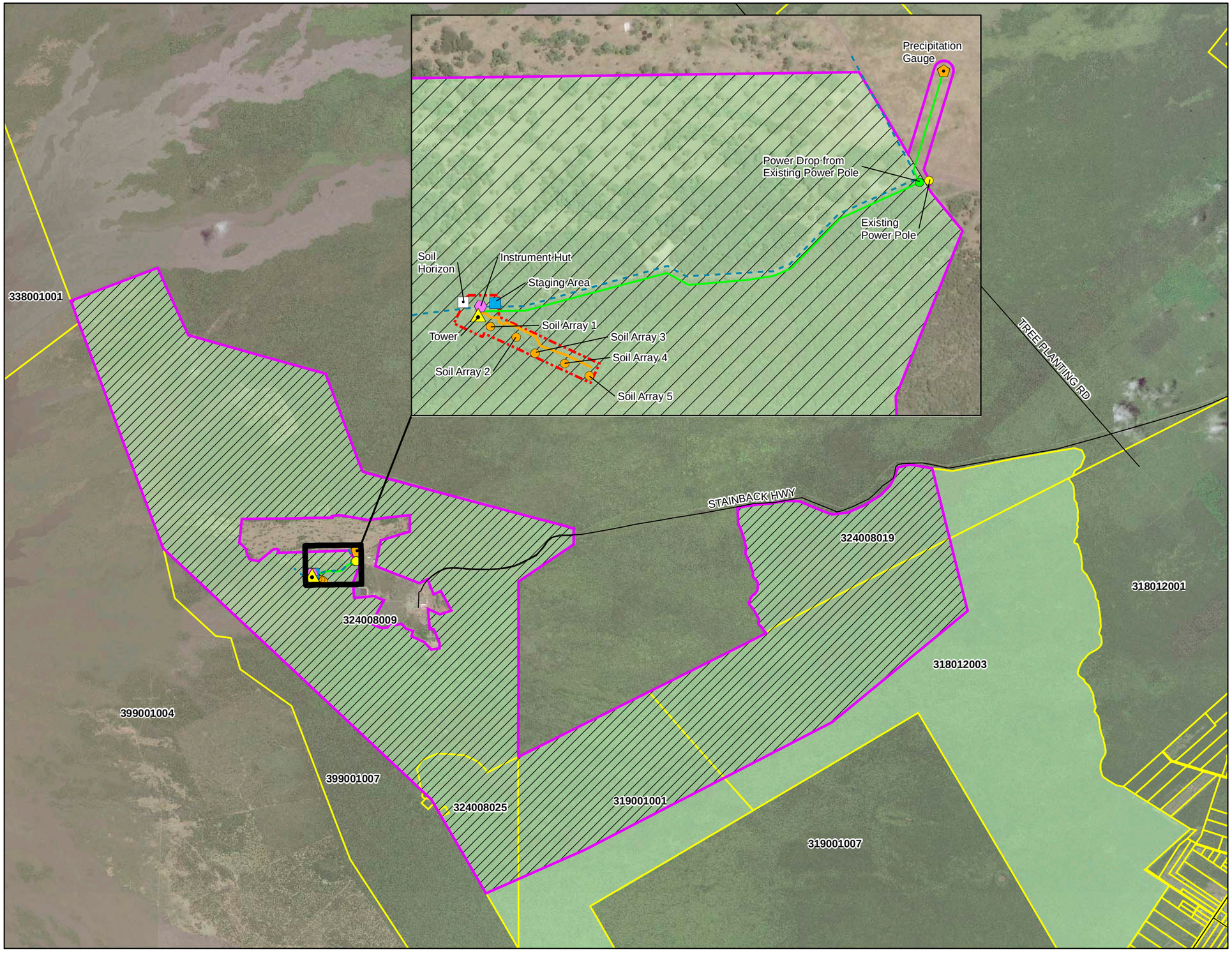
Cultural resources include prehistoric and historic archaeological sites, historic architectural properties (including buildings, structures, and objects), historic districts, designed landscapes, and traditional cultural properties (TCPs). These resources are protected under both federal and state laws, including NHPA and HRS Chapter 6E. In addition, HRS Chapter 343 and its implementing rules (HAR 11-200) require consideration of a proposed project's potential effect on cultural beliefs, practices, and resources. Four sub-resources (archaeological sites, architectural properties, TCPs, and other cultural uses, practices, and properties) are discussed as part of this section. Additional detail regarding the status of the NHPA Section 106 consultation process is provided in Section 5.2.

3.6.1 Area of Potential Effects

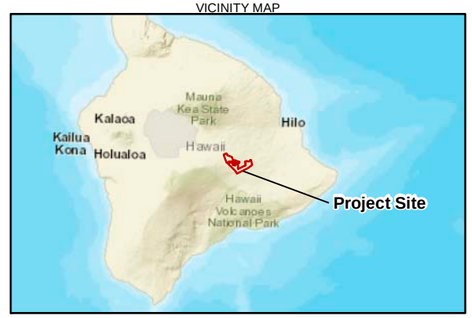
As described in Section 1.4.1, the NHPA Section 106 process requires identification of the APE, which is the geographic area(s) within which a project may directly or indirectly affect historic properties. The APE for the proposed project, as described in correspondence with the SHPD (see Appendix C), was defined to include the proposed location for the scientific infrastructure and all potential terrestrial sampling areas, as shown in Figure 6.

3.6.2 Historical Context

Early Hawaiian settlement is traced back to A.D. 300 and was primarily concentrated along the "watered, windward (koʻolau) shores" of Hawaiʻi's main islands (Maly and Maly, 2004). With an abundant supply of reliable water, these areas were conducive to agricultural production and the establishment of communities. The population primarily "engaged in subsistence practices in the form of fishing, and in agriculture on lands extending towards the uplands from the bays" (Maly and Maly, 2004). Hilo Bay attracted a large concentration of settlers due to its "lush tropical verdure and beauty" (Maly and Maly, 2004). As the population increased, settlers moved away from the more naturally rich areas and towards the more inaccessible areas of the islands.



VICINITY MAP



LEGEND

- Precipitation Gauge
- Tower
- Instrument Hut
- Staging/Parking Area
- Soil Horizon
- Soil Array
- Existing Power Pole
- Power Drop from Existing Power Pole
- On-grade Electrical Conduit
- Honeycomb Walkway
- Existing Access Road
- Extent of Potential Construction Activities
- Extent of Potential Terrestrial Sampling
- Tax Map Key
- Pu'u Maka'ala Natural Area Reserve
- Area of Potential Effects (APE)

Aerial Source: NAIP, 2016

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Miles

Figure 6
Area of Potential Effects (APE)
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

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Traditionally, natural and cultural resources are considered indistinguishable from one another in Hawaiian culture (Maly and Maly, 2004):

> *Native traditions described the formation (literally the birth) of the Hawaiian Islands and the presence of life on, and around them, in the context of genealogical accounts. All forms of the natural environment, from the skies and mountain peaks, to the watered valleys and lava plains, and to the shore line and ocean depths are believed to be embodiments of Hawaiian gods and deities*.

Hawai‘i, the largest of the islands, was the first island to be "born." Since ancient times, Hawaiians have established land and resource management systems. By circa 1525, the island of Hawai‘i had been divided into six districts (moku-o-loko), one of which was Hilo.

The "district of Hilo itself, extends from the shore up to the 9,000 foot level on Mauna Kea, and up to the summit of Mauna Loa, where it joins the districts of Ka‘u, Kona and Hamakua" (Maly and Maly, 2004). Hilo itself was subdivided into three traditional regions: Hilo Hanakeahi, Hilo One, and Hilo Paliku. Today, the district is divided into North and South Hilo. As a whole, "Hilo has been most famed for its rains, and is commemorated in many traditional *mele* (chants) and ‘*olelo no‘eau* (poetical sayings) by reference to the rains" (Maly and Maly, 2004).

Archibald Menzies and Captain George Vancouver were among the first Europeans to visit Hawai‘i. They arrived in 1793-1794 and were the first foreigners to reach the top of Mauna Loa, a feat that would not be repeated by another foreigner until 1834. Because of the remoteness of the ‘Ōla‘a and Waiakea forest lands that make up the Pu‘u Maka‘ala NAR, the area remained largely untouched by government infrastructure projects, including trails or roads (Maly and Maly, 2004). With the arrival of more European explorers, however, came new plant and animal species that often posed a threat to the natural Hawaiian landscape. In 1876, King David Kalākaua established the Act for the Protection and Preservation of Wood and Forests, which authorized the Minister of the Interior to "set apart and protect from ‘damage by trespass of animals or otherwise, such woods and forest lands, the property of government…best suited for the protection of water resources…’" (Maly and Maly, 2004). In 1904, the Board of Commissioners of Agriculture and Forestry enacted further legislation to protect the district of Hilo; "the Commissioners approved the recommendation that "all government and other lands in the district of Hilo, Island of Hawai‘i, lying above a line approximately 1750 feet above the sea, be set apart as forestry reservation'" (Maly and Maly, 2004). More land was added to the reservation in 1905 and 1913, including sections of the ‘Ōla‘a tract and upland sections of the Waiakea, "thus, making a contiguous line of forest across the Hilo District, and adjoining the Puna District" (Maly and Maly, 2004).

Records indicate that ‘practitioner’ trails associated with traditional and customary activities such as bird catching and canoe-making likely existed in the region (Maly and Maly, 2004). It was not until the 1940s that a road was constructed through the ‘Ōla‘a and Waiakea forest lands, around the same time that the Kūlani Prison Farm (now Kūlani Correctional Facility) was opened. An access road was constructed in the early 1950s that connected the prison to Mauna Loa's summit region (Maly and Maly, 2004).

Hawai‘i was among the first states in the United States to establish a system of NARs. In 1981, Executive Order (E.O.) 3102, enacted by Governor Waihe‘e, dedicated sections of the Waiakea and ‘Ōla‘a Forest Reserve lands as the Pu‘u Maka‘ala NAR (Maly and Maly, 2004).

3.6.3 Archaeological Resources

Prehistoric and historic archaeological resources are items or sites resulting from human activities that predate and postdate written records, respectively. A literature review was completed at the SHPD library and additional research was conducted to locate previous EAs and cultural studies completed for

the proposed site area. Three reports have been produced relating to the area within the APE and are listed in Table 7.

TABLE 7
Cultural Resources Studies Conducted within the APE

Title	Author	Date	Findings
Archaeological Inventory Survey and Limited Cultural Assessment for the Proposed Wastewater Treatment Facility at Kūlani Correctional Facility (TMK:3-2-4-08:9)	Rechtman, Robert B. Ph.D.	July 2001	No sites found. Archeological expectations for the general area are very limited due to location in the "rainforest zone."
He Moʻolelo ʻĀina: A Cultural Study of the Puʻu Makaʻala Natural Area Reserve Districts of Hilo and Puna, Island of Hawaiʻi	Maly, Kepa and Onaona Maly (Kumu Pono Associates LLC)	May 2004	No references to archaeological sites. The overall NAR was characterized as a cultural landscape, but no formal determination of eligibility was made.
SHPD Consultation for the Puʻu Makaʻala Natural Area Reserve Management Plan	DOFAW/SHPD	September, November 2011	DOFAW requested concurrence with determination of "no historic properties affected" (dated September 23, 2011); SHPD concurred with determination (dated November 18, 2011)

The literature review indicated that no archaeological sites have been previously identified within the APE. No records or references to specific archaeological sites within the APE were mentioned in the 2004 cultural study by Kumu Pono and the findings were negative for the other two reports listed in Table 7. No additional archaeological survey work was conducted for this undertaking.

3.6.4 Architectural Resources

Historic architectural resources consist of buildings, structures, objects, or other manmade items resulting from human activities that occurred after European settlement.

One architectural resource that is more than 50 years old is located within the APE: the Mauna Loa Boys School building. The school was constructed in 1952 and remained open for only 1 year, closing in 1953. At various points in its history, it was used by the Kūlani Correctional Facility and for military training activities. Currently, the dilapidated building is used to store fencing materials. Original fenestration has been removed and replaced with plywood, large sections of the roof are missing, and the surrounding landscape is overgrown. The building has not been used as a school since 1953. The building lacks integrity of materials, design, workmanship, feeling, association, and setting. A November 18, 2011, letter from the Deputy SHPO to DOFAW regarding the Puʻu Makaʻala NAR Management Plan describes the school as in "poor condition." During a Section 106 Consulting Parties meeting held for the proposed project on October 26, 2016, meeting attendees likewise noted the poor condition of the former school and that the proposed NEON site would have no potential to affect the building. The building was not identified as a historic property. In addition to the Mauna Loa Boys School, there are several water tanks in the APE; however, these are less than 50 years old and do not meet any other criteria for NRHP eligibility. Because the proposed project has no potential to affect the Mauna Loa Boys School, architectural resources are not further analyzed.

3.6.5 Traditional Cultural Properties

TCPs are sites, areas, and materials associated with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural

identity of the community. The 2004 study by Kumu Pono (Maly and Maly, 2004), which was a cultural study of the Pu‘u Maka‘ala NAR (which includes the entire APE), notes:

> *…the mountain landscape, its native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its 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 ‘Ola‘a and Waiakea Forest Reserves, the Pu‘u Maka‘ala NAR, and the Endangered Species Act).*

As such, the overall NAR has been characterized as a cultural landscape, but no formal determination of NRHP-eligibility for the landscape as a TCP has occurred. Although the cultural landscape has not been identified as eligible for listing, potential impacts to this resource are considered in Section 4.6.

3.6.6 Cultural Uses, Practices, and Properties

Other cultural resources can include plant or animal species, objects, places, uses or practices that are considered culturally or spiritually significant. While these properties may be culturally significant, they are not eligible as historic properties under the NRHP and thus are not covered by the NHPA.

Individual species in the NAR may be culturally significant, such as the ‘*alalā* or ‘*io*, both of which are regarded as ‘*aumakua* (Hawaiian ancestral spirits). While species with spiritual or cultural significance are not eligible for inclusion in the NRHP, they may be considered potentially significant cultural properties. Descriptions of species known to occur within the NAR are included in Biological Resources, Section 3.5.

Historically, areas of the NAR were used to build bird-catcher’s shelters, canoes, trails, and trailside resting places and shelters. The 2004 Kumu Pono report notes:

> *Because of the remote nature of the ‘Ola‘a and Waiakea forest lands which comprise the present-day Pu‘u Maka‘ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiakea, ‘Ola‘a, Keauhou and Humu‘ula. Based on the native traditions and kama‘aina testimonies, it is likely that ‘practitioner’ trails existed throughout the forest region. Features such as ‘kauhale manu’ (bird-catcher's shelters), ‘kahua kalaiwaa’ (canoe-makers clearings), ‘oioina’ (trailside resting places and shelters), the ‘ala hele’ (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape*.

NARS staff were interviewed to identify any known cultural sites or practices. Mr. Nick Agorastos, NARS Specialist with DLNR DOFAW, stated that he had never encountered anyone engaged in cultural practices in the site area, even though he or his staff are on the property almost daily. He noted that the NARS rules specify the need for a permit to conduct cultural practices within the NAR, and that he is only aware of two previous permit requests for Pu‘u Maka‘ala NAR, both involving removal of a *koa* log to build a canoe (Rau, 2016). There are no cultural uses or practices that are currently known to occur within the NAR or the APE.

3.7 Visual Resources

3.7.1 Background

Visual resources include natural and built features that can be seen by the public and contribute to the public's appreciation and enjoyment of these features. Visual resources can include solitary built and natural landmarks (such as buildings, trees, and bodies of water) or entire landscapes.

Impacts to visual resources are defined in terms of the extent to which a proposed project's presence would change the visual character and quality of the environment as seen by the public. Visual character is defined by the relationships between the existing visible natural and built landscape features. These relationships are considered in terms of how objects in the viewed landscape relate to each other in terms of visual dominance, scale, diversity, and continuity. Visual character is non-evaluative, in that it is simply a description of the viewed environment and does not assign value or degree of attractiveness to the viewed environment. Visual quality is considered in terms of the extent to which the visual elements work together to create a pleasing composition (versus contrasting with one another, thus creating an eyesore), and whether the resulting view is considered dramatic (versus common or average).

3.7.2 Existing Conditions

Pu'u Maka'ala NAR is located in a natural area characterized by forested vegetation and rugged, mountainous terrain. These features, combined with the remoteness of the site, generally limit the visual environment. Within and surrounding the NAR, the visual environment is dominated by the dense forest vegetation, which generally precludes broad landscape views. The NAR is not visible from any of the nearby communities. The only locations that offer any broad landscape views of the NAR are expected to be limited to Pu'u Kipu, Kūlani Cone, some of the higher elevations within the NAR, and the NAR entrance near Kūlani Correctional Facility. Even from these higher elevations, views of the surrounding environment are still heavily dominated by the surrounding forest vegetation. There is some existing infrastructure present within the NAR that affects the visual character in the project vicinity: various fences and gates, electrical lines and poles (serving Kūlani Correctional Facility), and radio and cellular telephone towers (e.g., on Kūlani Cone). However, given the expansive natural setting, the proposed NEON site is considered to have high visual quality. Figure 7 contains photographs that illustrate the existing visual character of the proposed site.

3.8 Hazardous Materials

3.8.1 Background

Consideration of hazardous materials includes existing materials in or on the ground or in existing structures (e.g., asbestos or lead-based paint), soil or groundwater contamination (e.g., from a leaking underground storage tank), as well as materials that would be brought to or generated at the site in association with the proposed project.

3.8.2 Existing Conditions

As described throughout this document, Pu'u Maka'ala NAR is comprised of natural forested habitat that is actively managed by DOFAW for the protection of natural resources. This area is not known to have supported any previous land uses that would have involved or generated hazardous materials.



Figure 7a. Photograph of Proposed Tower Location and Adjacent Access Road *(Pu'u Maka'ala NAR)*



Figure 7b. Photograph of Proposed Instrument Hut and Tower Guy Wire Location *(Pu'u Maka'ala NAR)*

FIGURE **7**
Photographs of Proposed Locations for
NEON Infrastructure and Equipment



Figure 7c. Photograph of Proposed Precipitation Gauge Location (left side of frame) and Existing Power Line (right side of frame) *(Pu'u Maka'ala NAR)*



Figure 7d. Photographs of Proposed Power Drop and Auxiliary Portal Location *(Pu'u Maka'ala NAR)*

FIGURE **7**
Photographs of Proposed Locations for
NEON Infrastructure and Equipment

Furthermore, visual inspection of the proposed project area and the surrounding areas by the NEON project team did not suggest the use or presence of hazardous materials, including the presence of structures, equipment, or storage containers that might be indicative of hazardous material use. Therefore, based upon prior and present use of the proposed project site, no hazardous substances or hazardous conditions are expected to be present within the proposed project area.

3.9 Air Quality

3.9.1 Background

Under the authority of the Clean Air Act, the U.S. Environmental Protection Agency (USEPA) has established nationwide air quality standards to protect public health and welfare. These federal standards, known as National Ambient Air Quality Standards (NAAQS), represent the maximum allowable atmospheric concentrations for six criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone, lead, and particulate matter (respirable particulate matter less than or equal to 10 micrometers in diameter [PM_{10}] and respirable particulate matter less than or equal to 2.5 micrometers in diameter [$PM_{2.5}$]). The NAAQS are based primarily on evidence of acute and chronic (or short-term and long-term) health effects, and apply to outdoor locations to which the general public has access.

Based on measurements of ambient criteria pollutant data, the USEPA designates areas of the United States as having air quality equal to or better than NAAQS (attainment) or worse than NAAQS (non-attainment). The general conformity rule requires federal agencies to ensure that actions they undertake in nonattainment and maintenance areas are consistent with air quality management plans for those areas.

Pursuant to HRS Chapter 342B (*Air Pollution Control*), the Clean Air Branch of the State of Hawai‘i Department of Health (HDOH) is responsible for implementing air pollution control in the State and has established Hawai‘i ambient air quality standards (HAAQS), which in some cases are more stringent than the comparable federal standards or address pollutants that are not covered by the federal standards. The HAAQS are based primarily on health effects data, but also reflect other considerations, such as protection of crops, protection of materials, or avoidance of nuisance conditions (such as objectionable odors).

3.9.2 Existing Conditions

In general, air quality in Hawai‘i is some of the best in the nation, primarily because of consistent trade winds and limited emission sources. Consistent with this trend, the existing air quality in the proposed project area is considered to be relatively good, in particular because of low levels of development and human activity, as well as exposure to consistently strong winds that work to disperse emissions.

HDOH and USEPA maintain a network of air quality monitoring stations throughout the islands. The closest air quality monitoring stations to the proposed project area are the Hilo and Mountain View stations. The Hilo station is located on Waianuenue Avenue near the Hilo Medical Center, and the Mountain View station is located on Volcano Road at the Mountain View Elementary School. Both stations were established to monitor vog during Kona or southerly wind conditions, and collect measurements for SO_2 and $PM_{2.5}$.

The most recent summary report published by HDOH provides measurements recorded in 2014. In general, the data indicate that criteria pollutant levels remain below the federal and state ambient air quality standards (HDOH, 2015). However, a vent opening on Kīlauea Volcano has resulted in increased

emissions of SO_2 and $PM_{2.5}$, with regular exceedances of the NAAQS for SO_2 and occasional exceedances of the NAAQS for $PM_{2.5}$. However, USEPA considers volcanic activity to be a natural, uncontrollable event and therefore the State requests exclusion of these NAAQS exceedances from attainment/non-attainment determination. Excluding these exceedances, Hawai'i as a state is designated as having attainment status for all criteria pollutants (HDOH, 2015). Therefore, the requirements of the General Conformity Rule of the Clean Air Act do not apply.

3.10 Noise

3.10.1 Background

Noise is defined as unwanted or undesirable sound. Noise intensity, or loudness, is determined by how sound pressure fluctuates. Because the range of sound pressure ratios vary greatly over many orders of magnitude, a logarithmic scale is used to express sound levels in dimensionless units of decibels (dB).

A-weighted sound levels are typically measured or presented as equivalent sound pressure level (Leq), which is defined as the average noise level, on an equal energy basis for a stated period of time and is commonly used to measure steady state sound or noise that is usually dominant. Statistical methods are used to capture the dynamics of a changing acoustical environment. Statistical measurements are typically denoted by Lxx, where "xx" represents the percentile of time the sound level is exceeded. The L_{90} is a measurement that represents the noise level that is exceeded during 90 percent of the measurement period. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period. Table 8 shows the relative A-weighted noise values of common environmental and industrial sounds.

TABLE 8
Comparison of dBA Levels of Common Sounds

Noise Source at Give Distance	A-Weighted Sound Level in Decibels (dBA)	Subjective Impression
Loud Rock Music	110	Very loud
Jet Flyover at 1,000 feet	100	--
Gas lawnmower at 3 feet	90	--
Garbage disposal at 3 feet	80	--
Vacuum cleaner at 10 feet	70	Moderately loud
Heavy traffic at 300 feet	60	--
Quiet urban daytime	50	--
Quiet urban nighttime	40	Quiet
Library	30	--
Recording studio	10	Threshold of hearing

Note:
dBA = A-weighted decibel

Source: Caltrans, 1998

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978 [42 U.S.C. Parts 4901-4918]), delegates the authority to regulate environmental noise to each state. The State of Hawai'i has adopted statewide noise standards, set forth in HAR 11- 46 ("Community Noise

Control"); these are administered by HDOH. The stated purpose of the standards is to "provide for the prevention, control, and abatement of noise pollution in the State from the following noise sources: stationary noise sources (such as air-conditioning units, exhaust systems, generators, compressors, and pumps); and equipment related to agricultural, construction, and industrial activities" (HAR 11-46). The noise standards are the maximum permissible sound levels (as measured from the property line) and vary according to land use district. The maximum permissible sound levels for each class of land uses are listed in Table 9.

TABLE 9
Maximum Permissible Sound Levels By Zoning District

Zoning District	Maximum Permissible Sound Levels [dBA] [a]	
	Daytime (7 am—10 pm)	Nighttime (10 pm—7 am)
Class A: All areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type	55	45
Class B: All areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type	60	50
Class C: All areas equivalent to lands zoned agriculture, country, industrial, or similar type	70	70

Notes:

[a] These maximum permissible sound levels apply to the following excessive noise sources: (1) stationary noise sources and (2) equipment related to agricultural, construction and industrial activities (HAR 11-46-4).

Pursuant to HAR 11-46-7, a permit may be obtained for operation of an excessive noise source beyond the maximum permissible sound levels. Factors that are considered in granting of such permits include whether the activity is in the public interest and whether the best available noise control technology has been incorporated into the activity.

3.10.2 Existing Conditions

The proposed project is located in an expansive natural area characterized by densely vegetated forest, with very limited development and human activity. Ambient noise levels are associated with environmental sounds such as wind, rain, and animals (particularly birds), and are typically low. The primary source of human-derived noise in the vicinity of the proposed project is Kūlani Correctional Facility, a minimum security prison that houses approximately 200 inmates. Vehicular traffic along Stainback Highway is infrequent, but also generates intermittent noise. A minimal amount of noise may also result from routine site management activities by DOFAW staff within Pu'u Maka'ala NAR.

With the exception of Kūlani Correctional Facility, the areas immediately adjacent to the proposed project site are comprised of open space. The nearest residential area is approximately 6 miles (9.6 kilometers) to the south.

3.11 Transportation and Traffic

The roadway system in East Hawai'i includes one principal highway (Hawai'i Belt Road, or Māmalahoa Highway), which consists of Route 19 and Route 11. Route 19 runs from Hilo Harbor around the northern side of the island to Kona; Route 11 intersects with Route 19 near Hilo Harbor, and runs around the southern side of the island to Kona. Secondary highways in this area include Keaau-Pahoa Road (Route 130), which extends from Māmalahoa Highway (Route 11) at Keaau towards Kalapana, and

Saddle Road (Route 200) which spans the island between Hilo and Kohala. These roadways fall under the jurisdiction of the State of Hawai'i Department of Transportation (HDOT, 2016). A network of smaller, local roadways provide access within and between Hilo and adjoining communities. These other roadways fall within the jurisdiction of Hawai'i County (Department of Public Works).

Access to Pu'u Maka'ala NAR is provided in two locations, via Wright Road and Stainback Highway. Wright Road intersects with Māmalahoa Highway (Route 11) south of Mountain View; it is a local roadway within Volcano Village and also provides access to the southwestern tip of the NAR. Stainback Highway intersects with Māmalahoa Highway (Route 11) just south of Hilo, and extends approximately 19 miles to provide access to Kūlani Correctional Facility and the northwestern edge of the NAR; the lower portion of Stainback Highway also provides an alternate route to residences in Mountain View (via North Kūlani Road). Access to the proposed NEON project site would be via Stainback Highway. A series of existing unimproved roads provide limited access within the NAR.

There are no other transportation resources, including those related to bicyclists, pedestrians, or mass transit, in the project vicinity. The nearest airport is the Hilo International Airport, which is located more than 20 miles northeast of the proposed tower location. Based on the criteria provided in Federal Aeronautical Administration (FAA) regulations, NSF has concluded that the proposed tower would not meet the height criteria requiring that notice be given to the FAA; as such, potential impacts associated with air traffic are not further addressed.

3.12 Human Health and Safety

3.12.1Natural Hazards

Potential natural hazards that could threaten human health and safety include volcanic activity, flooding, tsunami inundation, and wildfire.

3.12.1.1 Volcanic Activity

As noted in Section 3.3.1, Pu'u Maka'ala NAR is located on the eastern slopes of Mauna Loa. Eruptions from Mauna Loa have resulted in various lava flows within the NAR, dating from more than 10,000 years ago up through as recent as 1942. The Kūlani portion of the NAR has experienced the most recent flows and is the most vulnerable to volcanic activity, as it is downslope of potential eruption sites on the northeast rift zone.

The USGS has mapped the volcanic hazard zones on Hawaii Island. These zones reflect the probability of volcanic activity based on location, topography, and frequency of historic and prehistoric eruptions. The project area is primarily in Zone 3, with a small area in the northern portion of the site within Zone 2 (Wright et al., 1992).

3.12.1.2 Flooding

The flood zone classification for the proposed project site was obtained from the Hawai'i National Flood Insurance Program (NFIP) Flood Hazard Assessment Tool (DNLR, 2016). Based on NFIP information, Pu'u Maka'ala NAR is located entirely within an area that has been designated as Zone X, which is defined as those areas outside the 0.2-percent-annual-chance (or 500-year) flood event.

3.12.1.3 Tsunami

A tsunami is a series of ocean waves generated by sudden displacements in the sea floor, landslides or volcanic activity. A tsunami inundation zone means an area of expected tsunami inundation, based on scientific evidence that may include geographic field data and tsunami modeling. The Pu'u Maka'ala site

is not located in the tsunami inundation zone, as defined by the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 2016).

3.12.1.4 Wildfire

Given the relatively high levels of rainfall in this region, wildfire is not a serious concern in Pu‘u Maka‘ala NAR. However, the threat of wildfire is elevated in drier portions of the site (including Kūlani), particularly during periods of drought, and along publicly accessible roads due to the potential ignition threats associated with vehicles (DOFAW, 2013b).

3.12.2 Occupational Health and Public Safety

Occupational health risks are defined as those arising from physical, chemical, and other workplace hazards that interfere with establishing and maintaining a safe and healthy working environment. Existing hazards that could affect construction personnel, NEON and NARS personnel, and the general public include physical hazards (such as slip, trip, and fall hazards) and biological hazards (such as botanical or wildlife hazards, including thorned plants or stinging insects).

3.12.3 Protection of Children

E.O. 13045, *Protection of Children from Environmental Health Risks and Safety Risks,* requires federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children. Based on available information, there are no child-centric resources within or directly adjacent to Pu‘u Maka‘ala NAR.

3.13 Public Services and Utilities

3.13.1 Public Services

Fire protection services for Hawai‘i Island are provided by the Hawai‘i Fire Department. The fire department is responsible for fire protection and suppression, pre-hospital emergency medical services, land and sea search and rescue, hazardous materials response, ocean safety, and fire prevention and public education for the County of Hawai‘i. There are a variety of full-time fire/medic stations and volunteer fire stations, the nearest of which is located in Hilo. Fire suppression activities are also provided by the DOFAW Fire Management Program for areas including forest reserves, natural area reserves, wildlife and plant sanctuaries, public hunting areas and other wildland areas. The Hawai‘i Fire Department and DOFAW have established a cooperative agreement that specifies primary response and cooperative response areas for each agency. DOFAW is the primary responder for Pu‘u Maka‘ala NAR.

Police services are provided by the Hawai‘i Police Department, with nearby stations located in Hilo and Keaau.

In addition to fire and police services, there is an existing NOAA Weather Radio (NWR) communications facility adjacent to the proposed project area. The NWR broadcasts official warnings and hazard information as a public service to the community, in conjunction with various government emergency management agencies.

3.13.2 Utilities

Utility infrastructure relates to services such as electric, gas, telephone, sanitary sewer, domestic water, and solid waste management. Existing utilities provided within the County of Hawai‘i include electricity, telecommunications, solid waste management, domestic water and wastewater, and storm water drainage facilities.

No utility infrastructure is present within Pu‘u Maka‘ala NAR. Electrical and telecommunication service is provided to the adjacent Kūlani Correctional Facility; given the remote location, no other utility services (e.g., domestic water or sanitary sewer) are available.

3.14 Socioeconomics

The Pu‘u Maka‘ala NAR is located in a remote forested area. The largest town in the vicinity of Pu‘u Maka‘ala NAR is Hilo (approximately 19 miles to the northeast), which has a population of 37,000 individuals. A number of small communities are located in closer proximity (south and east of the NAR); the populations of these communities range from approximately 500 to 2,000 individuals. The communities around the Pu‘u Maka‘ala NAR have a large concentration of Native Hawaiians, which constitute a minority community in the U.S. (United States Census Bureau, 2015).

The economy of Hilo is diverse and depends primarily on government, agriculture, tourism and education (Hawai‘i County, 2016a). The median household income of Hilo is $53,939, which is less than 1 percent above the average U.S. median household income of $53,889 (United States Census Bureau, 2015).

4 Environmental Consequences

Pursuant to NEPA and its implementing regulations (40 CFR Part 1500 through Part 1508), federal agencies are required to undertake an assessment of the environmental effects of their proposed actions before making decisions. Similarly, HRS Chapter 343 and its implementing rules (HAR 11-200) also require environmental review for projects that include certain regulatory triggers; in the case of this proposed project, the applicable triggers include use of state land and use within land classified as Conservation District. The purpose of both NEPA and HRS Chapter 343 is to inform decision-makers and the public of the likely environmental consequences of the proposed action and its alternatives.

Consistent with these regulations, this section identifies the anticipated effects of the proposed project on environmental and socioeconomic conditions for each resource. The analysis of resource impacts focuses on environmental issues in proportion to the degree of impact within the Region of Influence (ROI), or the area in which project-related impacts could occur for each resource. For most resources, the ROI is generally limited to the project limits, as shown in Figure 2. However, for some resources, the potential impacts of the proposed project must be considered within the context of the surrounding vicinity. For example, the evaluation of land use, aesthetics, noise, transportation and traffic, and socioeconomics also includes the surrounding areas. Potential effects relative to resources that occur across a broader area – such as climate and air quality – were considered at a regional scale.

Analysis of impacts in terms of their duration, intensity, and scale is provided where possible. Mitigation measures or BMPs that would be implemented to avoid or minimize potential impacts are identified, where relevant. As required under NEPA, the environmental effects of the no action alternative were also evaluated, based on a comparison to the baseline conditions presented in Section 3.0.

4.1 Climate

This section identifies potential climate-related impacts that may result from implementing the Proposed Action and No Action alternatives. This assessment considers the potential for the proposed project to affect climatic conditions, including emission of greenhouse gases (including CO_2, CH_4, and N_2O), chemical compounds that trap heat in the atmosphere, contributing to climate change. The ROI for this analysis includes the proposed project limits and Stainback Highway (as the access route to the site). Table 10 presents the impact thresholds relative to climate.

TABLE 10
Impact Thresholds for Climate

Impact Intensity	Intensity Description
Negligible	The alternative would either not cause emissions of greenhouse gases or the change would be so small that it would not result in a measurable or perceptible consequence.
Minor	The alternative would result in a detectable level of change, but the impact would be small, localized, and of little consequence at a regional scale.
Moderate	The alternative would result in a measurable and consequential change in greenhouse gas emissions, which could adversely affect climate. Mitigation may be needed to offset adverse impacts, but would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change in greenhouse gas emissions, which could adversely affect climate. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods
Long term – continues after the construction and decommissioning periods

4.1.1 Proposed Action Alternative

Implementation of the proposed project would not be expected to have a measurable effect on climate, either during construction or as a result of long-term operations. A limited amount of greenhouse gas emissions, which contribute to climate change, would be associated with construction of the project. Emissions would primarily result from the use of heavy equipment, although some emissions would also be due to vehicle use. Published data from the USEPA indicate that 22 pounds of CO_2 are produced for every gallon of diesel fuel burned, and 19.4 pounds are produced for every gallon of gasoline used (USEPA, 2008). Given the scale of the proposed project, the total amount of emissions resulting from construction would be unnoticeable at a regional scale, considering the average greenhouse gas emissions in Hawai‘i is approximately 18.2 million metric tons a year (USEIA, 2016). As such, project construction would be expected to have a negligible, short-term impact on greenhouse gas emissions and climate change. Similarly, over the longer-term, operation of the proposed project would have a negligible effect on greenhouse gas emissions and climate change as no heavy equipment would be used and only a limited number of vehicles would be accessing the site.

Over the lifetime of the proposed project, the effects of climate change are expected to be increasingly realized at a global scale, and climate change variables could influence the conditions within the proposed project site. As discussed in Section 3.1, these variables could include increasing air temperatures and changes in rainfall, which could alter the natural resources within the NAR. These changes are expected to have a negligible long-term impact on the proposed project; rather, as discussed in Section 1, the proposed project has been specifically designed to help measure and assess any such changes.

4.1.2 No Action Alternative

Under the No Action Alternative, various climate change factors would still influence conditions at Pu‘u Maka‘ala NAR, including increasing air temperatures and changes in rainfall patterns. Data regarding changes in climate conditions and other related effects would not be collected as part of NEON, substantially limiting the ability for ecological scientists to study any such changes. However, no new climate-related impacts would be expected.

4.2 Land Use and Recreation

This section identifies potential direct and indirect impacts to land use and recreation that may result from implementing the Proposed Action and No Action alternatives. The assessment considered the potential for the project to displace an existing land use; preclude use of an area for its intended purpose; reduce access to recreational or open space areas; or conflict with the objectives of any applicable land use plan or policy. The ROI for land use and recreation is the area within and adjacent to Pu‘u Maka‘ala NAR.

The impact thresholds related to land use and recreation are defined in Table 11.

TABLE 11
Impact Thresholds for Land Use and Recreation

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change in land use or recreational access, or the change would be so small that it would not be perceptible. The alternative would be consistent with all applicable land use plans and policies.
Minor	The alternative would result in a detectable change in land use or recreational access, but the impacts would be localized and of little consequence. The alternative would be consistent with all applicable land use plans and policies.
Moderate	The alternative would result in a measurable and consequential change in land use or recreational access, or would be inconsistent with an applicable land use plan, policy, or both. However, the potential impacts could be reasonably mitigated to an acceptable level.
Major	The alternative would result in a substantial changes in land use or recreational access, would be inconsistent with an applicable land use plan, policy, or both. The potential impacts could not be reasonably mitigated.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.2.1 Proposed Action Alternative

Implementation of the proposed project would involve installation of scientific infrastructure and long-term terrestrial sampling within Pu‘u Maka‘ala NAR. The infrastructure would have a permanent footprint of approximately 0.2 acre. The terrestrial sampling would include approximately 62 plots, with a total footprint of approximately 630 acres; these plots would be distributed across approximately 11,660 acres of the NAR, and would involve very little ground disturbance (a few plots would involve soil sampling, as detailed in Table 3). As discussed in Section 2, the NEON project is intended to monitor the natural environment, and therefore, is designed to have minimal impact. Furthermore, the proposed site at Pu‘u Maka‘ala NAR was selected in coordination with DOFAW and NARS staff, in order that it would have minimal imposition on NAR management activities and other ongoing research efforts. As such, short-term construction and long-term operation of the NEON project is expected to have negligible impact on existing land uses and would not preclude any intended uses within and surrounding the project site. Although the NAR is publicly accessible for recreational use (excluding hunting), there is little evidence that the proposed project site is used for recreational activities. Regardless, project implementation would not restrict access or other otherwise preclude recreational uses, should they occur.

Given its purpose of ecological monitoring and the potential for minimal environmental impact, the proposed project is also expected to be consistent with the objectives of the underlying state land use designation as Conservation District, as well as those relating to the NAR. The regulations governing these land use designations specify the need for a Conservation District Use Permit and NAR Special Use Permit (respectively); these approvals would be obtained prior to construction. Consistency with the Conservation District and NAR criteria are discussed in Section 6, and will be further documented as part of the permit application packages.

4.2.2 No Action Alternative

Under the No Action Alternative, land use and recreation in the area within and surrounding the proposed project site is expected to be commensurate with the existing condition and there would be no new impacts.

4.3 Geology and Soils

This section identifies potential direct and indirect impacts to geology, geologic resources, and soils that may result from implementation of the Proposed Action and No Action alternatives. This impact assessment considers the extent to which each alternative could (1) disturb or alter an important natural geologic feature or landform, (2) change the local topography, (3) contribute to soil erosion, or (4) increase the exposure of people or property to seismic-related activities or other geologic processes (or any combination thereof). The ROI for geology and soils is the area within and surrounding Pu‘u Maka‘ala NAR. The impact thresholds related to geology and soils are defined in Table 12.

TABLE 12
Impact Thresholds for Geology and Soils

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change to geologic or soil resources, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change to geologic or soil resources; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to geologic or soil resources. Mitigation would be needed to offset adverse impacts.t would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change to the character or usability of geologic or soil resources. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.3.1 Proposed Action Alternative

Overall, construction of the proposed NEON field study site would involve a minimal amount of ground disturbance; no geologic features or landforms would be affected, nor would the local topography be altered as a result of construction and operation of the proposed project.

As detailed in Section 2.2, ground disturbance associated with project construction would be restricted to the area within the construction limits, with a total footprint of approximately 0.2 acre. Ground disturbing activities within this area would include excavation, grading, and use of heavy equipment, which collectively could result in soil erosion. The erosion potential is low because of the relatively small area of disturbance and type of soils present. Regardless, BMPs would be implemented to minimize the potential for construction-related erosion. Specifically, the extent of ground disturbance would be minimized to the extent practicable, and temporarily disturbed areas would be stabilized and revegetated as quickly as possible. Following construction, long-term terrestrial sampling activities would involve little to no ground disturbance, and as such, are not expected to contribute to soil erosion. At the end of the 30-year operational period, the scientific infrastructure would be removed. As

detailed in Section 2.2, it is expected that all infrastructure would be removed, but below-grade material (e.g., tower foundation) would be left in place. These decommissioning activities would include a limited amount of ground disturbance, which could result in soil erosion; the above-listed BMPs would be implemented to minimize the potential for decommissioning-related erosion. With inclusion of these mitigation measures, implementation of the proposed project is expected to have a minor short-term impact on soil erosion, with no long-term impacts to soils.

The proposed NEON site is located in a region that is volcanically active and is prone to seismic activity. However, implementation of the proposed project would not increase any risks associated with seismic activity, nor would these events increase any risks associated with operation of the NEON field study site; as such, no seismic-related impacts are anticipated as a result of the proposed project. Proper precautions would be taken if there were any indication of a potential eruption, and additional maintenance would be conducted as needed after a seismic event, should one occur.

4.3.2 No Action Alternative

Under the No Action Alternative, the geology and soils within the proposed project area would remain the same as the existing condition and there would be no new impacts.

4.4 Water Resources

This section identifies the potential direct and indirect impacts to water resources that may result from implementation of the Proposed Action and No Action alternatives. Impacts to water resources were assessed based on an evaluation of the potential to impact either a surface or groundwater feature within the context of the applicable regulations that protect water resources. Given the lack of surface water features in the proposed project area, the impact assessment is primarily focused on the extent to which surface or groundwater quality would be degraded. The ROI for water resources is Pu‘u Maka‘ala NAR and the adjacent areas that contribute to groundwater recharge. The impact thresholds related to water resources are presented in Table 13.

TABLE 13
Impact Thresholds for Water Resources

Impact Intensity	Intensity Description
Negligible	The alternative would either not affect water quality, or the change in water quality would be below or at the level of detection.
Minor	The alternative would result in a detectable change in water quality, but the impact would be small, localized, and of minimal consequence.
Moderate	The alternative would result in a measurable and consequential change in water quality. Mitigation would be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change in water quality. Extensive mitigation would be needed to offset the adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.4.1 Proposed Action Alternative

As discussed in Section 3.4, there are no lakes, rivers or streams located within Pu‘u Maka‘ala NAR. There is a limited number of isolated wetland features scattered throughout the NAR; however, none of the proposed project infrastructure or long-term terrestrial sampling would occur within or immediately adjacent to a wetland feature.

Installation of the proposed project components would require minimal subsurface work. The depth of excavation would generally be limited to approximately 2.5 feet, with the exception of drilling for anchors at each guy-wire anchor location (four 2-inch-diameter holes, 30 feet deep). Over the long-term, ground disturbance required for operation of the proposed project would be limited to shallow subsurface soil sampling for chemical analyses. The depths associated with these ground-disturbing activities are well above the water table, and therefore, no interference with groundwater is anticipated as a result of either construction or operation.

The proposed project would involve a minimal increase in impervious surface (approximately 0.2 acre), which is a fractional percentage of the open space area in Pu‘u Maka‘ala NAR; as such, groundwater recharge is not expected to be measurably affected. Water consumption associated with construction and operation would also be minimal (generally limited to drilling for the guy-wire anchors), and all water would either be transported to the site or obtained from existing water tanks within the NAR. As such, the proposed project is not expected to affect groundwater availability.

Although project-related ground disturbance is not expected to affect groundwater resources, it could increase the amount of sediment and other pollutants in stormwater runoff, which could affect water quality in receiving waters. However, as described in Section 2.2, the extent of ground disturbance would be very limited and with implementation of mitigation measures discussed in Section 4.3.1, the potential for erosion is expected to be minimal. Additional measures to minimize the potential for sedimentation and other water quality impacts to receiving waters would be implemented during construction and operation (particularly decommissioning), including the following:

- Erosion and sediment control measures (such as silt fences) would be installed before earth moving activities are initiated, and would be inspected and properly maintained throughout the construction period.
- Disturbance of soil would be minimized during periods of heavy rain.
- Vehicles and equipment would be inspected for leaks and contamination on a daily basis.
- In the event of a spill or leak of fuel or lubricants from onsite equipment, the materials would be cleaned in a timely manner and disposed of at an approved site.

With implementation of these measures, water quality impacts associated with the project are expected to be negligible and short-term.

4.4.2 No Action Alternative

Under the No Action Alternative, the proposed Domain 20 field study site would not be implemented as part of NEON. Conditions within Pu‘u Maka‘ala NAR would be commensurate with the existing conditions and there would be no new impacts to water resources.

4.5 Biological Resources

This section identifies the potential direct and indirect impacts to biological resources that may result from implementation of the proposed alternatives. Impacts to biological resources were assessed based on an evaluation of the potential for each alternative to (1) cause the loss of habitat, diminished health or reduction in diversity of native species, (2) adversely affect any protected species or habitat (particularly species listed or proposed for listing under the ESA or HRS Chapter 195D), or (3) introduce or contribute to the spread of invasive species. The ROI for biological resources is the area within and immediately surrounding Pu‘u Maka‘ala NAR; however, a broader area was considered where needed to assess the stability of a species’ population over the greater region. The impact thresholds related to biological resources are presented in Table 14.

TABLE 14
Impact Thresholds for Biological Resources

Impact Intensity	Intensity Description
Negligible	The proposed alternative would either not affect biological resources, or the impacts to biological resources would be below or at the lower levels of detection.
Minor	The proposed alternative would result in a detectable change to biological resources or habitat; however, the change would be small, localized, and of little consequence. Any disruption to wildlife would be short term and species would be expected to return to normal activities after disturbance. No measurable reduction in species population stability would occur. Threatened or endangered species (or those proposed for listing) or migratory birds may occur in the project area but the species would not be adversely affected. Critical habitat may occur in the project area and some loss may occur, but the physical and biological features that support the associated listed species would not be destroyed or adversely modified. There may be some increase in the presence of weed species over a small area, but the increase would be easily controllable.
Moderate	The proposed alternative would result in a readily apparent change to biological resources or habitat over a relatively wide area; however, the change would not constitute substantial degradation in the character of the biological resource or habitat. A permanent loss of vegetative cover or other habitat may occur; however, no measurable reduction in species population stability would occur. Any effects to threatened and endangered species (or those proposed for listing) or migratory birds would be temporary and would not result in mortality or impacts to population size. Critical habitat may occur in the project area and the physical and biological features that support the listed species would be adversely affected, but there would not be a substantial loss of critical habitat. There would be a noticeable increase in the presence of weed species and would require long-term or extensive control efforts.
Major	The proposed alternative would result in a substantial change to the character of the biological resource or habitat. A permanent loss in vegetative cover or other habitat would occur, resulting in a measurable reduction in species population stability. Effects to threatened and endangered species or migratory birds would result in mortality or impacts to population size. A substantial amount of critical habitat would be destroyed or adversely modified. There would be a large and uncontrollable increase in the presence of invasive species.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.5.1 Proposed Action Alternative

4.5.1.1 Vegetation

As described in Section 3.5, the majority of Pu‘u Maka‘ala NAR consists of relatively high-quality forest dominated by a variety of native species. A number of threatened and endangered species are known to occur, or could occur within the NAR. DOFAW and NARS staff maintain a detailed inventory of the threatened and endangered plant species within the NAR, and the proposed NEON infrastructure has been sited to avoid any known occurrences. A more detailed discussion of potential impacts to threatened or endangered species is provided in the following subsection.

During construction, impacts to vegetation would be limited to areas where ground disturbance or clearing is needed to allow installation of the infrastructure or equipment. However, as previously described, the extent of ground disturbance is fairly limited and the infrastructure was specifically sited to minimize vegetation impacts. The infrastructure, including the tower, instrument hut, precipitation gauge and auxiliary portals, has been sited to best avoid woody vegetation and any sensitive native species. Vegetation that would be affected by installation of this infrastructure is primarily non-native grass species or other understory species that are common to Hawai‘i.

The only infrastructure that would require clearing or trimming of woody vegetation is one of the tower guy wires, as the wires must be maintained free of vegetation to preserve their integrity and support to the tower. Three of the four guy wires for the tower would be located in relatively open areas; however, the guy wire that extends south from the tower would be located in an area that is heavily vegetated with *‘ōhi‘a*, *koa*, *‘ōlapa*, *hāpu‘u,* and *pilo*. Clearing and trimming of these species would be conducted along the guy-wire path in a highly targeted manner, with only the least amount of vegetation removal required to provide clearance for the wire to be conducted. A minimal amount of clearing or trimming of vegetation may also be needed along the access path to the soil array. All vegetation removal would be conducted in accordance with the SOPs for the project (see Section 2.2.2), including obtaining prior approval by the NEON science team, permitting team, and site host (DOFAW/NARS). A qualified arborist with specific knowledge of the target species and site conditions would be engaged, as needed.

Following construction and throughout the operational period of the project, very minimal disturbance of vegetation is anticipated. Some trimming may be needed to maintain clearance around the tower guy wires and other infrastructure; this work would be conducted in accordance with the SOPs. A small amount of vegetative material would be collected as part of the terrestrial sampling activities (see Table 3); no threatened or endangered plant species would be collected. Terrestrial sampling activities would be conducted in accordance with the SOPs for the proposed project, particularly those related to site access, route planning, and ongoing impact assessment and mitigation. In sampling plots where tree tagging is needed, coiled wire would be wrapped around the tree (instead of standard tree tags) to avoid physical impact to the tree.

As described in Sections 2.2 and 4.5, areas that are temporarily disturbed during construction, decommissioning, or both, would be revegetated. Revegetation efforts would use species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Revegetation efforts would be coordinated with DOFAW and NARS staff.

Given the very limited disturbance and with implementation of the measures described above, the proposed project is expected to have a minor impact on non-listed vegetation within the NAR, both during the short-term construction and long-term operation phases.

4.5.1.2 Wildlife

As described in Section 3.5, Pu‘u Maka‘ala NAR supports a variety of native and non-native wildlife species, including bird species, mammals, and invertebrates. Several threatened and endangered species are known to occur or have the potential to occur within the NAR. Potential impacts to these species are discussed in the following subsection.

Potential effects to non-listed native wildlife species could include both direct impacts (e.g., disturbance or collision with project vehicles) and indirect impacts associated with habitat loss and displacement of individuals. Construction-related activities could disrupt wildlife in their natural state, particularly as a result of increased human presence and noise levels. Increased noise levels would generally be associated with use of construction vehicles and equipment. However, construction-related noise would not be continuous and would attenuate as sound travels from the construction area, as a function of distance, terrain and the dense forest vegetation. Wildlife in proximity to active construction areas would likely respond to the increased noise levels during construction. More mobile wildlife (e.g., birds) would be expected to exhibit avoidance behaviors and relocate to avoid noise. Construction-related noise and disturbance would cease at the end of the construction period. Human presence would continue through the operational phase of the project as part of the terrestrial sampling activities; however, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Pu‘u Maka‘ala NAR. As detailed in Section 4.10, operation of the tower and instrument hut would generate a humming sound. Noise dampening mufflers are being developed to further reduce noise from the tower and hut, and it is expected that the sound would attenuate such that the impacts would be localized and wildlife would acclimate or relocate from the affected area, as needed.

The SOPs described in Section 2.2.2 would be implemented throughout construction and operation of the proposed project. These include site access and route planning efforts designed to limit potential disturbance, and ongoing impact assessment and mitigation. The amount of potential habitat that would be affected during construction and operation of the proposed project represents a very small percentage of that available within and surrounding Pu‘u Maka‘ala NAR. It is expected that wildlife species would readily occupy the remaining available habitat, such that habitat loss or degradation would not be expected to measurably affect the size or stability of any wildlife populations.

Given the very limited disturbance and with implementation of the measures described above, the proposed project is expected to have a minor effect on non-listed wildlife within the NAR, both during the short-term construction and long-term operation phases.

4.5.1.3 Listed Species and Critical Habitat

As detailed in Table 6, a variety of federally and state-listed threatened and endangered species are either known to occur or could occur within the proposed project site. This section discusses potential impacts to each of these species and critical habitat, and the proposed measures that would be implemented to avoid and minimize those impacts; this discussion reflects the information presented in the Biological Assessment submitted to USFWS as part of the ESA Section 7 consultation process (see Appendix E). Any refinements or additional measures identified through the ongoing ESA Section 7 consultation process (see Section 5.2.2) would be implemented as part of the proposed project. With implementation of these measures, impacts to federally and state-listed threatened and endangered species and critical habitat are expected to be minor over both the short and long term.

Plant Species

Pu‘u Maka‘ala NAR provides suitable habitat for many threatened and endangered plant species, several of which are known to occur or may occur within the proposed project area. These species are listed in Table 6. Direct impacts to threatened and endangered plant species could include damage to or destruction of individual plants as a result of project-related activities. Listed plant species could also be indirectly affected by loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of these protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The proposed project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid any protected plant species occurrences. Based on this effort, there are no known occurrences of protected plant species within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or within the construction area or along access routes. Listed plant species that occur in proximity to the proposed tower location include *Phyllostegia velutina*, *Cermontia lindseyana*, and *Cyanea shipmanii*; however, these would be outside the limits of the construction area. To further protect threatened and endangered plant species, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 3. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest of a threatened or endangered species. The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species. Similarly, the foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be sited to avoid any trees with protected plant species growing into the canopy and would not alter habitat conditions such that protected species would experience reduced growth or reproduction. As stated in Section 2.2.2, if it is subsequently determined that collection or harvest of a threatened or endangered plant species is necessary to achieve the project’s scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

As part of the SOPs for the proposed project (Section 2.2.2), researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to protected plant species. Other SOPs incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

As summarized in Table 6, portions of the proposed project area have been designated as critical habitat for the following plant species: Mauna Loa (*Kaʻu*) silversword, *ʻōhā wai* (*Clermontia lindseyana*), *hāhā* (*Cyanea shipmanii*), *hāhā* (*Cyanea stictophylla*), *haʻiwale* (*Cyrtandra giffardii*), *kīponapona* (*Phyllostegia racemosa*), *Phyllostegia velutina, kuahiwi laukahi* (*Plantago hawaiiensis*)*, and ʻānunu* (*Sicyos alba).* For each species, the physical or biological features used to define the critical habitat were based on the areas in which the species was reported from at the time critical habitat was designated, as described by the type of plant community, associated native plant species, locale information (e.g., steep rocky cliffs, talus slopes, stream banks), and elevation (USFWS, 2002); this information is summarized in Table 6.

The proposed infrastructure would be constructed within five units of critical habitat: (*Clermontia lindseyana*, *hāhā* [*Cyanea stictophylla*], *kīponapona* [*Phyllostegia racemosa*], *kīponapona* [*Phyllostegia racemose*], and *kuahiwi laukahi* [*Plantago hawaiiensis*]). The proposed infrastructure locations were micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed. As such, these areas lack the physical and biological features to support these species at this time. Although the proposed infrastructure is not expected to reduce the ability of the critical habitat to support populations of these species, it would displace approximately 0.2 acre of habitat for the lifetime of the proposed project. Removal of infrastructure at the close of the proposed project would allow for the eventual recovery of these areas.

The proposed sampling would occur within all nine units of critical habitat for plant species. Sampling within the phenology transect, bird grids, and mosquito points would not modify the physical or biological features that contribute to critical habitat for the various plant species, as there would be no consumptive sampling of vegetation or disturbance of soils. Tower plot and distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, litterfall and fine woody debris, fine root biomass, coarse downed wood, foliar biogeochemistry, herbaceous biomass, and beetle pitfall traps. Harvesting of canopy leaves would be conducted using a pruning pole or a remote-controlled, unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves from canopy dominants would not alter the physical and biological elements that support any of the listed plant species, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The tower plots and distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, litterfall traps, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support the various plant species. For these reasons, both short- and long-term impacts to critical habitat would be minor.

***Nēnē* (Hawaiian Goose)**

Nēnē do not use closed forest habitat, but are known to occur in the open areas in the Kūlani portion of Puʻu Makaʻala NAR. Although they prefer the mowed baseball field at the Kūlani Correctional Facility, *nēnē* have also been observed within and surrounding the former pastureland in the NAR (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). This portion of the proposed project area provides suitable nesting and foraging habitat for *nēnē*.

Direct impacts to *nēnē* could occur if a nest is damaged, goslings are separated from adults, or if an adult permanently leaves an area as a result of project-related activities. Short-term indirect impacts could occur if *nēnē* are temporarily displaced from their habitat as a result of noise or other disturbance associated with construction activities. Displacement could alter an individual's typical foraging and roosting patterns, forcing it to search for new foraging and roosting locations. Displacement from

roosting or foraging habitat could also lead to increased predation if a *nēnē* is forced to change its behavior and search for suitable habitat. Permanent removal of suitable nesting habitat would constitute a long-term indirect impact; however, this impact is considered discountable because only approximately 676 square feet of suitable habitat would be removed (for the precipitation gauge) and there is ample habitat available in the proposed project vicinity.

During the operational phase of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. The only activities that are expected to occur in areas with suitable habitat for *nēnē* relate to maintenance of the precipitation gauge.

The following measures would be implemented to avoid and minimize potential impacts to *nēnē* during construction and operation of the proposed project. With implementation of these measures, the proposed project is not expected to adversely impact this species:

- A biologist familiar with the nesting behavior of the *nēnē* would survey suitable habitat within the construction area before the initiation of any construction activities, or after any subsequent delay in work of 3 or more days (during which time, the birds could attempt nesting). If a nest were discovered, USFWS would be contacted.
- All NEON staff would be trained to identify *nēnē* and know the appropriate steps to take if *nēnē* are present within the proposed project area or encountered in transit to sampling locations.
- If a *nēnē* is encountered within the proposed project area, the bird would not be approached, and all activities within 100 feet of the bird would cease until the bird leaves the area of its own volition.
- If a *nēnē* is encountered while in transit to a sampling location, the researcher(s) would stop and remain in place until the bird moved more than 100 feet from the travel route of its own volition or slowly retreat and return for sampling at a later time.
- A maximum speed limit of 15 miles per hour (mph) would be enforced for all project vehicles traveling within the project site to minimize potential collisions with *nēnē*.

‘*Io* (Hawaiian Hawk)

The Hawaiian hawk is known to occur in the Kūlani portion of Pu‘u Maka‘ala NAR (DOFAW, 2010). The native forest (particularly areas with large, mature *‘ōhi‘a*) provides suitable nesting habitat, and the former pastureland may be used for foraging.

The Hawaiian hawk could be directly impacted by project construction in the event a nest is damaged or destroyed. Operation of construction equipment and other loud or unpredictable construction activities could also indirectly affect this species through nest failure. Harassment of nesting sites could result in altered feeding and breeding patterns or nest or chick abandonment. Nest disturbance could also increase exposure of chicks and juveniles to inclement weather or predators (USFWS, 2016). Nearly all of the construction activities have been scheduled to occur outside of the Hawaiian hawk nesting season. The only activity that would occur during the nesting season is installation of the sensors on the research tower and in the soil array. This activity would not involve any work that could directly impact a Hawaiian hawk nest (e.g., vegetation trimming), and noise levels would be limited to those associated with motorized hand tools (e.g., an electric winch and hand drills). The noise levels would not be continuous and would attenuate as sound travels from the construction area, as a function of distance, terrain and the dense forest vegetation. Furthermore, construction activities would be ongoing in the localized construction area for several months prior to the nesting season, such that nesting hawks

would be expected to exhibit avoidance behavior and selectively use other high-quality habitat in the surrounding areas.

During the operation period of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. Sampling activities during the hawk nesting season would generally be limited to litterfall and fine woody debris, leaf area index, plant phenology, mosquito points, beetle pitfall traps, bird surveys, and soil sampling. These are non-destructive activities and would involve only minimal disturbance of soil and understory vegetation. Maintenance activities would involve periodic inspection and replacement of equipment and instruments, and may include infrequent vegetation trimming. Overall, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Pu‘u Maka‘ala NAR. Operation of the tower and instrument hut would generate a humming sound, but it is expected that the sound would attenuate such that the impacts would be localized and Hawaiian hawks would acclimate or relocate from the affected area, as needed.

The following measures would be implemented to avoid and minimize potential impacts to the Hawaiian hawk. With implementation of these measures, the proposed project is not expected to adversely impact this species:

- Vegetation clearing and construction would be avoided during the Hawaiian hawk breeding season (March through September) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest is found) would be coordinated with USFWS.
- If determined to be needed, nesting deterrents would be placed on the tower. Any deterrent used would first be approved by USFWS and DOFAW.
- Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed.
- NEON staff would be trained to recognize the Hawaiian hawk and their nests. In the event that a Hawaiian hawk nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied.

Honeycreepers

‘*Akiapōlā‘au*, Hawai‘i *‘ākepa*, *alawi*, and *‘i‘iwi* (collectively referred to as honeycreepers) are forest birds known to occur within Pu‘u Maka‘ala NAR, particularly in the Kūlani area. High quality nesting and foraging habitat is present throughout the native *‘ōhi‘a* forest.

Construction of the proposed project could directly impact honeycreepers if a nest is damaged or destroyed. Operation of construction equipment and other loud or unpredictable construction activities could also indirectly affect honeycreepers through nest failure. Harassment of nesting sites could result in altered feeding and breeding patterns or nest or chick abandonment. Nest disturbance could also increase exposure of chicks and juveniles to inclement weather or predators (USFWS, 2016). Nearly all of the construction activities have been scheduled to occur outside of the honeycreeper nesting season, which is understood to be from February through July (although nesting has been known to start as

early as January in some locations). All activities that require vehicular motorized construction equipment (e.g., a bobcat), which would result in the most noise and disturbance, have been scheduled to occur prior to February. The activities that would occur between February and July include the final stages of erecting the research tower (and guy wires), assembly of the instrument hut, and installation of the sensors. Equipment to be used during these activities includes a gin pole with a motorized spool (to pull material up the tower), a motorized spool to pull the guy wires, and motorized hand tools (e.g., an electric winch and hand drills) for installation of the tower and instrument hut components. These activities would not involve any work that could directly impact a honeycreeper nest (e.g., vegetation trimming), and noise levels would be limited to those associated with motorized hand tools. The noise levels would not be continuous and would attenuate as sound travels from the construction area, as a function of distance, terrain and the dense forest vegetation. Furthermore, construction activities would be ongoing in the localized construction area for several months prior to the nesting season, such that nesting honeycreepers would be expected to exhibit avoidance behavior and selectively use other high-quality habitat in the surrounding areas.

During the operation period of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. Sampling activities during the honeycreeper nesting season would generally be limited to litterfall and fine woody debris, leaf area index, plant phenology, mosquito points, beetle pitfall traps, bird surveys, and soil sampling. These are non-destructive activities and would involve only minimal disturbance of soil and understory vegetation. Maintenance activities would involve periodic inspection and replacement of equipment and instruments, and may include infrequent vegetation trimming. Overall, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Pu‘u Maka‘ala NAR. Operation of the tower and instrument hut would generate a humming sound, but it is expected that the sound would attenuate such that the impacts would be localized and honeycreepers would acclimate or relocate from the affected area, as needed.

The following measures would be implemented to further avoid and minimize potential impacts to honeycreepers. With implementation of these measures, the project is not expected to adversely impact these species:

- Vegetation clearing and construction activities would be avoided during the honeycreepers nesting season (February through July), to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 500 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS.
- The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds.
- Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed.

***‘Alalā* (Hawaiian Crow)**

As described in Section 3.5.5, *‘alalā* have been extinct in the wild for approximately 15 years, but captive bred birds are in the process of being released to areas of suitable habitat. The first release occurred in December 2016; however, no birds are currently present in the NAR from that release. A second release

is planned in late summer or early fall 2017. Similar releases are anticipated to occur annually for the next 5 years, depending on the success and survival of the released birds.

Given the anticipated timing of the proposed project relative to the planned release of *ʻalalā*, it is expected that construction would be complete well before any *ʻalalā* are nesting within Puʻu Makaʻala NAR.

During the operation period of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. Sampling activities during the *ʻalalā* nesting season would generally be limited to litterfall and fine woody debris, leaf area index, plant phenology, mosquito points, beetle pitfall traps, bird surveys, and soil sampling. These are non-destructive activities and would involve only minimal disturbance of soil and understory vegetation. Maintenance activities would involve periodic inspection and replacement of equipment and instruments, and may include infrequent vegetation trimming. Overall, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Puʻu Makaʻala NAR. Operation of the tower and instrument hut would generate a humming sound, but it is expected that the sound would attenuate such that the impacts would be localized and *ʻalalā* would acclimate or relocate from the affected area, as needed.

Ongoing coordination has been conducted with the *ʻalalā* release team to better understand the potential for the impacts described above and to identify measures to avoid and minimize potential impact. As a result of this coordination, the proposed project has been sited such that none of the infrastructure or terrestrial sampling plots would be located within 1,600 feet of the initial release site. Additional measures would be implemented to avoid and minimize potential impacts to *ʻalalā* in the event that an *ʻalalā* release has occurred and there is the potential for *ʻalalā* to be present in the vicinity of project-related activity. With implementation of the following measures, the proposed project is not expected to adversely impact the species, either over the short term or long term:

- Vegetation clearing and construction would be avoided during the *ʻalalā* breeding season (February through July), to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS.
- The use of shiny materials would be minimized and shiny surfaces would be masked to decrease their attractiveness to *ʻalalā*. Specifically, the tower would be constructed of materials that are a dull, galvanized gray. An exterior treatment involving dark or dull colors would be added to any shiny surfaces, such as power boxes and communication equipment.
- All trash would be placed into appropriate containers and promptly removed from the project site, to avoid inadvertent discarding of shiny materials or other items that may be of interest to *ʻalalā*.
- The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds.
- The beetle traps would be fitted or retrofitted, depending on timing of *ʻalalā* releases, with chicken wire to limit the extent to which *ʻalalā* could access the traps. Any preservatives used in the beetle traps would be verified to be non-toxic to birds.

- Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed.
- NEON staff would be trained to recognize *ʻalalā* and their nests. In the event that an *ʻalalā* nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were to be identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied.

Seabirds

Hawaiian petrels, Newell's shearwaters, and band-rumped storm-petrels (collectively referred to as seabirds) may fly over the proposed project area in transit between the ocean and upland breeding sites. Seabirds are vulnerable to striking objects that protrude above the vegetation canopy, such as antennas or guy wires. In addition, they are attracted to lights, which can cause disorientation (Banko et al., 1991; Ainley et al., 1997; Mitchell et al., 2005). Fledging seabirds are especially affected by artificial lighting and can become exhausted from circling the light sources, resulting in grounding. Once grounded, the birds are vulnerable to predation by small mammals (e.g., cats and mongoose).

To avoid and minimize any such impacts to seabirds, the following measures would be implemented. With implementation of these measures, the project is not likely to adversely affect seabirds:

- Construction activities would be restricted to daylight hours to avoid the use of nighttime lighting that could attract seabirds.
- Installation of outside lighting would be avoided, to the extent possible. If outside lights are required for safety or security purposes, directional lighting or shielded lighting would be used to prevent upward radiation. The shields would be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below. Outside lights that are not needed for security and safety would be turned off from dusk through dawn during the seabird fledging season (September 15 to December 15).
- The guy wires for the research tower would not extend above the top of the tree canopy to minimize the potential for bird strikes.
- The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds.

Hawaiian Hoary Bat

The Hawaiian hoary bat is known to occur within Puʻu Makaʻala NAR, particularly in the Kūlani area. Roosting typically occurs in dense canopy foliage or in the subcanopy when canopy is sparse, with open access for launching into flight (U.S. Department of Agriculture [USDA], 2009). It forages in open, wooded, and linear habitats with a wide range of vegetation types (USFWS, 2014), and while foraging, leaves young unattended in 'nursery' trees and shrubs.

If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June 1 to September 15), there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. To avoid and minimize any such impacts to Hawaiian hoary bats, the following measures would be implemented. With implementation of these measures, the project is not likely to adversely affect this species:

- No trees taller than 15 feet are planned to be trimmed or removed as a result of the proposed project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees. However, if it is subsequently determined that a limited number of trees

need to be trimmed or removed during that time period, a qualified biologist would conduct observations following standard protocols to determine whether any of the trees that would be removed are being used by bats and could harbor juveniles. If any trees are determined to be used by bats, they would not be trimmed or removed until after September 15.

- No fences are proposed to be installed as part of the project. In the event a fence is needed, it would have barbless top-strand wire to prevent entanglement of Hawaiian hoary bats on barbed wire.

Picture-Wing Fly (*Drosophila mulli*)
Drosophila mulli is restricted to the distribution of its host plant, *loulu* (*Pritchardia beccariana*). It was previously documented in the far eastern tip of Pu‘u Maka‘ala NAR, along Stainback Highway, but was last observed in this area in 2000. If still present in this location, this species could be affected by project-related activities. Specifically, if any *loulu* that are being used by *Drosophila mulli* are cleared, trimmed, or otherwise damaged, *Drosophila mulli* that are occupying the plant could inadvertently be harmed or killed.

To avoid and minimize any such impacts to *Drosophila mulli*, the following measures would be implemented. With implementation of these measures, the project is not likely to adversely affect this species.

- No *loulu* or wet montane forest habitat would be cleared or trimmed, nor would vegetation biomass be harvested as part of sampling within areas that are designated critical habitat for *Drosophila mulli*. If *loulu* is to be cleared, trimmed or harvested in portions of the project area that are not within designated critical habitat, they would first be inspected for *Drosophila mulli* by a qualified biologist. If *Drosophila mulli* are found, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid impacts to the occupied *loulu*. Temporary protective fencing would be installed around the occupied *loulu*, as appropriate.
- Mosquito traps would not be installed within 1,000 feet of critical habitat for *Drosophila mulli* or any location where the species was previously documented within Pu‘u Maka‘ala NAR.

As listed in Table 6 and shown in Figure 5, a small area on the northeastern edge of the project area (along Stainback Highway) has been designated as critical habitat for *Drosophila mulli*. Designation of critical habitat for *Drosophila mulli* was based on the following features: (1) wet, montane *‘ōhi‘a* forest between the elevations of 1,955 and 3,585 feet (596 to 1,093 meters) and (2) the larval stage host plant *Pritchardia beccariana*, which exhibits one or more life stages (from seedlings to senescent individuals) (USFWS, 2008). No infrastructure would be constructed and no sampling is proposed within the area of designated critical habitat for *Drosophila mulli*. NEON would avoid any subsequent sampling within this area and would not use this area for access to interior sampling point locations. Because this area would not be sampled or disturbed, there would be no effect on critical habitat for *Drosophila mulli*.

4.5.1.4 Invasive Species

As described in Section 3.5, there are already a variety of invasive species established within Pu‘u Maka‘ala NAR. However, given the prevalence of native and sensitive species and the objective for the NAR, invasive species are considered to be a severe threat and are actively managed by NARS staff through implementation of their management plan.

Project implementation could provide pathways and opportunities for introduction of additional invasive species to the proposed project site or could create conditions suitable for establishment and

spread of invasive species within the NAR. Invasive species could accidentally be introduced to the project site via vehicles, construction equipment, materials, or personnel. Invasive species currently within the NAR could take advantage of construction-related habitat disturbance to become established or spread across a larger area. To avoid and minimize the potential for introduction and spread of invasive species, the sanitation procedures used by DOFAW and NARS staff would be implemented over the lifetime of the project. The current procedures are listed below; any future modifications or additions made by DOFAW and NARS would be incorporated, as appropriate.

- All vehicles, tools, equipment and building materials, and packaging and shipping containers will be cleaned and fumigated before being shipped to Hawaii and again once they arrive. The same protocol will be followed before leaving the local port.
- All vehicles, equipment, and materials will be stored offsite at a clean staging area and will be subject to sanitation protocols daily before they are returned to the site. This measure will be randomly inspected for compliance and enforced.
- All other materials (including personal equipment and boots) will be inspected for foreign matter (including dirt, seeds, eggs, larvae, or other propagules) and cleaned prior to site entry.
- All workers would be instructed on specific procedures to prevent the introduction and spread of invasive species in the proposed project area.
- All trash, including food waste, would be placed into appropriate containers, removed from the project site, and properly disposed of.
- NEON domain staff would conduct regular monitoring for invasive species within the proposed project area throughout the operational period. If invasive species were detected, removal and control would be coordinated with the NARS Specialist.

In addition to introduction and spread of invasive plant and animal species, the proposed project could also contribute to the spread of Rapid *ʻŌhiʻa* Death, which is spreading across the eastern side of Hawaiʻi Island. To avoid and minimize the potential for Rapid *ʻŌhiʻa* Death to spread to the proposed project area, the sanitation procedures set forth by the Rapid *ʻŌhiʻa* Death Working Group would be implemented throughout construction and operations of the NEON project. The current procedures are listed below; any future modifications or additions to these procedures will be adopted for the proposed project, as appropriate.

- A survey of the proposed project site would be conducted no more than two weeks before any tree cutting to determine if there are any infected *ʻōhiʻa* trees. If infected *ʻōhiʻa* are suspected at the site, the appropriate agencies would be contacted for further guidance (including USFWS, University of Hawaiʻi Cooperative Extension Service, USDA Forest Service, and USDA Agriculture Research Service).
- Tools used to cut *ʻōhiʻa* would be cleaned with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. If a bleach solution is used, tools would be oiled afterwards to prevent corrosion. Chainsaw blades would be brushed clean, sprayed with the cleaning solution, and run briefly to lubricate the chain.
- Personal gear, including shoes and clothes, would be cleaned before and after entering the forest. Shoes would be brushed to remove soil, then sprayed with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. Other personal gear would also be sprayed with the cleaning solution. Clothing would be washed with hot water and detergent.

- Vehicles used off-road or in infected forest areas would be thoroughly cleaned using a pressure-washer and detergent. All soil would be removed from the tires and vehicle undercarriage.
- If clearing or trimming of *ʻōhiʻa* is required for the proposed project, the cut wood would be left onsite and would not be transported.

With implementation of these measures, project-related impacts related to invasive species are expected to be minor, both during short-term construction and over the course of long-term project operations.

4.5.2 No Action Alternative

Under the No Action Alternative, biological resources within Puʻu Makaʻala NAR would not be affected by construction and operation of the NEON project and are expected to be commensurate with the existing condition. The NAR would continue to be managed to protect threatened and endangered species and minimize the ongoing threat associated with introduction and spread of invasive species. There would be no new impacts from the No Action Alternative. However, as the NEON project would not be implemented, long-term ecological data would not be collected and made available to inform ecological research and land management activities.

4.6 Archaeological, Architectural, and Cultural Resources

This section describes the potential impacts to cultural resources within the APE that may result from implementation of the Proposed Action and No Action alternatives. As shown in Figure 6, the APE includes the proposed location for the scientific infrastructure and all potential terrestrial sampling areas. Because NEPA and NHPA Section 106 are parallel processes that are closely related in their findings of consequences for cultural resources, this section presents the findings for both regulations. For purposes of clarity, this section uses the term “impact” when discussing NEPA and the term “effect” when discussing Section 106. Under Section 106, the Proposed Action is referred to as the undertaking. Additional detail on the status of Section 106 consultation process is provided in Section 5.2.

Methodology

Once historic properties and other cultural resources within the APE were identified, the proposed project was analyzed to determine whether it would have direct or indirect impacts on those resources. The intensity level and duration of the impact were then determined for the purposes of the NEPA analysis. If any historic properties were identified, the potential for adverse effects was assessed for the purposes of the Section 106 analysis.

For the NEPA analysis, the assessment of direct impacts considered the potential for any of the following to occur as a result of project implementation: (1) destruction or alteration of historic properties, (2) alteration of cultural practices or traditions, or (3) physical changes to the setting and integrity of historic properties. The extent to which the proposed project could impact historic properties and other cultural resources was based on the description of the proposed project (see Section 2.2) and the types of properties and resources identified.

For indirect impacts, broader changes that could result from project implementation (such as changes in land use) were identified and analyzed qualitatively, based primarily on those seen from other similar projects. This includes impacts that would be caused by the proposed project but that would occur at a later time and distance from the proposed project activities. No indirect impacts to historic properties or other cultural resources were identified for the Proposed Action or No Action alternatives. Therefore, no further discussion of indirect impacts is included in this section.

Section 106 Assessment of Effects

Because this section addresses both NEPA and Section 106, the following presents an explanation of how Section 106 evaluates consequences of proposed project activities on historic properties. The ACHP's regulations implementing Section 106 of the NHPA create a process by which federally assisted projects are reviewed for their effects on historic properties. After the historic property is identified and evaluated, the Criteria of Adverse Effect (36 CFR 800.5[1]) are applied. These criteria are used to determine whether the undertaking could change the characteristics that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Section 106 of the NHPA allows the following three findings for effects on historic properties:

- No Historic Properties Affected
- No Adverse Effect
- Adverse Effect

An effect is adverse under Section 106 if it diminishes the integrity of the property's historically significant characteristics. Examples of adverse effects include, but are not limited to, the following:

- Deconstruction of the historic property
- Relocation of the historic property
- Introduction of visual, audible, or atmospheric elements that are out of character with the setting of the historic property

The federal agency makes the determination of effects for each historic property. Based on these determinations, an overall finding of effect for the undertaking is reached, in consultation with the SHPD and other consulting parties.

When an undertaking is found to have an adverse effect, Section 106 requires notification to the ACHP and consultation with the SHPO (which in Hawai'i is carried out by SHPD as the administering division), and other interested parties regarding appropriate avoidance, minimization, or mitigation measures. Examples of mitigation measures include such things as redesigning aspects of a proposed project, or relocating or documenting historic properties. For a finding of adverse effect, the product of consultation is usually an MOA (per 36 CFR 800.6(c)) containing stipulations specifying measures that would be implemented to avoid, minimize, or mitigate the adverse effects.

NEPA Impact Thresholds and Section 106 Effects

Table 15 identifies impact thresholds for the NEPA analysis relevant to historic properties and other cultural resources, and also lists the correlation between NEPA impacts and NHPA Section 106 effects.

TABLE 15
Impact Thresholds for Archaeological, Architectural, and Cultural Resources

Impact Intensity	Intensity Description
Negligible	Impacts on historic properties or other cultural resources would not be detectable and would not alter resource characteristics. *The NHPA Section 106 determination would be no historic properties affected or no adverse effect on historic properties.*
Minor	Impacts on historic properties or other cultural resources would result in little, if any, loss of integrity and would be slight but noticeable. Impacts would not appreciably alter resource characteristics. *The NHPA Section 106 determination would be no adverse effect on historic properties.*

TABLE 15
Impact Thresholds for Archaeological, Architectural, and Cultural Resources

Impact Intensity	Intensity Description
Moderate	Impacts on historic properties would result in some loss of integrity and would be noticeable. Impacts could appreciably alter resource characteristics. Measures to mitigate impacts would be relatively easy to implement (e.g., through consultation, changes in project design, or via an MOA), and would be sufficient to reduce the intensity of impacts to a level less than major under NEPA. *The NHPA Section 106 determination would likely be no adverse effect, but only after implementing minimization or mitigation measures sufficient to reduce the adverse effects on historic properties.*
Major	Impacts on historic properties or other cultural resources would result in disturbance to an important site, substantial loss of integrity, or severe alteration of property conditions, the result of which would significantly affect the human environment. Mitigation would not be sufficient to reduce the intensity of impacts to a level less than major under NEPA. *The NHPA Section 106 determination would be adverse effect to historic properties. Measures to mitigate, avoid, or minimize adverse effects under Section 106 would be decided through consultation and stipulated in an MOA.*
Duration:	**Short term** – occurs only during the construction or decommissioning periods
	Long term – continues after the construction and decommissioning periods

Note:
Text shown in italics is the corresponding NHPA Section 106 Finding of Effect.

4.6.1 Proposed Action Alternative

As described in Section 3.6, there are no known historic properties that are eligible for or listed in the NRHP located within the APE. In addition, there are no known cultural sites or practices associated with the APE. However, the overall NAR has been characterized as a cultural landscape. As discussed in this section, impacts from the proposed project would not be detectable and are not anticipated to alter the significant aspects of the cultural landscape present within the APE. Therefore, the proposed project would result in a finding of negligible, short- and long-term impacts to cultural resources under NEPA and no historic properties affected under Section 106. An unanticipated discovery plan would be in place before initiating project activities to address any archaeological resources that might be inadvertently found.

4.6.1.1 Archaeological Resources

There are no known archaeological resources within the APE. Although the proposed site area has not been surveyed, previous cultural resources studies indicate that the probability of historic properties being present in the proposed site area is very low. Several factors diminish the likelihood for archaeological resources to be present within the APE: the property site is in a remote area with a high elevation, there are no known archaeological or historic properties in the vicinity, and archaeological studies in adjacent areas have not found any sites and have determined that there is a low likelihood of sites in the western upper-elevation of the rain forest. The area was not historically inhabited and the historic uses associated with the area were limited to transient activities, such as bird catching, canoe making, and trail building that did not alter the natural landscape (Maly and Maly, 2004). No physical evidence of features associated with these historic uses is extant. Therefore, the site elevation and difficult accessibility, combined with the ephemeral nature of traditional uses and features, make the archaeological expectations for the area very low. Should any historic properties be present, the

likelihood of adverse effects to them from the proposed project is low because the site components entail only minimal ground disturbance.

As with any ground-disturbing project, there remains a potential for discovery of buried cultural resources. If previously unidentified archaeological resources were discovered during project activities, ground-disturbing activities would be halted in the vicinity of the find and NSF would consult with the SHPD and other consulting parties, as appropriate, regarding eligibility for listing in the NRHP, project effects, necessary mitigation, or other treatment measures. An unanticipated discovery plan would be in place before initiating project activities to address any archaeological resources that might be discovered.

With implementation of these BMPs, the proposed project is expected to result in no impacts to archaeological resources under NEPA and no historic properties affected under Section 106.

4.6.1.2 Traditional Cultural Properties

There are no known TCPs within the APE that have been determined eligible for or are listed in the NRHP. The NAR is characterized as a cultural landscape, although it has never been formally evaluated for the NRHP. The ACHP defines landscapes as "large-scale properties often comprised of multiple, linked features that form a cohesive area or place" (ACHP, 2016). Landscapes acquire cultural and historical meaning through traditional use "by the peoples who have traveled, used, and interwoven these places into generations of practices" (ACHP, 2016). Physical characteristics, as well as visual and audio aspects can all contribute to the significance of a landscape (ACHP, 2016). Because cultural landscapes gain their significance through traditional cultural practices, they are viewed as a type of TCP. The NAR is an approximately 18,730-acre site and a determination of eligibility for this large property as a cultural landscape is beyond the scope of this proposed project. The proposed project would encompass the scientific infrastructure and a total of approximately 62 sampling plots (comprising approximately 630 acres) that would be distributed throughout approximately 11,660 acres of the 18,730-acre Puʻu Makaʻala NAR, with a permanent project footprint of approximately 0.2 acre. Because of the dense forest vegetation and remote nature of this area, potential visual changes associated with the proposed project would be very limited and are not expected to significantly affect the visual quality of the site, as further discussed in Section 4.7. The proposed site components are small intrusions into the expansive cultural landscape, and their presence should not inhibit traditional or customary practices, should they occur. Therefore, the proposed project would result in negligible, short- and long-term impacts to the potential TCP of the cultural landscape under NEPA and no adverse effects under Section 106.

4.6.1.3 Cultural Uses, Practices, and Properties

There are no cultural uses or practices that are currently known to occur within the APE or other portions of the NAR. As described in Section 3.6.6, individual species that occur in the NAR (or are planned to occur in the NAR) may be culturally significant, such as the ʻ*alalā* or ʻ*io*, both of which may be regarded as ʻ*aumakua*. Potential impacts to species are discussed further in Section 4.5 (Biological Resources). The proposed project is not anticipated to alter the cultural or spiritual associations with any individual species. The research tower could result in slight changes to the visual character of the species' habitat, but this is not expected to diminish their cultural or spiritual significance. In addition, the types of activities associated with the proposed project (pedestrian access to conduct terrestrial sampling and research) are consistent with the activities associated with cultural practices that have occurred in the area historically, including access for establishing bird-catcher shelters, canoe-makers clearings, trailside resting places and shelters, and trails. Therefore, the proposed project would result in negligible, short- and long-term impacts to cultural uses, practices, and properties.

4.6.2 No Action Alternative

Under the No Action Alternative there would be no change from the existing conditions. The No Action Alternative would result in a finding of no impacts to cultural resources under NEPA and no historic properties affected under NHPA Section 106.

4.7 Visual Resources

This section describes the potential impacts to visual resources that may result from implementation of the Proposed Action and No Action Alternatives. This impact assessment evaluates impacts to primary viewers based on the extent to which the proposed project would result in a perceivable change in the visual character of the proposed project site, and whether those changes would provide the same visual quality as the current condition. The ROI for visual resources is the area within and surrounding Pu‘u Maka‘ala NAR. The impact thresholds related to visual resources are defined in Table 16.

TABLE 16
Impact Thresholds for Visual Resources

Impact Intensity	Intensity Description
Negligible	The alternative would either not impact the visual quality of the landscape, or changes would be so slight that there would be no measurable or perceptible consequence.
Minor	The alternative would result in a detectable change to the visual quality of the landscape. However, this change would be small, localized, and of little consequence.
Moderate	The alternative would impact the visual quality of the landscape; the impact would be readily detectable, with consequences at the regional level. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in extensive changes to the visual quality of the landscape, with substantial consequences at the regional level. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.7.1 Proposed Action Alternative

Construction and operation of the proposed project could affect visual resources within and surrounding Pu‘u Maka‘ala NAR. Visual impacts could occur during the construction period as a result of dust and the presence of heavy equipment. However, these activities would be localized and temporary in nature; in addition, the construction site would be kept free of litter and excess equipment and materials, and generally maintained in a clean and organized condition, such that short-term construction-related impacts are expected to be minor.

Over the 30-year operational period for the project, new man-made structures would be permanently located at the proposed project site, which could alter the visual qualities of the area. However, as described in Section 3.7, the proposed project site is not readily accessible by the public and views from the surrounding community are limited by the dense forest vegetation and remote nature of the site. Based on input from DOFAW and NARS staff, it is expected that the only project-related structure that may be visible from surrounding areas is the tower, which would extend approximately 10 meters above the existing forest canopy. Locations from which the tower may be visible are expected to be limited to Pu‘u Kipu, Kūlani Cone, some of the higher elevations within the NAR, and the NAR entrance near Kūlani

Correctional Facility. Of these, the NAR entrance is the only location that is readily accessible by the public. Given the viewing distances and its relatively low profile, the tower is not expected to be a prominent feature of the views from these locations. Moreover, it would be similar in nature to other existing infrastructure (e.g., an existing tower located on Kūlani Cone). As such, it is not expected that the proposed tower would diminish the overall visual quality of the area. Installation of the proposed infrastructure would also affect aesthetics at a localized scale within the NAR. Specifically, the infrastructure would introduce built elements that would contrast with the surrounding natural environment. However, the infrastructure has been sited in areas that have been previously disturbed and support existing infrastructure (e.g., fences, electrical lines, and power poles). To minimize the potential obtrusiveness of the proposed infrastructure, the tower and ancillary components would be designed to blend into the surrounding environment to the degree possible. The tower would be constructed of galvanized steel, which blends well with forest vegetation. Cloaking methodologies would be applied to decrease the visibility of specific objects, including the auxiliary portals and electrical lines. With implementation of these measures, project-related impacts to visual resources would be perceivable, but the visual quality of the site would remain high, such that long-term impacts are expected to be minor.

4.7.2 No Action Alternative

Under the No Action Alternative, the NEON project would not be constructed and the visual character and quality of the site would not change. Therefore, the No Action Alternative would have no impact to visual resources.

4.8 Hazardous Materials

This section identifies the potential direct and indirect impacts related to hazardous materials that may result from implementation of the Proposed Action and No Action Alternative. Impacts related to hazardous materials were assessed based on an evaluation of the potential to either uncover or expose an existing hazardous material, or to accidentally release a hazardous material to the site. The ROI for this analysis is Pu‘u Maka‘ala NAR. The impact thresholds related to hazardous materials are presented in Table 17.

TABLE 17
Impact Thresholds for Hazardous Materials

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change relative to hazardous materials, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change relative to hazardous materials; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change relative to hazardous materials. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change relative to hazardous materials. The change would be measurable and would result in a severe impact. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.8.1 Proposed Action Alternative

Given the lack of hazardous materials present within Pu‘u Maka‘ala NAR, implementation of the proposed project is not expected to uncover or otherwise expose any hazardous materials within the project site.

Construction would require the use of some hazardous materials, including diesel fuel, gasoline and lubricants. Similar materials may also be occasionally used for operations and maintenance activities, as well as during decommissioning and site closure. Propylene glycol, ethanol, and other chemicals would also be used for sampling, instrument operations and instrument maintenance. However, only a limited amount of these materials would be present onsite, and BMPs would be implemented to avoid and minimize potential impact. BMPs include use of proper handling and storage procedures and routine inspection of vehicles and equipment for leaks, as needed to prevent spills or releases of hazardous materials during construction activities. With implementation of these measures, impacts related to hazardous materials are expected to be negligible over both the short and long term.

4.8.2 No Action Alternative

Under the No Action Alternative, the proposed Domain 20 core site would not be implemented as part of NEON. Conditions within Pu‘u Maka‘ala NAR would be commensurate with the existing conditions and there would be no impacts related to hazardous materials.

4.9 Air Quality

This section identifies potential direct and indirect impacts to air quality that may result from implementation of the Proposed Action and No Action Alternative. This assessment of impacts is based on the potential for construction and long-term operation to affect air quality relative to applicable federal and state standards that apply to regulation of air quality. The ROI for air quality is the area within and surrounding Pu‘u Maka‘ala NAR. The thresholds for impacts related to air quality are defined in Table 18.

TABLE 18
Impact Thresholds for Air Quality

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change to air quality or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change in air quality, but the change would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to air quality. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change in air quality; the change would be measurable and would result in a severe impact (such as an exceedance of federal or state air quality standards). Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.9.1 Proposed Action Alternative

Construction of the proposed project would require the use of vehicles and heavy equipment, which would generate internal combustion engine emissions and fugitive dust. Short-term emissions of CO_2, nitrogen oxides, VOCs, sulfur oxides, PM_{10}, and $PM_{2.5}$ would occur from burning fossil fuels and from generating fugitive dust. Workers commuting daily to and from the work site in their personal vehicles would also result in emissions of criteria air pollutants.

Emissions would occur over the approximately 8-month construction period, with potential impacts generally limited to the project site and along roadways to and within the Pu‘u Maka‘ala NAR. As such, the emissions would be temporary, intermittent, and localized in nature. In comparison to overall emissions in the region, these contributions are relatively small and would not be expected to affect attainment of the federal or state ambient air quality standards, such that construction-related impacts would be minor and short-term in nature.

State law (HAR Title 11 Chapter 60.1, Air Pollution Control) requires that the best practical operation or treatment be implemented during construction activities such that there is not discharge of visible fugitive dust beyond the property lot line. To comply with these requirements and to minimize any other adverse effects on air quality, the following BMPs would be implemented during construction:

- All construction vehicles and equipment would be maintained in proper tune according to manufacturer’s specifications.
- The number of vehicles accessing and moving within the project area would be limited to the extent possible. Vehicles speed on unpaved roads within the project area would be limited to 15 miles per hour or less.
- Vehicles and equipment would not be allowed to idle for extended periods of time (i.e., more than 20 minutes).
- The extent of ground disturbance would be minimized where possible. Temporarily disturbed areas would be stabilized and revegetated as quickly as possible.
- All trucks hauling soil or other loose materials would be covered.
- The entrance to the proposed project site would be stabilized to avoid offsite tracking of sediment.

Operations-related impacts associated with the proposed project would be similar to the existing conditions. Emissions sources would be limited to vehicle traffic to and from the site for ongoing sampling activities (see Table 3 for sampling frequency). The tower and instrument hut HVAC units would result in some condensation, but are expected to produce little to no emissions. Although the proposed project is designed to accommodate a generator, one would only be used in the event of an emergency, where any generator-related emissions would be of short duration and temporary. Long-term operation-related air quality impacts would be negligible.

4.9.2 No Action Alternative

Under the No Action Alternative, monitoring equipment would not be installed and sampling activities would not be conducted, such that no emissions of criteria pollutants would occur. The existing range of air pollution sources within the proposed project area would not be expected to change substantially over the period of analysis. With continuing trade wind patterns, air quality levels are expected to remain relatively constant and would continue to be in compliance with federal and state standards. As such, the No Action Alternative would have negligible adverse impacts on air quality over both the short and long term.

4.10 Noise

This section identifies potential direct and indirect noise impacts that may result from implementation of the Proposed Action and No Action Alternative. Noise impacts were determined based on potential increased noise levels around noise-sensitive land uses. For such uses, unwanted sound would adversely affect the designated use within a particular area, and typically include residential areas, hospitals, places of worship, libraries, schools, historic structures and districts, wildlife preserves, and parks. Noise impacts to wildlife are discussed in Section 4.5. The ROI for noise includes Pu‘u Maka‘ala NAR, Stainback Highway (as the access route to the site), and the adjacent properties. The impact thresholds related to noise are presented in Table 19.

TABLE 19
Impact Thresholds for Noise

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change in noise levels over the ambient condition, or the change would be so small that it would not be measurable or perceptible.
Minor	The alternative would result in a detectable change in noise levels over the ambient condition; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change in noise level over the ambient condition. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change in noise level over the ambient condition. The change would be measurable and would result in a severe impact. Extensive mitigation would be needed to offset adverse impacts, and success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.10.1 Proposed Action Alternative

Construction of the proposed project would require operation of construction vehicles and heavy equipment (e.g., mini excavator with hydraulic hammer and skid steer, and drill rig) for various activities, including delivery of the infrastructure and equipment, excavation and pouring of foundations, and installation of the tower, instrument hut and other equipment. Typical construction equipment generally emits noise in the range of 80 to 90 dBA at 50 feet (USEPA, 1971); earth-moving equipment is expected to be the loudest equipment used during construction. Construction related noise would occur throughout the construction period, but would occur intermittently and for relatively short durations of time. The nearest offsite noise-sensitive land uses are residences located approximately 6 miles (9.7 km) from the proposed location where the NEON infrastructure would be installed. Given this distance, and because noise dissipates based on the distance to the source, construction-related noise is not expected to have any effect on these residences or other offsite noise-sensitive land uses.

Per HAR 11-46-3, the proposed project area is located in Class A Zoning District (open space, conservation and residential). Under the Class A Zoning District, the maximum permissible sound levels are 55 dBA during the daytime (7 am to 10 pm) and 45 dBA during the nighttime (10 pm to 7 am). Based on the typical noise levels emitted by construction equipment, construction noise levels may exceed the State’s maximum permissible property line noise levels. Pursuant to HAR 11-46-7, a Community Noise Permit would be obtained from HDOH to allow the operation of construction-related equipment, as

needed. It is expected that the permit would restrict the times of day when construction activities may emit noise in excess of the maximum permissible sound levels. The HDOH may also require the incorporation of noise mitigation into the construction plan. BMPs that would be implemented to reduce noise levels are expected to include the following:

- Proper tuning and balancing of construction equipment, and maintenance in accordance with the manufacturer's specifications
- Use of noise barriers, mufflers, or both on diesel and gasoline engines
- Restriction of construction activities to typical working days/hours
- Keeping unnecessary noise to a minimum

Given the short duration and temporary nature of the construction activities, and with approval of a Community Noise Permit (including implementation of noise-reduction measures), construction-related noise is expected to result in a minor short-term impact.

Long-term operation of the site would include routine terrestrial sampling activities and maintenance of the infrastructure/equipment. Noise associated with these activities would be limited to intermittent use of passenger vehicles (e.g., pickup truck) and field crew activity, which is expected to be similar in nature to current research and monitoring activities within the NAR. Operation of the infrastructure would not produce any noise, with the exception of HVAC systems, pumps in the instrument hut and a few of the tower-mounted sensors. Based on conditions experienced at other NEON project sites, the noise levels in the immediate vicinity of this infrastructure could result in a detectable change over the ambient environment, but would attenuate over a short distance and are expected to be of little consequence. If needed, engineered mufflers may be added to the pumps to reduce noise levels during operations. Although the proposed project is designed to accommodate a generator, one would only be brought onsite and used in the event of an emergency, in which case, generator associated noise impacts would be short in duration and temporary. Overall, with implementation of mitigation measures as needed, operation of the NEON Domain 20 site is expected to result in a minor, long-term impact to noise levels.

4.10.2 No Action Alternative

Under the No Action Alternative, noise associated with the implementation of the proposed project would not occur and ambient noise levels would remain consistent with the existing conditions. There would be no new noise-related impacts.

4.11 Transportation and Traffic

This section identifies the potential direct and indirect impacts related to transportation and traffic that may result from implementation of the Proposed Action and No Action alternatives. Impacts to transportation and traffic were assessed based on an evaluation of the extent to which each alternative would affect traffic levels or patterns, or otherwise alter the transportation network. The ROI for transportation and traffic is Pu‘u Maka‘ala NAR and the roadways that will be used to access to the site. The impact thresholds related to the transportation and traffic analysis are presented in Table 20.

TABLE 20
Impact Thresholds for Traffic and Transportation

Impact Intensity	Intensity Description
Negligible	The alternative would not result in a change in traffic or transportation resources, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a change in traffic or transportation resources, but the change would be small, localized and of little consequence.
Moderate	The alternative would result in a measurable and consequential change in traffic or transportation resources. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change in traffic or transportation resources; the change would be measurable and would result in a severe impact. Extensive mitigation would be needed to offset adverse impacts, and success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.11.1Proposed Action Alternative

During the construction phase of the proposed project, a range of vehicles would be used to access the site, including those needed to transport construction personnel and those for equipment delivery. Standard passenger vehicles would be used to transport construction personnel, and would be accessing the site daily during the construction period. A range of larger vehicles (e.g., flat-bed trucks) would be needed to transport the proposed infrastructure and other project equipment. A total of 5 loads would be required to transport the tower and instrument hut, with additional loads transporting concrete and conduit, as needed.

Over the course of the 30-year operational period, transportation to the site would generally be limited to passenger vehicles for NEON domain personnel. On average, it is expected that personnel would be visiting the site several times per week to perform sampling or maintenance activities. Larger vehicles are expected to be required on a very infrequent basis, as needed for occasional maintenance tasks (e.g., equipment replacement) and infrastructure removal during decommissioning.

During both construction and operations, vehicles would access the proposed project site via Stainback Highway. Given the relatively small number of vehicles associated with project implementation, there is not expected to be a measurable change in traffic levels or roadway capacity along Stainback Highway (or any of the roads leading to Stainback Highway) during either the construction or operation phase. There could be short-term delays along Stainback Highway during large vehicle deliveries to and from the site, as the roadway is relatively narrow and may not be able to accommodate two-way traffic involving large construction vehicles. Large vehicle deliveries along Stainback Highway would be timed to avoid typical commute hours to minimize the potential impacts to other motorists, particularly residents traveling to and from Mountain View via North Kūlani Road, to the extent possible. The timing of large vehicle deliveries would also be coordinated with Kūlani Correctional Facility to minimize impacts to their staff and visitors, as appropriate. Traffic controls (including signage, flagging, or other similar methods) would also be implemented as needed, in coordination with the HDOT District Engineer, to further minimize impacts to other vehicles travelling on Stainback Highway.

As previously described in Section 2.2, an existing road would be used for access within Pu‘u Maka‘ala NAR. No additional roadway would be constructed, but improvements may be needed along certain

segments of the existing road to accommodate construction vehicles. In general, vehicular traffic within Pu‘u Maka‘ala NAR would be minimized to the extent practicable, so as to decrease potential roadway impacts. This effort will include (1) coordination of deliveries to minimize the total number of trips needed and (2) carpooling requirements for construction and operations staff.

Given the relatively minimal transportation requirements for the proposed project, and with implementation of the above-listed measures, traffic-related impacts are expected to be minor over both the short and long term.

4.11.2No Action Alternative

Under the No Action Alternative, the Domain 20 core site would not be implemented as part of NEON, and associated changes in transportation or traffic would not occur. Therefore, there would be no new impacts related to transportation or traffic.

4.12 Human Health and Safety

This section identifies potential direct and indirect impacts related to human health and safety that may result from implementation of the Proposed Action and No Action alternatives. This assessment of impacts considers natural hazards, occupational health and public safety, and protection of children. The ROI for this analysis includes the proposed site boundaries and encompasses land within 0.5 mile of the site. The impact thresholds related to human health and safety are defined in Table 21.

TABLE 21
Impact Thresholds for Human Health and Safety

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change relative to human health and safety, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change relative to public safety, occupational health, and protection of children; however, the impact would be small, localized, and of little consequence.
Moderate	Potential impacts would result in a measurable and consequential change to public safety, occupational health, and protection of children. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	Potential impacts would result in a substantial change to public safety, occupational health, and protection of children; the change would be measurable and could result in substantial injury or loss of life. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.12.1Proposed Action Alternative

4.12.1.1 Natural Hazards

As described in Section 4.3, the proposed NEON site is located in a region that is volcanically active and is prone to seismic activity. However, implementation of the proposed project would not increase any risks associated with volcanic eruptions or seismic activity, nor would these events increase any risks associated with operation of the NEON field study site. As such, impacts associated with volcanic

eruptions or seismic activity are not anticipated as a result of the proposed project. Proper precautions would be taken if there were any indication of a potential eruption or seismic event.

The proposed NEON site is not located within an identified floodplain (DNLR, 2016) or the tsunami inundation zone (NOAA, 2016); as such, it is extremely unlikely that hazardous conditions associated with flooding or a tsunami would occur within the proposed project area. The potential for wildfire within or near the site is also considered highly unlikely because of the high levels of rainfall. For these reasons, impacts associated with natural hazards are considered negligible over both the short and long term.

4.12.1.2 Occupational Health and Public Safety

Hazards associated with construction and operation of the proposed NEON site at Pu‘u Maka‘ala NAR are expected to be limited to physical and biological hazards. Physical hazards include the potential for slips, trips, and falls because of uneven ground surfaces and working at heights (e.g., on the tower), as well as those associated with operation of construction equipment. Natural hazards include exposure to dangerous plants or animals (e.g., thorned plants or stinging insects) and extreme elements (e.g., sunburn and heat stroke). Occupational health and safety are a high priority to NSF and Battelle, and all personnel and contractors working at the site would comply with applicable Occupational Safety and Health Administration (OSHA) regulations. In addition, the construction contractor would develop and implement a Health and Safety Plan to minimize risks associated with potential hazards. Based on implementation of these measures, construction and operation of the project is expected to have a negligible impact on occupational health over both the short and long term.

Although the proposed project site is accessible to the general public, very little (if any) public access occurs in the area where the proposed infrastructure would be located. As such, the hazards discussed above are not expected to pose a risk to the general public.

4.12.1.3 Protection of Children

The proposed project site would be located in a remote portion of Pu‘u Maka‘ala NAR, and there are no child-centric resources within a 0.5-mile radius of the site. Consequently, the presence of children in areas within or surrounding the project site is highly unlikely. If children were to visit the proposed project site, it is expected that it would be under very controlled circumstances, with adult supervision. Therefore, the proposed project is not expected to pose any health and safety risks that would disproportionately affect children.

4.12.2No Action Alternative

Under the No Action Alternative, the Domain 20 field study site would not be implemented as part of NEON, and there would be no new impacts associated with human health and safety.

4.13 Public Services and Utilities

This section identifies potential direct and indirect impacts related to public services and utilities that may result from implementation of the Proposed Action and No Action alternatives. This assessment of impacts considers the extent to which the action would interfere with police, fire, or emergency medical providers; disrupt service for any public utility; or burden a public service or utility system. The ROI for public services and utilities is the area within and surrounding Pu‘u Maka‘ala NAR. The impact thresholds related to public services and utilities are defined in Table 22.

TABLE 22
Impact Thresholds for Public Services and Utilities

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change to public services and utilities, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would require or result in a change to public services and utilities, but the change would be small, localized, and of little consequence.
Moderate	The alternative would require or result in a measurable and consequential change to public services and utilities. Mitigation would be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would require or result in a substantial change to public services and utilities; the change would be measurable and would result in a severe impact (e.g., substantial interference or interruption of a public service or utility). Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.13.1 Proposed Action Alternative

The proposed project is not expected to interrupt, increase the demand for, or otherwise affect police, fire, or emergency medical services. Likewise, the proposed project is not expected to affect the nearby NWR communication facility. Based on direct coordination with NOAA Pacific Region staff, it was determined that, because NEON would not transmit data over radio frequencies, there is no concern regarding potential interference with the NWR system. Regardless, notification would be provided to NOAA prior to the start of construction and sensor installation, so that they can monitor data from the NWR system for any variances.

As described in Section 3.13, no utility infrastructure is present within Puʻu Makaʻala NAR. Electrical and telecommunication lines are located nearby, within the adjacent Kūlani Correctional Facility property. To obtain power and telecommunication service for the proposed project, service lines would be installed from the existing infrastructure to a new meter socket and transfer switch, which would be owned and used by the utility company.

The proposed project is not expected to affect the existing utility infrastructure or the current level of service. Electrical and telecommunication utilities would remain functional during construction but may experience temporary and short-term interruptions; these would be limited to the extent possible. Further coordination with utility owners would occur before and during construction. Short-term impacts on utilities would be negligible because service would be maintained during construction, and there would be no long-term adverse impacts related to utilities.

4.13.2 No Action Alternative

Under the No Action Alternative, the proposed Domain 20 core site would not be implemented as part of NEON. Conditions within Puʻu Makaʻala NAR would be commensurate with the existing conditions, such that no impacts to public services or utilities would occur.

4.14 Socioeconomics

This section identifies potential direct and indirect impacts related to socioeconomics that may result from implementation of the proposed project. This assessment of impacts considers potential effects to population, the local economy and environmental justice. The ROI for socioeconomics is the County of Hawai‘i. The thresholds for impacts related to human health and safety are defined in Table 23.

TABLE 23
Impact Thresholds for Socioeconomics

Impact Intensity	Intensity Description
Negligible	The alternative would either not result in a change to socioeconomic conditions, or the change would be so small that it would not be of any measurable or perceptible consequence.
Minor	The alternative would result in a detectable change to socioeconomic conditions; however, the impact would be small, localized, and of little consequence.
Moderate	The alternative would result in a measurable and consequential change to socioeconomic conditions. Mitigation may be needed to offset adverse impacts. It would be relatively simple to implement and would have a high likelihood for success.
Major	The alternative would result in a substantial change to socioeconomic conditions; the change would be measurable and would result in a severe impact. Extensive mitigation would be needed to offset adverse impacts, and the success could not be guaranteed.

Duration: **Short term** – occurs only during the construction or decommissioning periods

Long term – continues after the construction and decommissioning periods

4.14.1 Proposed Action Alternative

4.14.1.1 Population

There are adequate construction resources within the local workforce to complete the necessary construction activities, and the housing of scientists during operations would be primarily temporary. Consequently, impacts to the regional population would be negligible over the short and long term.

4.14.1.2 Economy

Maintenance staff and research scientists would be employed in association with the proposed project, but the long-term benefit to the local economy is expected to be negligible, because of the limited number of individuals employed.

4.14.1.3 Environmental Justice

Executive Order (E.O.) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, requires federal agencies to consider disproportionate risks to minority and low-income communities. The communities surrounding the Pu‘u Maka‘ala NAR have a large concentration of Native Hawaiians (U.S. Census Bureau, 2015), which constitutes a minority community in the U.S. However, the impacts from the proposed project are less than significant and would remain within the boundaries of Pu‘u Maka‘ala NAR. There would be no disproportionate high and adverse environmental impacts to minority or low-income communities. Potential impacts to Native Hawaiian cultural resources are described in Section 4.6.

4.14.2No Action Alternative

Under the No Action Alternative, socioeconomic conditions in the area within and surrounding the proposed project site would be expected to remain relatively unchanged; therefore, there would be no new impacts.

4.15 Cumulative Impacts

Cumulative impacts are those impacts that result from the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future projects, regardless of the person or agency that undertakes the other projects. Principles of cumulative impact analysis in the CEQ guide *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ, 1997) states: "for cumulative effects analysis to help the decision maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully."

The potential for cumulative impacts to the environment from the proposed project was evaluated by reviewing other projects and activities in the region that could affect the same environmental resources within a similar timeframe. Actions that were considered include those projects that were recently completed, are currently underway, or are expected to occur in the foreseeable future. Potential cumulative activities identified in the vicinity of the project area include the following:

- **DOFAW Activities in Puʻu Makaʻala NAR**- DOFAW and NARS staff actively manage the Puʻu Makaʻala NAR to protect the native ecosystems and cultural resources found at the site. DOFAW and NAR management activities, which could combine with those associated with the proposed project, include the following categories (DOFAW, 2016d):
  - Non-native Animal Control: Involves removal of ungulates (hooved animals) and small mammals to limit effects of non-native animal species at the NAR. Control activities include fencing, one-way gates, and other innovative actions.
  - Non-native Plant Pest Control: Involves management of weed species. Control activities include hand pulling of weeds, herbicides, and biological controls.
  - Restoration and Habitat Enhancement: Involves the enhancement of habitat and population size of native birds and plants. In Puʻu Makaʻala NAR, DOFAW and NARS staff are actively reforesting 340 acres of previous pastureland, which were grazed until 2007. DOFAW and NARS staff are also actively involved in the ʻAlalā Release Project.
  - Monitoring: Surveys are routinely performed to help managers understand the specific resources in the Puʻu Makaʻala NAR.
  - Research: Scientific research is performed to better understand the life history of bird and plant species, and obtain an understanding of restoration effort success.
- **ʻAlalā Release Project**: The ʻAlalā Project is a joint effort by DOFAW, USFWS, and San Diego Zoo Global to reintroduce *ʻalalā* to the wild and establish a self-sustaining population. The first release occurred in December 2016, although no birds from that release are currently in the NAR. Twelve birds are planned to be released at a new, undisclosed location within the NAR in late summer or early fall 2017. Similar releases are anticipated to occur annually for the next 5 years, depending on the success and survival of the released birds. Following each release, there will be a team of onsite biologists providing supplemental feeding, conducting ongoing predator control, monitoring life history, and conducting nest searches for approximately 5 years (DOFAW, 2016c).

- **Kūlani Correctional Facility**: The 280-acre Kūlani Correctional Facility is located adjacent to the Puʻu Makaʻala NAR and approximately 1 mile southwest of the proposed NEON site. The facility houses approximately 200 low-risk inmates and provides vocational training and substance abuse treatment programs. The vocational programs include facility maintenance, agriculture/horticultural and other technology training programs. The facility was reopened in 2014 after closure in 2009. There are no current plans to make additions or expansions of the current facilities (DAGS and DPS, 2013).

The proposed project would result in limited adverse impacts and measures would be implemented to avoid and minimize the impacts. Nonetheless, cumulative impacts can result from implementation of multiple projects that have individually minor but collectively significant impacts. Upon review, it has been determined that there would be negligible short-term and long-term cumulative effects to the resources identified in this EA. The following is an explanation of this finding, by resource:

- Climate Change: The identified cumulative activities would result in exceptionally low amounts of greenhouse gas emissions when compared to statewide emissions, and would not noticeably effect global climate change.
- Land Use and Recreation: The identified cumulative activities would not result in a change in land use or recreation opportunities.
- Geology, Topology, and Soils: The identified cumulative activities require limited ground-disturbing activities; therefore, there is little potential to effect geology, topology, or soils.
- Water Resources: The identified cumulative activities require limited ground-disturbing activities; therefore, there is little potential impact to water resources.
- Biological Resources: The necessary construction and increased human presence during monitoring from the proposed project could adversely affect native plant and bird species present at the site. While the Kūlani Correctional Facility would also involve substantial human activity, the facility has limited native habitat and expected impacts to biological resources are expected to be minimal (State of Hawaiʻi, 2012). The other identified activities (DOFAW activities in the NAR and the ʻAlalā Project) would also increase human activity, but would be restricted to trained natural resource personnel, whose objective is to protect the biological resources at the site. For this reason, it is not expected that there would be a noticeable adverse cumulative impact to native vegetation, birds, or threatened or endangered species. It is expected that if additional adverse impacts were noticed, revised monitoring, research, and control protocols would be enforced.
- Archaeological, Historic, and Cultural Resources: The identified cumulative activities are not expected to affect any known resources. If a resource was to be effected, it is expected that DOFAW or the Department of Public Safety would consult with the SHPO, pursuant to HRS Chapter 6E, and appropriate mitigation measures would be developed and implemented.
- Visual Resources: No changes to the visual environment are expected from the identified cumulative activities.
- Hazardous Materials: It is expected that any hazardous material usage resulting from the identified cumulative activities would be handled in accordance to applicable state and federal regulations; therefore, the potential for cumulative impacts is limited.
- Air Quality: The identified cumulative activities would not result in substantial emissions in NAAQS criteria pollutants.

- Noise: Limited amounts of noise are associated with the identified activities, and cumulatively, are expected to be of little consequence relative to the current noise environment.
- Transportation and Traffic: The identified cumulative activities would not result in a noticeable increase in traffic, nor would they affect current road infrastructure.
- Human Health and Safety: It is assumed that standard safety protocols would be followed during the identified cumulative activities; therefore, there is little likelihood for cumulative impacts.
- Socioeconomics: The reopening of the Kūlani Correctional Facility has resulted in increased regional jobs; which would be a beneficial socioeconomic impact. The other projects would have limited to no socioeconomic impacts.

5 Agency Coordination, Public Involvement and Consultation

5.1 Agency Coordination

NSF began the process of informal consultation with federal, state, and local agencies in 2010, as part of the environmental compliance effort for the overall NEON project. Agency consultation has been ongoing for the various locations that have been considered for the Domain 20 field study site; as described in Section 2.1, these include the Laupāhoehoe site, the Upper Waiakea site, and the proposed Pu‘u Maka‘ala NAR site. Consultation efforts have been conducted in support of general project development, as well as for specific regulatory purposes, including NHPA Section 106 and ESA Section 7 consultation.

The agencies that have been consulted specifically in regard to the Pu‘u Maka‘ala NAR site, as presented in this document, are listed in Table 24.

TABLE 24
Agency Consultation

Federal	SHPO USFWS USDA and USFS (Institute of Pacific Island Forestry) NOAA
State of Hawai‘i	OEQC OCCL DOFAW NARS SHPD
County of Hawai‘i	County of Hawai‘i Planning Department
Other Public-Private Stakeholder Organizations	‘Alalā Working Group Three Mountain Alliance Rapid *‘Ōhi‘a* Death Working Group

5.2 Public Involvement and Consultation

5.2.1 Scoping

NEPA regulations (40 CFR 1501.7) specify that “there shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.” Similarly, HAR 11-200-9.1 requires that an applicant for an action requiring compliance with HRS Chapter 343 seek advice and input from agencies with jurisdiction or expertise, as well as citizen groups and individuals that may be affected at the earliest practicable time.

In compliance with these requirements, NSF conducted scoping before developing the Draft EA. As described in Section 1.5, a scoping letter containing preliminary project information and requesting input was distributed to more than 200 agencies, organizations, and individuals. Table 25 summarizes the 11 responses received.

TABLE 25
Comments Received as Part of Scoping Process for Draft EA

Commenter	Date	Details
Private Landowner (D. Aki)	August 15, 2016	Letter requesting to be removed from project stakeholder list
State of Hawai'i Department of Health Clean Water Branch	August 18, 2016	Letter providing standard project requirements relating to water quality standards
National Park Service	August 18, 2016	Letter providing recommended BMPs to minimize the potential for introduction and spread of invasive species, and impacts related to seabirds
State of Hawai'i DLNR, Land Division	August 22, 2016	Letter indicating that the Land Division has no comments on the proposed project
State of Hawai'i Department of Agriculture	August 22, 2016	Email describing concerns related to the potential spread of Rapid *'ōhi'a* Death and request to address appropriate protocols
State of Hawai'i DLNR OCCL	August 23, 2016	Email providing preliminary information regarding the Conservation District subzone and permit requirements
Hawai'i Fire Department	August 25, 2016	Letter providing the relevant fire codes
County of Hawai'i Planning Department	August 25, 2016	Email providing zoning and land use permit requirements for the proposed project site
SHPD/Deputy SHPO	September 12, 2016	Letter requesting additional information regarding identification of historic properties and a determination of eligibility for any historic properties within the APE, pursuant to 36 CFR 800 and HAR 13-275
USFWS	September 12, 2016	Letter providing information on federally listed species that occur in the project area, measures to avoid and minimize impacts to those species, and measures to address Rapid *'ōhi'a* Death
State of Hawai'i Department of Transportation	October 3, 2016	Letter indicating that the developer should submit an FAA Form 7460-1 "Notice of Proposed Construction or Alteration." It is also recommended that a red light be placed on the tower.

A detailed scoping report, including a copy of the scoping letter, comments received, and responses to those comments is contained in Appendix A.

5.2.2 Comments on Draft EA

As described in Section 1.5.2, the Draft EA was released for public comment in May 2017, pursuant to the requirements of NEPA and HRS Chapter 343. A total of 13 comments were received during the public comment period. These comments have been reviewed and considered as part of the NEPA and HRS Chapter 343 processes, and are reflected in the revisions to this Final EA as appropriate.

The comments received on the Draft EA are summarized in Table 26, and copies of the comment letters are replicated in Appendix C. Pursuant to HRS 343 and HAR 11-200-9.1, responses have been provided to the comments received; copies of the response comment letters are also replicated in Appendix C.

TABLE 26
Comments Received During Draft EA Public Review Process

Commenter	Date	Summary
Susan Cordell	May 25, 2017	Pleased that NEON has tailored project activities to satisfy stakeholder concerns; notes that ongoing research and climate towers in forest (since 2007) have had little to no environmental impact (e.g., no bird/bat strikes or introduction of invasive species).
Cory Harden	May 25, 2017	Requests that project be designed to allow people to perform projects (with approval) to test for contaminants (e.g., roundup, depleted uranium oxides).
Ronald Fujiyoshi	May 25, 2017	States that the EA should include a section on protection of customary and traditional practices for native Hawaiians; requests that EA address how the project would affect management of game; identified additional stakeholders; requested that project test the environmental impact of the firing of weapons at Pohakuloa Training Area
Peter Vitousek	May 26, 2017	States that the site is representative of upper montane Hawaiian rainforest and doesn't think there would be serious environmental damage from the development as proposed; states that the work will provide useful information, and voices support for project moving forward.
Department of Health, Environmental Planning Office	June 1, 2017	Recommends review of state and federal environmental health land use guidance, including strategies to support sustainable and healthy design, and environmental GIS website; encourages use of Hawaii Environmental Health Portal
County of Hawaii Police Department	June 2, 2017	Does not anticipate significant impacts to traffic and/or public safety concerns
Dwayne Yoshina	June 7, 2017	States that another "private terrarium" is not needed in the community; wants area kept open for use as a food resource habitat
Jim Albertini	June 9, 2017	Raises concerns about chemical and biological weapons testing in proximity to Pu'u Maka'ala NAR; states that testing in the general area should be done for residue and effects from such chemical/biological agents as well as from the toxins used at the Pohakuloa Training Area
Department of Health, Clean Water Branch	June 16, 2017	No comments (notes that comments were previously provided in response to scoping letter)
Department of Public Safety	June 20, 2017	Provides information regarding Kulani Correctional Facility, use of Stainback Highway, and access to Kulani Cone
County of Hawaii Department of Water Supply	June 21, 2017	No objection or comments
Department of Transportation*	June 27, 2017	Notes that Federal Aviation Administration (FAA) form is not required, but recommends one be filed for safety concerns; states that the proposed project is not expected to significantly impact the State highway facility, but notes that construction and heavy vehicle activity should be coordinated with the HDOT District Engineer.
Department of Public Safety, Hawaii Community Correctional Center*	June 30, 2017	States that Hawaii Community Correctional Facility is 30 miles north of the project site and is outside of the area of concern, but that Kulani Correctional Facility is used for training, meetings, and exchange of prisoners.

** Indicates that comment letter was received outside of the public comment period, but has been considered to the extent possible.*

5.2.3 Endangered Species Act Section 7 Consultation

Section 7 of the ESA requires federal agencies to ensure that any agency action is not likely to jeopardize the continued existence of any species listed as threatened or endangered (or any species proposed for listing). NSF, as the lead federal agency for the proposed project, is consulting with USFWS pursuant to the requirements of ESA Section 7. Based on close coordination and input received to date from USFWS and other stakeholders, NSF has prepared and submitted to USFWS a Biological Assessment, along with a request for concurrence with their determination of effect (see Appendix E). Any additional requirements identified through the remainder of the Section 7 consultation process would be implemented as part of the proposed project. Although agency consultation is not explicitly required to comply with state laws protecting threatened and endangered species (HRS Chapter 195D), NSF is also seeking input from DOFAW as part of this process.

Table 27 lists the milestones of the Section 7 consultation process for this undertaking. Copies of documents relating to the ESA Section 7 process are contained in Appendix E.

TABLE 27
Endangered Species Act Section 7 Consultation Process

Action	Date	Details
Letter from USFWS (in response to NEPA/HRS Chapter 343 scoping)	September 12, 2016	Letter offering technical assistance for the proposed NEON project at Pu‘u Maka‘ala NAR, including list of federally listed species that occur in the project vicinity and measures to avoid and minimize project impacts to those species, and measures to minimize impacts related to Rapid *‘Ōhi‘a* Death (see Appendix D)
Email to USFWS and other project stakeholders	October 19, 2016	Email inviting USFWS and other project stakeholders (including scientists and researchers conducting work in Pu‘u Maka‘ala NAR) to consultation meeting, with detailed information regarding the proposed infrastructure and sampling protocols
Consultation meeting with USFWS	October 25, 2016	Meeting to discuss the ESA Section 7 consultation process, potential impacts to federally listed species, and measures to avoid and minimize project impacts to those species
Consultation meeting with USFWS and other project stakeholders	October 26, 2016	Meeting with USFWS and other project stakeholders (including scientists and researchers conducting work in Pu‘u Maka‘ala NAR) to provide proposed project overview and discuss stakeholder issues to inform ESA compliance
Email to USFWS and other project stakeholders	January 23, 2017	Email to participants of October 26, 2016 meeting containing meeting minutes, revisions to terrestrial sampling protocols and proposed mitigation measures developed in response to concerns raised at meeting
Email to USFWS	March 23, 2017	Email transmitting information regarding listed species and preliminary effects analysis
Coordination with USFWS	April 26, 2017	Conference call to obtain input from USFWS on information regarding listed species and preliminary effects analysis
Coordination with USFWS	May 23, 2017	Meeting to discuss information regarding listed species and preliminary effects analysis
Submittal of consultation documentation	June 19, 2017	Submitted Biological Assessment and determination of effect
Email from USFWS regarding additional critical habitat	July 7, 2017	Information provided by USFWS regarding consideration of critical habitat for *Plantago hawaiiensis* in the Biological Opinion

5.2.4 National Historic Preservation Act Section 106 Consultation Process

This section describes the Section 106 consultation process and identifies the Section 106 Consulting Parties. As stated in 36 CFR 800.1:

> "Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effects of their undertakings on historic properties and afford the Council [Advisory Council on Historic Preservation (ACHP]) a reasonable opportunity to comment on such undertakings. The procedures in this part define how Federal agencies meet these statutory responsibilities. The section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties."

NSF, as the lead federal agency for the proposed undertaking, has invited participation in the consultation process, in compliance with Section 106. The consultation process has also incorporated the state regulatory compliance requirements for historic and cultural properties pursuant to HRS 6E. Table 28 summarizes the consultation milestones for this undertaking. Copies of correspondence relating to the Section 106 and 6E compliance process are provided in Appendix D.

TABLE 28
NHPA Section 106 Consultation Milestones

Action	Date	Details
Letter from Deputy SHPO/ SHPD (in response to NEPA/HRS Chapter 343 scoping)	September 12, 2016	Letter indicating the additional information needed to determine the potential impacts to historic properties, including information relating to identification and determination of eligibility of historic properties within the APE
Email to SHPD requesting names of NHOs and other potential Consulting Parties	September 22, 2016	Email to SHPD Cultural Historian for Hawai'i Island requesting names of NHOs and others that may be interested in consulting on the proposed project
Response from SHPD with names of NHOs and other potential Consulting Parties	September 29, 2016	Response from SHPD Cultural Historian for Hawai'i Island with names of NHOs and others that may be interested in consulting on the proposed project
Letters sent to potential Consulting Parties and SHPO/SHPD (via email)	October 18, 2016	Letter seeking to identify Consulting Parties to be included in Section 106 process; providing notice of upcoming Section 106 Consulting Party meeting; and requesting input on cultural resources in the proposed project area
Section 106 Consultation Meeting	October 26, 2016	Meeting to provide proposed project overview and obtain consulting party input on historic properties and cultural practices (three individuals attended the meeting)
Section 106 Initiation Letter to SHPO/SHPD	December 7, 2016	Letter initiating Section 106 consultation with SHPD/SHPO (copies sent to list of potential Consulting Parties via email on December 13, 2017)
Email to SHPO/SHPD	January 10, 2017	Email following up on the consultation initiation letter sent December 7, 2016
Response from Historic Hawaii Foundation	January 12, 2017	Letter from Historic Hawaii Foundation with input regarding the APE and concurring with the preliminary finding of no historic properties affected

TABLE 28
NHPA Section 106 Consultation Milestones

Action	Date	Details
Email to SHPO/SHPD	March 23, 2017	Email requesting comments related to the consultation initiation letter sent December 7, 2016
Section 106 Concurrence Letter to SHPO/SHPD	April 24, 2017	Letter transmitting Cultural Resources Assessment of Effects and seeking concurrence with finding of effect (copies sent to list of potential Consulting Parties)
Call/Email to SHPD	June 22, 2017	Call/email to inquire on the status of SHPD's response to the request for concurrence

Based on the *Native Hawaiian Organization (NHO) Notification List* published by the U.S. Department of the Interior Office of Native Hawaiian Relations (2016), NSF identified an initial list of potential Consulting Parties who may be interested in the proposed NEON project at Puʻu Makaʻala NAR. As indicated in Table 28, input on other potential Consulting Parties was requested from SHPD staff. The potential Consulting Parties identified through this process, all of whom have been contacted as part of the Section 106 consultation process, are listed in Table 29. Of these, only Historic Hawaiʻi Foundation and the Hawaiʻi County Cultural Resources Commission have requested to be formally identified as a Consulting Party.

TABLE 29
Potential Consulting Parties

Aha Moku Council	Keoni Kealoha Alvarez
Association of Hawaiian Civic Clubs	Koʻolau Foundation
George K. Cypher ʻOhana	Kua O Ka Lā
Hawaiʻi County Cultural Resources Commission	Makuʻu Farmers Association
Hawaiʻi Island Burial Council	Mauna Kea Watershed Alliance
Hawaiʻi Volcanoes National Park	National Park Service
Hawaiian Civic Club of Hilo	Office of Hawaiian Affairs
Historic Hawaiʻi Foundation	Protect Kahoʻolawe ʻOhana
Kākoʻo ʻŌiwi	Piihonua Hawaiian Homestead Community Association
Kamehameha Schools	

6 Consistency with Applicable Plans and Policies

6.1 Conservation District (HRS 183C)

Land uses within the state Conservation District are under the sole jurisdiction of the state and are governed by HRS Chapter 183C and the implementing rules contained in HAR 13-5. The Conservation District was created to protect important natural resources essential to the preservation of the state's fragile natural ecosystems and the sustainability of the state's water supply. The Conservation District is divided into five subzones: protective, limited, resource, and general, as well as a “special” subzone to accommodate unique projects (HRS 183C-1). The proposed infrastructure would be within the general and resource subzones, and the terrestrial sampling would occur within the resource and protective subzones.

The OCCL is responsible for regulating land uses within the Conservation District. HAR 13-5-22 identifies those land uses which may be permitted within the protective subzone (and HAR 13-5-23 through 25 further permit these land uses in the remaining subzones); these include “data collection, research, education, and resource evaluation that involves permanent facilities or structures larger than 500 square feet or a land use causing significant ground disturbance or impact to a natural resources” (P-1, Data Collection). This land use is permitted with the issuance of a Conservation District Use Permit. The criteria that would be used in evaluating the project are provided in HAR 13-5-30(c). These are listed below, with a discussion of how each criterion is addressed by the proposed project.

(1) The proposed land use is consistent with the purpose of the conservation district

The purpose of the Conservation District is to conserve, protect, and preserve the important natural and cultural resources of the state through appropriate management and us to promote their long-term sustainability and the public health, safety, and welfare. The proposed project is one component of a continental-scale ecological observation facility designed to gather and synthesize data needed to study the impacts of climate change, land use change, and invasive species on natural resources and biodiversity. The resulting data and the research that it would support would help to inform management and long-term sustainability of the natural environment within Pu‘u Maka‘ala NAR, as well as throughout Hawai‘i, consistent with the purpose of the Conservation District.

(2) The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur

The objective of the protective subzone is to protect valuable natural and cultural resources. The objective of the resource subzone is to ensure, with proper management, the sustainable use of the natural resources. The objective of the general subzone is to designate open space where specific conservation uses may not be defined, but where urban use would be premature. As described above for Criterion 1, the proposed project is designed to provide data to address key issues related to ecological research and management, which are considered critical to long-term resource conservation and protection. Project-related impacts to natural resources would be tightly monitored and are expected to be minimal, as further discussed in response to Criterion 4. As such, the proposed project is considered to be consistent with the subzone objectives.

(3) The proposed land use complies with provisions and guidelines contained in Chapter 205A, HRS, entitled "Coastal Zone Management," where applicable

The discussion in Section 6.3 discusses the project within the context of the Coastal Zone Management Act and the objectives outlined in HRS Chapter 205A.

(4) The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region

Avoidance and minimization of impacts to natural resources is fundamental to the long-term success of the proposed project, as it is intended to monitor natural changes in native ecosystems. The infrastructure for the proposed project would have a very small footprint (approximately 0.2 acre), and stringent impact avoidance and minimization measures would be implemented throughout construction and operation of the proposed project. As such, impacts to natural resources are expected to be minimal and would be far outweighed by the long-term benefits related to ecological research and management, consistent with the above-listed criterion.

(5) The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels

The proposed project would involve installation of research infrastructure and long-term terrestrial sampling. The proposed locations of the project components were identified in coordination with DOFAW and NARS staff, such that they would be located in areas with suitable physical conditions and capabilities. The infrastructure siting process focused on meeting the constructability and scientific requirements for the proposed project, while balancing land use and management goals, and minimizing the potential for impacts to sensitive resources within the NAR. The terrestrial sampling plots were identified through an iterative process, in an effort to avoid areas with particularly sensitive resources and also to account for other research and management activities. Activities associated with the proposed terrestrial sampling are expected to be similar in nature to other research and management efforts conducted in the NAR. As such, the proposed project is considered to be consistent with Criterion 5.

(6) The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable

The proposed infrastructure would introduce built elements into an otherwise natural environment, but would be designed to have the smallest possible footprint (approximately 0.2 acre) and to blend into the surrounding environment to the degree possible. In general, the infrastructure is not expected to be visible from surrounding areas. The top of the tower would extend approximately 10 meters above the existing forest canopy and may be visible from a few, very limited viewpoints, but is not expected to be a prominent feature that diminishes the aesthetics of the landscape. Therefore, the proposed project is considered to be consistent with Criterion 6.

(7) Subdivision of land will not be used to increase the intensity of land uses in the conservation district

The proposed project does not involve the subdivision of land.

(8) The proposed land use will not be materially detrimental to the public health, safety and welfare

The proposed project would be located in a relatively remote area that is seldom accessed by the general public. Neither construction nor operation of the proposed project would adversely affect public health, safety, or welfare. Overall, project implementation would contribute to public welfare by

providing information that could be used to inform long-term management and sustainability of the natural environment, consistent with the above-listed criterion.

6.2 Natural Area Reserves (HRS Chapter 195)

Recognizing the unique natural resources that are found in Hawai‘i and the need to protect and preserve those resources, HRS Chapter 195 established a statewide NAR system to preserve specific areas in perpetuity. Rules that govern the NAR system are provided in HAR 13-209-5. These rules specify that the need for a Special Use Permit for research, education, management, or other activities otherwise prohibited within the NARs. Proposed activities must be consistent with the criteria listed in HAR 13-209-5.5. These criteria are listed below, with a discussion of how the proposed project would be consistent with each criterion.

(1) The proposed special-use cannot be conducted elsewhere

As detailed throughout this document, there are specific requirements for NEON field study sites as needed to meet the overall project objectives. These requirements include (1) a “wildland” area comprised of undeveloped, natural land representing the dominant vegetation and soil type for that domain, (2) contiguous habitat over an area large enough to implement the sampling protocols, (3) areas subject to minimal disturbance (i.e., not pristine, but still high quality habitat), (4) adequate soil depth to implement sampling protocols, (5) site accessibility, and (6) proximity to an existing power supply. A detailed and prolonged site selection process was conducted in close coordination with project stakeholders, including DOFAW and NARS staff and the ecological research community, based upon which, the proposed location within Pu‘u Maka‘ala NAR was selected. Other potentially suitable locations considered throughout this process were ultimately dismissed as they either would not meet the NEON requirements or would not be consistent with underlying land management goals, as discussed in Section 2.1.

(2) The proposed special-use is consistent with the purpose and objectives of the natural area reserve system

The Management Policies of the Natural Area Reserves System (NARS Commission, 1997) states that the NARS was established *“to preserve and protect, in perpetuity, examples of Hawaii’s unique terrestrial and aquatic natural resources, in order that present and future generations may be able to learn about and appreciate these natural assets. In addition, these Reserves were created to provide baselines against which changes to other native ecosystems can be measured.”* The proposed project is well-aligned with this purpose, as it is designed to gather and synthesize data needed to study the impacts of climate change, land use change and invasive species on natural resources and biodiversity. The resulting data and the research that it would support would help to inform management and long-term sustainability of the natural environment within Pu‘u Maka‘ala NAR and throughout Hawai‘i, as well as at the continental scale.

(3) The proposed special-use is consistent with the management plan developed for the reserve

As specified in the Pu‘u Maka‘ala NAR Management Plan (DOFAW, 2013b), the overall management goal is to manage threats to the integrity, diversity and functioning of Pu‘u Maka‘ala NAR ecosystems so that the unique natural and cultural resources are protected, maintained, and enhanced. Specific components of the plan address (1) ungulate management, (2) weed management, (3) habitat protection and rare species restoration program, (4) fire prevention and response, (5) monitoring, (6) public access, outreach, and education, (7) enforcement, (8) partnership collaboration, and (9) infrastructure and other actions. The proposed project would not conflict with any of these

management goals, and in some cases would help to achieve the goals. In particular, the proposed project would help to progress specific objectives related to monitoring ("*monitoring the current status and trends of natural resources as part of a long-term monitoring program*") and partnership collaboration ("*working with other groups collaboratively to address joint management needs [e.g., invasive species management, rare plant management, education, monitoring and research]*"). As such, the proposed project is considered to be consistent with this criterion.

(4) The proposed special-use provides a benefit (direct or indirect) to the natural area reserve system or to the individual reserve(s) or both

As described above, the proposed project would align with the management objectives related to long-term monitoring and partnership collaboration. Specifically, the NEON project would collect long-term monitoring data needed to study the impacts of climate change, land use change and invasive species on natural resources and biodiversity. These data would be made freely available to DOFAW and NARS staff (as well as others in the research community and general public), helping to inform management and long-term sustainability of the natural environment within Pu'u Maka'ala NAR, as well as throughout Hawai'i.

(5) The proposed special-use will not damage or threaten to damage the integrity or condition of the natural, geological, or cultural resources in the natural area reserve and adjacent area or region

As detailed in this document, the proposed project is not expected to significantly affect any geological or cultural resources. Construction and operation of the proposed project would result in some minor impacts to natural resources; however, avoidance and minimization of these impacts is fundamental to the long-term success of the proposed project, as it is intended to monitor natural changes in native ecosystems. The infrastructure for the project would have a very small footprint (approximately 0.2 acre) and stringent impact avoidance and minimization measures would be implemented throughout construction and operation of the proposed project. As impacts to natural resources are expected to be minimal and would be far outweighed by the long-term benefits related to ecological research and management, the proposed project is considered to be consistent with this criterion.

(6) The proposed special-use complies with provisions and guidelines contained in Chapter 205A, Hawaii Revised Statutes, entitled "Coastal Zone Management", where applicable

The discussion in Section 6.3 discusses the project within the context of the Coastal Zone Management Act and the objectives outlined in HRS Chapter 205A.

(7) The applicant shall have complied with, or be in compliance with, the conditions of any previously approved permit

A NARS Special Use Permit was previously issued for the proposed project's geotechnical study. Battelle complied with all terms of this permit and formally reported and closed the permit.

6.3 Coastal Zone Management (HRS Chapter 205A)

Under the authority of the federal Coastal Zone Management Act (16 U.S.C. 1451-1456), Hawai'i's Coastal Zone Management (CZM) program was enacted as HRS Chapter 205A in 1977, and is administered by the State of Hawai'i Department of Business, Economic Development and Tourism (DBEDT) Office of Planning. The CZM area encompasses the entire state, including all marine waters seaward to the extent of the State's police power and management authority, including the 12-mile U.S. territorial sea and all archipelagic waters. The Hawai'i CZM program integrates decisions made by state and county agencies such as the Land Use Commission, DLNR, HDOH, HDOT, and State of Hawaii Department of Agriculture to provide greater coordination and compliance with existing laws and rules.

The policy objectives of the program are listed below, with a brief statement on project consistency with each objective.

- Recreational Resources. To provide coastal recreational opportunities accessible to the public and protect coastal resources uniquely suited for recreational activities that cannot be provided elsewhere.
  - The proposed project area does not contain coastal recreation resources nor would it affect access to coastal recreation opportunities.
- Historic Resources. To protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.
  - The proposed project would not affect any historic or prehistoric resources.
- Scenic and Open Space Resources. To protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.
  - The proposed project would not affect any coastal scenic views. It would involve work in forested open space lands; however, the project-related infrastructure would have a minimal footprint and is not expected to diminish the overall visual quality of this open space.
- Coastal Ecosystems. To protect valuable coastal ecosystems, including reefs, from disruption and to minimize adverse impacts on all coastal ecosystems.
  - The proposed project is located inland and would not affect coastal ecosystems.
- Economic Uses. To provide public or private facilities and improvements important to the state's economy in suitable locations; and ensure that coastal dependent development such as harbors and ports, energy facilities, and visitor facilities, are located, designed, and constructed to minimize adverse impacts in the coastal zone area.
  - The proposed project is not a coastal-dependent development.
- Coastal Hazards. To reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.
  - The proposed project is not located in a tsunami or floodplain zone, and is not subject to coastal hazards.
- Managing Development. To improve the development review process, communication, and public participation in the management of coastal resources and hazards.
  - As detailed in Section 1.5, there have been ongoing communication and opportunities for participation by project stakeholders. There will be additional opportunities for the public to review and comment on the project through the HRS Chapter 343 EA and permitting process.
- Public Participation. To stimulate public awareness, education, and participation in coastal management; and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZM program.
  - The proposed project does not contain a public participation component for programmatic coastal management issues. Project-specific input would be elicited through the HRS Chapter 343 EA and permitting process.

- Beach Protection. To protect beaches for public use and recreation and locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements because of erosion.
  - The proposed project is located inland and does not affect Hawai‘i beaches.
- Marine Resources. To implement the state's ocean resources management plan.
  - The proposed project would not directly or indirectly affect resources addressed in the ocean resources management plan.

Key components of the CZM program include (1) regulation of development within the SMA, a designated area extending inland from the shoreline, (2) a Shoreline Setback Area, which serves as a buffer against coastal hazards and erosion, and protects viewplanes, and (3) a Federal Consistency provision, which requires that federal activities, permits, and financial assistance be consistent, to the maximum extent practicable with the enforceable policies of the Hawai‘i CZM program. The proposed project site is not located within either the SMA or the Shoreline Setback Area. As discussed throughout this document, the proposed project would not significantly affect the resources addressed under CZM policy. Federal funding from NSF, which is categorized as federal assistance, does not require Hawaii CZM Program federal consistency review, as determined by the Hawaii Office of Planning.

6.4 Hawai‘i State Environmental Policy (HRS Chapter 344)

The purpose of HRS Chapter 344 is to “establish a State policy which will encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawai‘i.” It specifies that the programs, authorities, and resources of the state be used to conserve natural resources and improve the quality of life. Guidelines that relate to the project specify management practices that conserve and fully use all natural resources. As presented throughout this document, the NEON project is designed to gather and synthesize data needed to study the impacts of climate change, land use change and invasive species on natural resources and biodiversity. The resulting data and the research that it would support would help to inform management and long-term sustainability of the natural environment.

6.5 Hawai‘i County General Plan

The Hawai‘i General Plan (Hawai‘i County, 2005) is a policy document for the long-range comprehensive development of the Island of Hawai‘i and provides direction for future growth of the County. The current Hawai‘i General Plan was approved by the County Council and became effective on February 9, 2005, repealing the previous plan adopted on November 14, 1989.

The 2005 Hawai‘i General Plan includes a total of 21 study elements, each of which were analyzed and evaluated relative to all other elements, County and district goals, and land use patterns. Study elements that relate to the proposed project include Environmental Quality, and Natural Resources and Shoreline. The proposed project does not conflict with any of the objectives or policies of the Hawai‘i General Plan, and in particular, supports the following policies related to the above-mentioned study elements:

- Environmental Quality, Policy 4.3(a): Take positive action to further maintain the quality of the environment.

- Natural Resources and Shoreline, Policy 8.3(a): Require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.
- Natural Resources and Shoreline, Policy 8.3(b): Encourage a program of collection and dissemination of basic data concerning natural resources.

6.6 Community Development Plan

Chapter 15.1 of the General Plan outlines the process for adopting Community Development Plans. Community Development Plans are enabled by Hawai‘i County Code Section 16-2 and administered by the Planning Department. The intent of these plans is to translate the broad General Plan statements into actions for a specific geographical area. They serve as the forum for community input into establishing County policy at the regional level and coordinating the delivery of County services to the community. However, it is not mandatory that a Community Development Plan be developed for each region, with the need generally based on the extent of the region's growth or changes in zoning and land use.

The proposed project is located in the Hilo district. A Community Development Plan process has not been undertaken for this district. Some resource documents are provided by the Planning Department for the Hilo district (Hawai‘i County, 2016b), including information on EnVision Downtown Hilo, Bayfront Trails, and Hawai‘i County Complete Streets; none of these resources relate to the proposed project.

6.7 Hawai‘i County Code

Section 25-2-71 of the Hawai‘i County Code requires plan approval before the construction or installation of any new structure or development or any addition to an existing structure or development in all districts except in the single-family residential (RS), residential and agricultural (RA), family agricultural (FA), agricultural (A) and intensive agricultural (IA) districts, and except for the construction of one single-family dwelling and any accessory buildings per lot. As confirmed by the County of Hawai‘i Planning Department, plan approval will be required for this proposed project.

6.8 Anticipated Permit Requirements

Table 30 presents the permits that are expected to be required for the NEON field study at Pu‘u Maka‘ala NAR, along with the current status of each permitting process.

TABLE 30
Anticipated Permits and Approvals

Permit/Approval	Agency/Entity	Status
NEPA Compliance	NSF	Final EA and FONSI published
Endangered Species Act, Section 7 Compliance	USFWS	In progress (see Section 5.2.2)
NHPA Section 106 Compliance	SHPO	In progress (see Section 5.2.3)
Conservation District Use Permit	OCCL, BLNR	Application submitted; in progress
NARS Special Use Permit[a]	NARS Commission, BLNR	Application submitted; in progress
State of Hawai‘i Chapter 343 Compliance	DLNR (accepting authority)	Final EA and FONSI published
HRS Chapter 195D Compliance	DLNR, DOFAW	In progress (based on ESA Section 7 compliance)

TABLE 30
Anticipated Permits and Approvals

HRS Chapter 6E Compliance (SHPD Notification and Review)	SHPD	In progress (concurrent with NHPA Section 106 process)
Community Noise Permit	HDOH	To be obtained, as needed
Plan Approval	County of Hawai'i, Planning Department	To be obtained
Construction Permit[b]	County of Hawai'i, Public Works	To be obtained, as needed

Notes:

[a] For the purposes of HRS Chapter 343, the NARS Special Use Permit is considered an approval for use of state land, which is a trigger requiring compliance with HRS Chapter 343.

[b] The County of Hawai'i issues a variety of construction permits, including (but not limited to) building, grading, and grubbing permits. It is possible that a grading permit will be required; the need for any other construction permits will be verified and obtained as needed.

FONSI = Finding of No Significant Impact

7 Summary of Impacts and Determination

7.1 Summary of Impacts

Based on the analysis contained in this document, Table 31 summarizes the potential impacts associated with the proposed project and the measures that would be implemented to avoid or minimize those impacts.

7.2 NEPA and HRS Chapter 343 Determination

The proposed project involves construction and operation of a core field study site for NEON's Pacific Tropical domain (Domain 20), and would be the only site representing this domain for the continental-wide network. Over the 30-year operational period, abiotic, biological, biophysical, biogeochemical, and land use data from the site would be made freely available to the scientific community and general public for use in analyzing ecological conditions in the Hawaiian Islands and would be comparable to data collected across the continental United States, Puerto Rico, and Alaska.

As the lead agency under NEPA, and based upon the analysis presented in this document, NSF has determined that implementation of the proposed project would not result in a significant adverse direct, indirect or cumulative impact on the quality of the environment. As such, NSF has issued a FONSI. Because no significant environmental impacts would result from implementation of the proposed project, an EIS is not required and will not be prepared. NSF will issue its final decision regarding whether to proceed with the proposed project upon closure of the ESA Section 7 and NHPA Section 106 processes.

Similarly, DLNR (as the approving agency) has determined that the anticipated impacts of the proposed project would not constitute a significant effect in the context of HRS Chapter 343, and has issued notice of a negative declaration determination to the OEQC. This determination is based on an evaluation of the project impacts in relation to the significance criteria specified in HAR 11-200-12(b), as summarized in Table 32.

TABLE 31
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
General	N/A	A Project Work Plan detailing the SOPs would be developed and executed. The Plan would be subject to DOFAW/NARS approval (with a request for review and input from USFWS) before project implementation, and would continue to be refined over the lifetime of the project. SOPs would include (but not be limited to) the following (as summarized in Section 2.2.2): • Communication Procedures • Staff Training • Decontamination Procedures • Site Access and Route Planning • Ongoing Impact Assessment and Adaptive Mitigation • Vegetation Trimming • Collection of Listed Plant Species • Stakeholder and Community Engagement
Climate	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact relative to climate; no avoidance or minimization measures are proposed.
Land Use and Recreation	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact relative to land use and recreation; no avoidance or minimization measures are proposed.
Geology and Soils	Construction: Minor, short-term impact Operation: Minor, short-term impact (decommissioning)	Measures to avoid and minimize potential impacts related to soil erosion include the following: • The extent of ground disturbance would be minimized to the extent practicable. • Temporarily disturbed areas would be stabilized and revegetated as quickly as possible.
Water Resources	Construction: Negligible, short-term impact Operation: Negligible, short-term impact (decommissioning)	Measures to minimize the potential for water quality impacts to receiving waters would be implemented during construction and operation (particularly decommissioning), and are expected to include the following: • Erosion and sediment control measures (such as silt fences) would be installed before earth-moving activities are initiated, and would be inspected and properly maintained throughout the construction period. • Disturbance of soil would be minimized during periods of heavy rain. • Vehicles and equipment would be inspected for leaks or contamination on a daily basis. • In the event of a spill/leak of fuel or lubricants from onsite equipment, the materials would be cleaned in a timely manner and disposed at an approved site.

TABLE 31
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Biological Resources (Vegetation)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on vegetation include: • Any vegetation removal required during construction or operation would be conducted in accordance with the SOPs for the project (see Section 2.2.2), including prior approval by the NEON science team, permitting team and site host. A qualified arborist with specific knowledge of the target species and site conditions would be engaged, as needed. • Terrestrial sampling activities would be conducted in accordance with the SOPs for the proposed project, particularly those related to site access, route planning, and ongoing impact assessment and mitigation. • In sampling plots where tree tagging is needed, coiled wire would be wrapped around the tree (instead of using standard tree tags) to avoid physical impact to the tree. • Areas temporarily disturbed during construction, decommissioning, or both, would be revegetated. Revegetation efforts would utilize species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Revegetation efforts would be coordinated with DOFAW and NARS staff.
Biological Resources (Wildlife)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on wildlife include those listed as part of the SOPs (see Section 2.2.2), including site access and route planning efforts designed to limit potential disturbance, and ongoing impact assessment and mitigation.
Biological Resources (Critical Habitat)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts to critical habitat include: • The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff.
Biological Resources (Threatened and Endangered Species)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts to threatened and endangered species include: **Plant Species** • Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts. • Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits. • The clip harvesting of herbaceous plant material would be specifically sited to avoid protected species. Similarly, the foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be sited to avoid any trees with protected plant species growing into the canopy. If it is subsequently determined that collection or harvest of a threatened or endangered plant species is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection. • Researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to protected plant species.

		Nēnē • A biologist familiar with the nesting behavior of the *nēnē* would survey suitable habitat within the construction area before the initiation of any construction activities, or after any subsequent delay in work of 3 or more days (during which time, the birds could attempt nesting). If a nest were discovered, USFWS would be contacted. • All NEON staff would be trained to identify *nēnē* and know the appropriate steps to take if *nēnē* are present within the project area or encountered in transit to sampling locations. • If a *nēnē* is encountered within the project area, the bird would not be approached, and all activities within 100 feet of the bird would cease until the bird leaves the area of its own volition. • If a *nēnē* is encountered while in transit to a sampling location, the researcher(s) would stop and remain in place until the bird moved more than 100 feet from the travel route of its own volition or slowly retreat and return for sampling at a later time. • A maximum speed limit of 15 mph would be enforced for all project vehicles traveling within the project site to minimize potential collisions with *nēnē*. ***Hawaiian Hawk*** • Vegetation clearing or construction would be avoided during the Hawaiian hawk breeding season (March through September) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest is found) would be coordinated with USFWS. • If determined to be needed, nesting deterrents would be placed on the tower. Any deterrent used would first be approved by USFWS and DOFAW. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. • NEON staff would be trained to recognize the Hawaiian hawk and their nests. In the event that a Hawaiian hawk nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied. **Honeycreepers (*ʻakiapōlāʻau*, Hawaiʻi *ʻākepa*, *alawi*, and *ʻiʻiwi*)** • Vegetation clearing and construction activities would be avoided during the honeycreepers' nesting season (February through July), to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 500 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. ***ʻAlalā*** • Vegetation clearing and construction activities would be avoided during the *ʻalalā* breeding season (February through July), to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS. • The use of shiny materials would be minimized and shiny surfaces would be masked to decrease their attractiveness to *ʻalalā*. Specifically, the tower would be constructed of materials that are a dull, galvanized gray. An exterior treatment involving dark or dull colors would be added to any shiny surfaces, such as power boxes and communication equipment.

TABLE 31
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• All trash would be placed into appropriate containers and promptly removed from the project site, to avoid inadvertent discarding of shiny materials or other items that may be of interest to *ʻalalā*. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. • The beetle traps would be fitted or retrofitted, depending on timing of *ʻalalā* releases, with chicken wire to limit the extent to which *ʻalalā* could access the traps. Any preservatives used in the beetle traps would be verified to be non-toxic to birds. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. • NEON staff would be trained to recognize *ʻalalā* and their nests. In the event that an *ʻalalā* nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest is identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied. **Seabirds** • Construction activities would be restricted to daylight hours to avoid the use of nighttime lighting that could attract seabirds. • Installation of outside lighting would be avoided, to the extent possible. If outside lights are required for safety or security purposes, directional lighting or shielded lighting would be used to prevent upward radiation. The shields would be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below. Outside lights that are not needed for security and safety would be turned off from dusk through dawn during the seabird fledging season (September 15 to December 15). • The guy wires for the research tower would not extend above the top of the tree canopy to minimize the potential for bird strikes. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. **Hawaiian Hoary Bat** • No trees taller than 15 feet are planned to be trimmed or removed as a result of the project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees. However, if it is subsequently determined that a limited number of trees need to be trimmed or removed during that time period, a qualified biologist would conduct observations following standard protocols to determine whether any of the trees that would be removed are being used by bats and could harbor juveniles. If any trees are determined to be used by bats, they would not be trimmed or removed until after September 15. • No fences are proposed to be installed as part of the proposed project. In the event a fence is needed, it would have barbless top-strand wire to prevent entanglement of Hawaiian hoary bats on barbed wire. **Picture-Wing Fly** • No *loulu* or wet montane forest habitat would be cleared or trimmed, nor would vegetation biomass be harvested as part of sampling within areas that are designated critical habitat for *Drosophila mulli*. If *loulu* is to be cleared, trimmed or harvested in portions of the project area that are not within designated critical habitat, they would first be inspected for *Drosophila mulli* by a qualified biologist. If *Drosophila mulli* are found, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid impacts to the occupied *loulu*. Temporary protective fencing would be installed around the occupied *loulu*, as appropriate. • Mosquito traps would not be installed within 1,000 feet of critical habitat for *Drosophila mulli* or any location where the species was previously documented within Puʻu Makaʻala NAR.

TABLE 31
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Biological Resources (Invasive Species)	Construction: Minor, short-term impact Operation: Minor, long-term impact	To avoid and minimize the potential for introduction and spread of invasive species, the sanitation procedures utilized by DOFAW/NARS staff will be implemented over the lifetime of the project. The current procedures are listed below; any future modifications or additions made by DOFAW/NARS will be incorporated, as appropriate. • All vehicles, tools, equipment and building materials, and packaging and shipping containers will be cleaned and fumigated before being shipped to Hawai‘i and again once they arrive. The same protocol will be followed before leaving the local port. • All vehicles, equipment, and materials will be stored offsite at a clean staging area and will be subject to sanitation protocols daily before they are returned to the site. This measure will be randomly inspected for compliance and enforced. • All other materials (including personal equipment and boots) will be inspected for foreign matter (including dirt, seeds, eggs, larvae, or other propagules) and cleaned before entering the site. • All workers would be instructed on specific procedures to prevent the introduction and spread of invasive species in the project area. • All trash, including food waste, would be placed into appropriate containers, removed from the project site, and properly disposed of. • NEON domain staff would conduct regular monitoring for invasive species within the project area throughout the operational period. If invasive species were detected, removal and control would be coordinated with the NARS Specialist. To avoid and minimize the potential for Rapid *ʻŌhiʻa* Death to spread to the proposed project area, the sanitation procedures set forth by the Rapid *ʻŌhiʻa* Death multi-agency working group would be implemented throughout construction and operations of the NEON site. The current procedures are listed below; any future modifications or additions to these procedures will be adopted for the proposed project, as appropriate. • A survey of the proposed project site would be conducted no more than two weeks before any tree cutting to determine if there are any infected *ʻōhiʻa* trees. If infected *ʻōhiʻa* are suspected at the site, the appropriate agencies would be contacted for further guidance (including USFWS, University of Hawai‘i Cooperative Extension Service, USDA Forest Service and USDA Agriculture Research Service). • Tools used to cut *ʻōhiʻa* would be cleaned with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. If a bleach solution is used, tools would be oiled afterwards to prevent corrosion. Chainsaw blades would be brushed clean, sprayed with the cleaning solution, and run briefly to lubricate the chain. • Personal gear, including shoes and clothes, would be cleaned before and after entering the forest. Shoes would be brushed to remove soil, then sprayed with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. Other personal gear would also be sprayed with the cleaning solution. Clothing would be washed with hot water and detergent. • Vehicles used off-road or in infected forest areas would be thoroughly cleaned using a pressure-washer and detergent. All soil would be removed from the tires and vehicle undercarriage. • If clearing or trimming of *ʻōhiʻa* is required for the proposed project, the cut wood would be left onsite and would not be transported.
Archaeological, Architectural, and Cultural Resources	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The following measures would be implemented to avoid and minimize potential impacts to archaeological resources, should they be discovered: • If previously unidentified archaeological resources were discovered during project activities, ground disturbing activities would be halted in the vicinity of the find and NSF would consult with the SHPD and other consulting parties, as appropriate, regarding eligibility for listing in the NRHP, project effects, necessary mitigation, or other treatment measures.

TABLE 31
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• An unanticipated discovery plan would be developed before construction activities to address archaeological and cultural resources that might be discovered. Measures to avoid and minimize impacts to culturally important species, including *ʻalalā* and Hawaiian hawk are addressed as part of Biological Resources.
Visual Resources	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize the potential for impacts to visual resources include the following: • To minimize the potential obtrusiveness of the proposed infrastructure, the tower and ancillary components would be designed to blend into the surrounding environment to the degree possible. The tower would be constructed of galvanized steel, which blends well with forest vegetation. Cloaking methodologies would be applied to decrease the visibility of specific objects, including the auxiliary portal and electrical lines.
Hazardous Materials	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize the potential for impacts related to hazardous materials include the following: • Use of proper handling and storage procedures for construction equipment fuel and lubricants • Routine inspection of vehicles and equipment for leaks
Air Quality	Construction: Minor, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize potential impacts on air quality include the following: • All construction vehicles and equipment would be maintained in proper tune according to manufacturer's specifications. • The number of vehicles accessing and moving within the project area would be limited to the extent possible. Vehicles speed on unpaved roads within the project area would be limited to 15 miles per hour or less. • Vehicles and equipment would not be allowed to idle for extended periods of time (i.e., greater than 20 minutes). • The extent of ground disturbance would be minimized where possible. Temporarily disturbed areas would be stabilized and revegetated as quickly as possible. • All trucks hauling soil or other loose materials would be covered. • The entrance to the project site would be stabilized to avoid offsite tracking of sediment.
Noise	Construction: Minor, short-term impact Operation: Minor, long-term impact	Pursuant to HAR 11-46-7, a permit would be obtained from HDOH to allow the operation of construction-related equipment, as needed. It is expected that the permit would restrict the times of day when construction activities may emit noise in excess of the maximum permissible sound levels. The HDOH may also require the incorporation of noise mitigation into the construction plan. BMPs that would be implemented to reduce noise levels during construction are expected to include the following: • Proper tuning and balancing of construction equipment, and maintenance in accordance with the manufacturer's specifications • Use of noise barriers or mufflers on diesel and gasoline engines • Restriction of construction activities to typical working days/hours • Keeping unnecessary noise to a minimum Measures to avoid and minimize potential impacts during project operations include the following: • If needed, engineered mufflers may be added to the pumps to reduce noise levels during operations.
Transportation and Traffic	Construction: Minor, short-term impact	Measures to avoid and minimize potential traffic-related impacts include the following: • Large vehicle deliveries along Stainback Highway would be timed to avoid typical commute hours to minimize the potential impacts to other motorists, particularly residents traveling to and from Mountain View via North Kūlani Road, to the extent possible.

TABLE 31
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
	Operation: Minor, long-term impact	• The timing of large vehicle deliveries would also be coordinated with Kūlani Correctional Facility to minimize impacts to their staff and visitors, as appropriate. • Traffic controls (including signage, flagging, or other similar methods) would be implemented as needed, in coordination with the HDOT District Engineer, to further minimize impacts to other vehicles travelling on Stainback Highway. • Vehicular traffic within Puʻu Makaʻala NAR would be minimized to the extent practicable, so as to decrease potential roadway impacts. This effort will include (1) coordination of deliveries to minimize the total number of trips needed and (2) carpooling requirements for construction and operations staff.
Human Health and Safety	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize potential human health and safety impacts include the following: • All personnel and contractors working at the site would comply with applicable OSHA regulations. • The construction contractor would develop and implement a Health and Safety Plan to minimize risks associated with potential hazards.
Public Services and Utilities	Construction: Negligible, short-term impact Operation: No impact	Measures to avoid and minimize potential impacts to public services and utilities include the following: • Notification would be provided to NOAA prior to the start of construction and sensor installation, such that they can monitor data from the NWR system for any variances.
Socioeconomics	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact on socioeconomics; no avoidance or minimization measures are proposed.

TABLE 32
Evaluation of Significance Criteria (per HAR 11-200-12)

Significance Criteria	Project Evaluation
Involves an irrevocable commitment to loss or destruction of any natural or cultural resource	The proposed project would involve installation of research infrastructure and long-term terrestrial sampling. It would not result in an irrevocable commitment to loss or destruction of important natural or cultural resources. A variety of threatened or endangered species occur (or could occur) in the project area; however, avoidance and minimization measures would be implemented such that these species would not be adversely affected. The project is not expected to affect any archaeological, historic or cultural resources.
Curtails the range of beneficial uses of the environment	Implementation of the proposed project is designed to provide long-term observation and collection of data regarding the natural environment, and as such would not curtail the range of beneficial uses of the environment.
Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders	The proposed project is consistent with the environmental goals and objectives of the State of Hawai‘i, particularly as it would provide data needed to study changes in the natural environment while safeguarding unique resources in a manner that balances human welfare and nature.
Substantially affects the economic welfare, social welfare, and cultural practices of the community or state	The proposed project would have a positive impact on the economic and social welfare of the community by providing local employment opportunities and by contributing to the collective body of knowledge regarding the local ecosystem.
Substantially affects public health	The proposed project would not adversely affect public health.
Involves substantial secondary impacts, such as population changes or effects on public facilities	The proposed project is not expected to induce changes in land use, population size or public facilities, such that secondary impacts would not occur.
Involves a substantial degradation of environmental quality	Avoidance and minimization of impacts to natural resources is fundamental to the long-term success of the proposed project, as it is intended to monitor natural changes in the natural environment. The infrastructure for the project would have a very small footprint (approximately 0.2 acre) and stringent impact avoidance and minimization measures would be implemented throughout construction and operation of the proposed project. Therefore, the proposed project is not expected to substantially degrade environmental quality.
Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions	Other actions that could affect the resources within Pu‘u Maka‘ala NAR within a similar timeframe include ongoing DOFAW management activities, the *‘Alalā* Release Project, and re-opening of the Kūlani Correctional Facility. However, mitigation measures would be implemented to avoid and minimize potential impacts, such that there is little to no potential for cumulative effects to environmental resources.
Substantially affects a rare, threatened, or endangered species, or its habitat	A total of 33 listed threatened and endangered species are known to occur (or may occur) in the project area. These include a variety of vascular plant and ferns, birds, mammals and invertebrate species. Critical habitat has been designated within the project area for 10 species, including 9 plant species and 1 invertebrate species. Implementation of seasonal restrictions on construction activities and other measures are designed to avoid impacts to these species. Similarly, project implementation is not expected to adversely affect the physical and biological features of the designated critical habitat that support the associated listed species.

TABLE 32
Evaluation of Significance Criteria (per HAR 11-200-12)

Significance Criteria	Project Evaluation
Detrimentally affects air or water quality or ambient noise levels	There would be minimal short-term impacts on air quality and noise levels during the construction period. Mitigation measures would be implemented to minimize these construction-related impacts. Over the long term, there would be no adverse impacts relative to air quality, noise or water quality.
Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters	The proposed project would not be located in a floodplain, tsunami zone, or coastal zone. It would be in a region that is volcanically active and is prone to seismic activity. However, implementation of the proposed project would not increase any risks associated with seismic activity, nor would these events increase any risks associated with operation of the NEON field study site.
Substantially affects scenic vistas and viewplanes identified in county or state plans or studies	There are no designated viewplanes in the project vicinity. The top of the tower would extend approximately 10 meters above the existing forest canopy and may be visible from a few, very limited viewpoints, but is not expected to be a prominent feature that diminishes landscape views.
Requires substantial energy consumption	The proposed project would not require substantial energy consumption. While there would be short-term construction-phase energy consumption, over the long-term, the proposed project would require relatively low levels of energy (primarily associated with operation of the research equipment).

8 List of Preparers

The primary persons responsible for contributing to, preparing and reviewing this report are listed in Table 33.

TABLE 33
List of Preparers and Reviewers

Name	Role	Experience
Michelle Rau	Project Manager, NEPA Lead, and Socioeconomics and Environmental Justice Author	M.S. Business Administration, B.S. Ecology and Evolutionary Biology; 19 years of experience
Lisa Kettley	Lead Technical Author	M.S. Biological Sciences, B.S. Environmental Studies; 19 years of experience
Lori Price	Cultural Resources and NHPA Section 106 Lead	M.F.A. Historic Preservation and Architectural History; 21 years of experience
Paul Luersen	Senior Technical Reviewer	M.C.R.P., City and Regional Planning; 39 years of experience
Richard Reaves	Senior Technical Reviewer, Biological Resources and Section 7 Lead	Ph.D. Wetland and Wildlife Ecology, B.S. Wildlife Ecology and Resource Management; 23 years of experience

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10 Acronyms, Abbreviations, and Terminology Index

Acronym	Definition
ACHP	Advisory Council on Historic Preservation
AGL	above ground level
AIBS	American Institute of Biological Sciences
APE	Area of Potential Effects
ATBC	Association for Tropical Biology and Conservation
BLNR	Board of Land and Natural Resources
BMP	best management practice
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CO	carbon monoxide
CO_2	carbon dioxide
CH_4	methane
cm	centimeter
CTAHR	[University of Hawai‘i] College of Tropical Agriculture and Human Resources
CWRM	Commission on Water Resource Management
CZM	Coastal Zone Management
DAGS	Department of Accounting and General Services
dB	decibel
dBA	A-weighted decibel
DBEDT	Department of Business, Economic Development and Tourism
DFIR	double-fenced intercomparison reference
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DPS	Department of Public Safety
E.O.	Executive Order
EA	environmental assessment
EIS	environmental impact statement
EISPN	EIS Preparation Notice
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
g	gram
HAAQS	Hawai‘i ambient air quality standards
HAR	Hawaii Administrative Rules
HDOH	State of Hawai‘i Department of Health
HDOT	State of Hawai‘i Department of Transportation
HRS	Hawaii Revised Statutes
HVAC	heating, ventilation, and air conditioning
Leq	equivalent sound pressure level
LiDAR	Light Detection and Ranging
LTER	Long Term Ecological Research

Acronym	Definition
m	meter
m^2	square meter
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
N/A	not applicable
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAR	Natural Area Reserve
NARS	Natural Area Reserves System
NEON	National Ecological Observatory Network
NEPA	National Environmental Protection Act
NFIP	National Flood Insurance Program
NHO	Native Hawaiian organization
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSF	National Science Foundation
NWR	NOAA Weather Radio
OCCL	Office of Conservation and Coastal Lands
OEQC	Office of Environmental Quality Control
OSHA	Occupational Safety and Health Administration
PICCC	Pacific Islands Climate Change Cooperative
$PM_{2.5}$	particulate matter less than or equal to 2.5 micrometers in diameter
PM_{10}	particulate matter less than or equal to 10 micrometers in diameter
PVC	polyvinyl chloride
RFI	request for information
ROI	Region of Influence
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Office
SMA	Special Management Area
SO_2	sulfur dioxide
SOP	standard operating procedure
TCP	traditional cultural property
TMK	tax map key
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USEIA	U.S. Energy Information Administration
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey

Appendix A
Scoping Report

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National Science Foundation
National Ecological Observatory Network
Domain 20 Core Tower and
Sampling Site Environmental Assessment

Scoping Report

Introduction

This Scoping Report provides the public and agency scoping comments received during the 30-day public comment period for the National Science Foundation (NSF) National Ecological Observatory Network Domain 20 Core Tower and Sampling Site Environmental Assessment (EA). Members of the public and government agencies were invited to comment on the EA during an official comment period from July 23 to August 22, 2016; however, comments that were received after this period were also considered and are captured below. The scoping letter including the proposed agency and stakeholder distribution list is included in Attachment 1. All comments received along with responses are included in Attachment 2.

The following individuals/agencies provided comments:

- Alec Wong, State of Hawai'i Department of Health Clean Water Branch
- Cynthia L. Orlando, National Park Service
- Munekata Micah, Hawai'i Department of Agriculture
- Russell Tsuji, State of Hawai'i, Department of Land and Natural Resources
- Kimberly T. Mills, State of Hawai'i, Department of Land and Natural Resources
- Darren J. Rosario, County of Hawai'i, Hawai'i Fire Department
- Shancy Watanabe, County of Hawai'i-Planning Department
- Michelle Bogardus, Fish and Wildlife Service
- Alan S. Downer, PhD, State Historic Preservation Office
- Ford N. Fuchigami, State of Hawaii Department of Transportation

In addition to these comments, the following requests were also received: (1) one recipient asked for a hard copy of the Draft EA, when available, and (2) one recipient asked to be removed from the mailing list. Both requests will be fulfilled.

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Attachment 1
Scoping Letter

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NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
Arlington, Virginia 22230

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
1151 Punchbowl St. Room 325
Honolulu, Hawaii 96813

March 8, 2016

SUBJECT: Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Upper Waiakea Forest Reserve and Puu Maka'ala Natural Area Reserve, Hawai'i Island

Dear Participant,

The National Ecological Observatory Network (NEON), a continental-scale research network funded by the National Science Foundation (NSF) and operated by awardee NEON, Inc., proposes to establish a research site within the Upper Waiakea Forest Reserve (with likely overlap into the Puu Maka'ala Natural Area Reserve), Hawai'i Island. The site is needed in order to provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawai'i," and would be the only site representing this domain in the United States. Site components include a tower, instrument hut, soil sensor array, precipitation gauge with double fencing, and related infrastructure (no new roads are anticipated), and operations will support terrestrial sampling activities; see the attached project information summary and overview for further details.

Pursuant to the National Environmental Policy Act (NEPA), NSF completed an Environmental Assessment evaluating the nation-wide NEON program, including a site in the Hawai'i Experimental Tropical Forest, in 2009. NSF found that NEON would have no significant impact on the environment, contingent on some site-specific agency consultation and avoidance measures. However, since then, the previously analyzed site in Hawai'i (Laupahoehoe) has been determined to be unsuitable due to challenges implementing the design. In addition, certain components (relocatable sampling sites) have been removed from the scope due to: (1) a reduction in the overall scope of NEON to combat construction delays and potential cost overruns; and (2) changes to the plant community that altered the ability to answer intended scientific questions. The Upper Waiakea Forest Reserve/Puu Maka'ala Natural Area Reserve has been identified as a suitable replacement because the site represents a wildland lacking in long-term observations, and NSF is currently conducting supplemental NEPA review to identify and assess any potential environmental effects of

establishing a NEON site at the proposed location. This federal NEPA process is being conducted in coordination with a state-level review under Chapter 343, Hawai'i Revised Statutes, carried-out in support of permitting activities by the Hawai'i Department of Land and Natural Resources. The attached project information is meant to meet the needs for Pre-Assessment Consultation under Chapter 343, as well as scoping under NEPA.

NSF respectfully requests your review and comments on this proposal. It is anticipated that an Environmental Assessment will be jointly prepared by NSF and the State of Hawai'i's Division of Forestry and Wildlife, in coordination with NEON, Inc. NSF will make this document publically available for your review and comment. Concurrent with the NEPA review, NSF will be assessing impacts to cultural resources and consulting with the State Historic Preservation Office and other consulting parties per Section 106 of the National Historic Preservation Act. If you are interested in being a consulting party under Section 106, please identify this in your response. NSF will also be carrying out its compliance with Section 7 of the Endangered Species Act through the NEPA process; compliance with the State of Hawai'i's endangered species law and relevant conservation requirements will be conducted concurrent to this process, as appropriate..

Please submit comments via electronic mail by the end of the day on April 7, 2016, to: NEON-EA-comments@nsf.gov. If you do not have web access or would prefer to send your comments via regular, United States first-class mail, please mail your comments to:

Kristen Hamilton, RE: NEON Domain 20 Site
National Science Foundation
4201 Wilson Boulevard
Suite 1265
Arlington, Virginia 22230

Please note that to promote efficiency and to save resources, future notifications and links to environmental review documents for this proposed project will be sent by electronic mail. If you do not have web access or would prefer to receive hard copies of notifications and/or environmental review documents, please notify Ms. Kristen Hamilton at the address above.

If you would like to continue participating in the federal/state environmental review process for the proposed NEON site described in this notice and you are able to receive email notifications, please send your email address to: NEON-EA-comments@nsf.gov. If you do not wish to continue participating in this process and would like to be removed from our list of participants, please provide notification to us either via email at NEON-EA-comments@nsf.gov or via regular mail at the mailing address indicated above.

If you have questions or concerns about the scoping process, please call Ms. Hamilton at (703) 292-4820.

Sincerely,

Steven Ellis, Program Director
Division of Biological Infrastructure
Biology Directorate
National Science Foundation

David Smith, Administrator
Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawai'i

Enclosed: Scoping/Pre-Assessment Consultation Package with Stakeholder List

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NATIONAL ECOLOGICAL OBSERVATORY NETWORK
Scoping Information for use in Federal National Environmental Policy Act Review and Pre-Assessment Consultation for Environmental Assessment (Hawai'i Revised Statutes Chapter 343)

PROJECT INFORMATION SUMMARY

Project Name:	National Ecological Observatory Network Domain 20 Core Tower and Sampling Site
Funding Agency:	National Science Foundation 4201 Wilson Boulevard Arlington, VA 22230
Applicant:	National Ecological Observatory Network (NEON) 1685 38th St. Suite 100 Boulder, CO 80301
Approving Agency Ch. 343, HRS:	State of Hawai'i, DLNR 1151 Punchbowl Street Honolulu, HI 96813
Class of Action:	Long Term Direct Lease and Permit Use of State Land, as per Section 171-43.1. HRS, as amended
Project Location:	Upper Waiakea Forest Reserve and Puu Maka'ala Natural Area Reserve, Hawai'i Island
Hawai'i Tax Map Key (TMK):	TMK# (3) 2-4-008:001
Landowner:	State of Hawai'i
Proposed Project Area:	A 1,000-2,000-acre project area; a direct lease area of 12.34 acres would include a tower, instrument hut, Double Fence Intercomparison Reference (DFIR) precipitation gauge (with required vegetation clearance area), associated foundations, and any associated power trench or conduit run, and terrestrial sampling would occur within the greater permitted area.
State Land Use District:	Conservation District - Protective Subzone
County of Hawai'i Zoning:	Conservation District - Protective Subzone
County Land Use Plan Allocation Guide Map:	Conservation District
Flood Zone:	Zone X

NATIONAL ECOLOGICAL OBSERVATORY NETWORK
Scoping Information for use in Federal National Environmental Policy Act Review and Pre-Assessment Consultation for Environmental Assessment (Hawai'i Revised Statutes Chapter 343)

PROJECT SITE

The National Ecological Observatory Network (NEON), solely funded by the National Science Foundation (NSF), is proposing an ecological research tower, instrument hut, sensor system, double fenced precipitation gauge, supporting infrastructure, terrestrial ground sampling, and an annual flyover In the Upper Waiakea Forest Reserve/Puu Maka'ala Natural Area Reserve in North Hilo on Hawai'i Island. The proposed project area encompasses TMK# (3) 2-4-008:001 and would be leased and permitted by the State of Hawai'i, via a 12.34-acre direct lease (includes tower, instrument hut, DFIR), and a 1,000-2,000-acre permit to use State land to conduct terrestrial sampling (this will be further refined via consultation with the State).

OVERVIEW OF PLANNED PROJECT

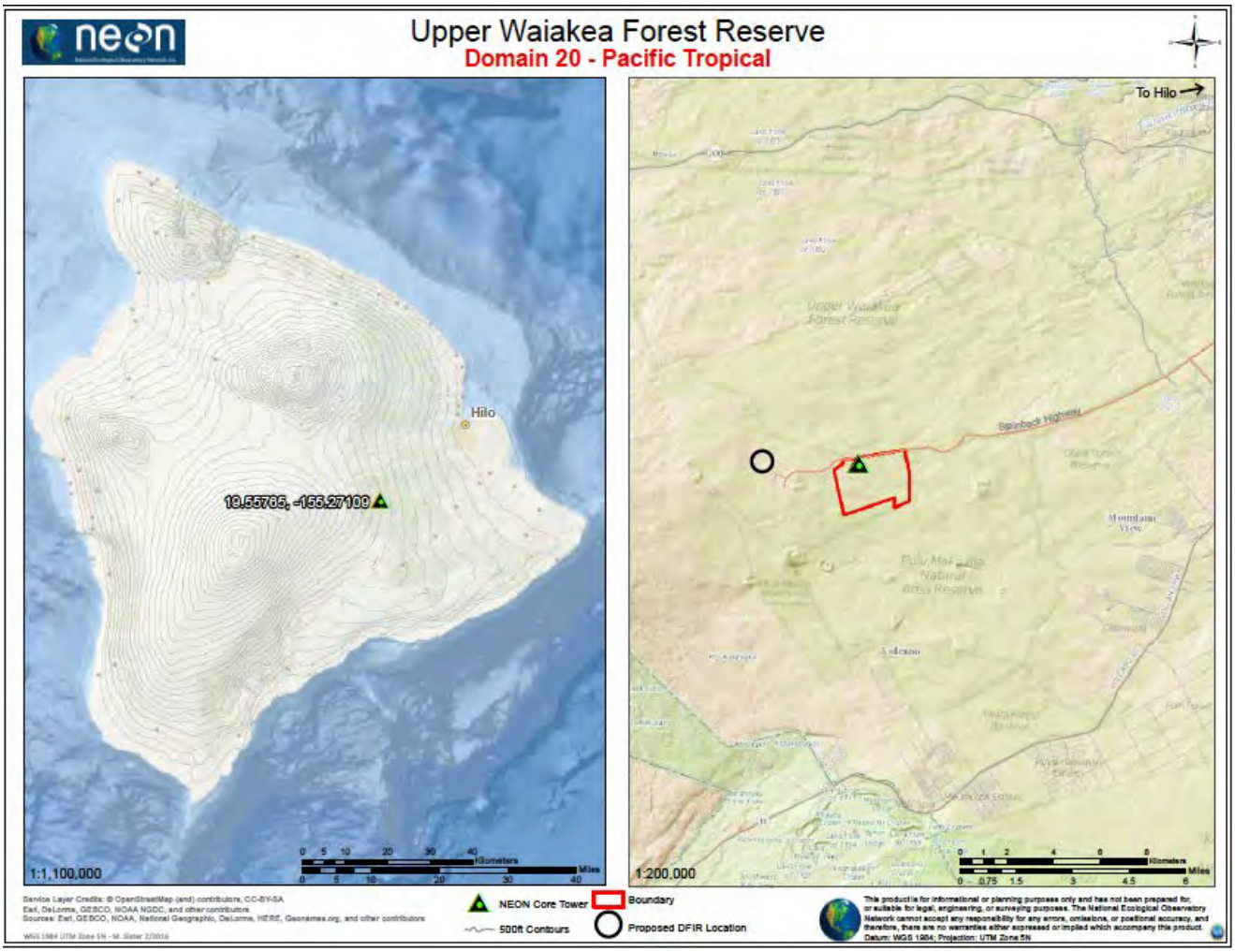
The NEON is a non-profit, continental-scale research network created for discovering, understanding and forecasting the impacts of climate change, land use change and invasive species on continental scale ecology by providing infrastructure to support research, education and environmental management. The NEON approach will standardize scientific ecological efforts and will enable integrated observatory operations at a continental scale.

The NEON partitioned the continental United States, including Alaska, Hawai'i and Puerto Rico, into 20 eco-climatic domains. Each domain represents a different region of vegetation, landforms, climate, and ecosystem performance. Within each of these domains a fully instrumented core site will be established, hosting a tower (21-30 meters tall, approximately 10 meters above the surrounding canopy), infrastructure, sensor systems, terrestrial sampling protocols and annual aerial observation flights. Each site will collect data on climate and atmosphere, soils, vegetation and a variety of organisms. Core sites must be located in minimally managed "wildland" areas and are slated to operate for the 30-year lifetime of NEON.

The proposed NEON Upper Waiakea Forest Reserve/Puu Maka'ala Natural Area Reserve ecological research tower, instrument hut, soil sensor array and supporting infrastructure and foundations would be located approximately at GPS coordinates: 19.55765, -155.27109. Terrestrial sampling would be distributed among sampling plots in the surrounding area of the Puu Maka'ala Natural Area Reserve. Terrestrial plot sampling and associated plot sizes include the following:

- 20 Tower Plots– 20X20 meters
- 30 Base Plots– 40X40 meters
- 6 Tick Plots– 40X40 meters
- 6 Mammal Grids– 90X90 meters
- 5 Bird Grids– 500X500 meters
- 2 Phenology Plots– 200X20 meters
- 10 Mosquito Points– 5X5 meters

No additional roads would be constructed, and strict construction limits would be implemented during the tower construction phase.



Proposed NEON tower location and sampling boundary- note that infrastructure and sampling plot boundaries are currently being refined in consultation with the Division of Forestry and Wildlife

No significant adverse impacts to the existing environmental conditions at the proposed site are anticipated. NEON is currently working with the State of Hawai'i to coordinate a direct lease agreement (12.34 acres), via Section 171-43.1, HRS, as amended, that would encompass the tower, instrument hut, DFIR, and soil sensor array area, as well as a permit to encompass the entire NEON terrestrial sampling area.

PURPOSE OF ENVIRONMENTAL REVIEW

The NSF is conducting an environmental review of the proposed site pursuant to the National Environmental Policy Act (NEPA), which requires that federally funded projects be evaluated for potential environmental effects. Based on the results of public scoping and agency consultation, as well as any needed site surveys, NSF will determine if an Environmental Assessment is required under federal law. Concurrent to this federal review, an Environmental Assessment is being prepared pursuant to the laws of the State of Hawai'i, in compliance with Hawai'i's

Environmental Review Process, Hawai'i Revised Statutes (HRS) and Chapter 343. State law requires that a program or project that proposes the use of State lands or funds must undergo an environmental review. Any Environmental Assessment prepared under the federal and/or state review will examine the potential environmental impacts of the project and seek agency and public comment on the proposed use of the site. Concurrent with the NEPA review, NSF will be assessing impacts to cultural resources and consulting with the State Historic Preservation Office and other consulting parties per Section 106 of the National Historic Preservation Act. The NSF will also be carrying out its compliance with Section 7 of the Endangered Species Act through the NEPA process; compliance with the State of Hawai'i's endangered species law and relevant conservation requirements will be conducted concurrent to this process, as appropriate.

Proposed Agency and Stakeholder Review List

DLNR Agencies

Division of Conservation and Resources Enforcement
Natural Area Reserves Commission
Land Division
Office of Conservation and Coastal Lands
State Historic Preservation Division
Division of Aquatic Resources

Neighboring Landowners and Stakeholders

Gene Alan Rynkewicz /et al.
Christopher J Linden /et al.
James Cobb
Benjamin K S Sr/Ramona Hu Trst Glenda
M White
Palmer Kim /et al.
Russell Kaneko
Attn: James Chow Trs
Tadashi Higaki Tr /et al.
Thomas Jerome Canny
W.H. Shipman Ltd.
Wilbert Castro Jr Trust /et al.
Eleanor R Chow Trst
Dorian Marvin
Keith Eric Hompstead /et al.
Lau Family Tr
Jeffrey Robert Noguchi Vincent Git
Kin Chun /et al.
Lance J Wilson Trst /et al.
Delbert T Cambra /et al.

Miriam L Tocman /et al.
Attn: Duane Rapoza Ttee
Gary R Guenther /et al. Gary
M Urasaki
Kathryn Anne Burton Trst
Attn: Lorna S Ortega Carol
Kanoelani Lum Trst
Randolph Schemkes /et al.
Lori Ann C Lindsey Trst
Ronald T Toyama Trst /et al.
Maria L S Fasone Trust
Jason T Macmurray
Jonathan P Kurtzweil /et al.
Russell Shibata /et al. Robert
William Patey
Daniel Y N Yee Family Tr /et al. John
William Ikaika Crabbe Michael P
Kelley/et al.
Gary Robert Kozanecki /et al.
Margaret L Lipinski Trst Alberta
B Turner /et al. Lucille
Kozanecki Trst Charlotte Nobue
Ng
Daniel J Lutkenhouse /et al.
Francis M Toyama Trst
Melissa L Pang Ching Robert
W Babick
Kanoe M Mc Tavish /et al.
Edward H Aki /et al.
Purdyco Ltd.
Emily M Eissner /et al.
Bong Hee Park /et al.
Louie S Ondo /et al.
Keith & Betty Wilhelm
Sue S Johnson /et al.
Natalie Ann Veriato Trst Elspeth
Kalani Vandaele
Richard Lee
Pierce Trst /et al.
Albert Lindsey Bicknell Jr /et al.
Kirk Black
Manuel Arruda Jr Tr

Kathleen Michelle Demello Trst Grice, Daniel R
B/Christensen, Kathleen A Wendell G Causey
/et al.
Dick Reason /et al.
Brigham Nephi Clifton
Sarah Helena Linfoot
Marshall A Luke Tr
Milton Kaneko David
Harold Ung
Troy Burton Hill /et al. Bruce
James Morgan
Monte Roldan /et al.
Michel Dean Daak Dennis
Delfin Sr /et al. Clifford
Muragin Robin Leinaala
Amador Cory Harden Tr
Michael J Donald James T
Hiyane /et al. Wendell G
Causey /et al.
Arakaki,Charles And Arakaki,Eleanor S
Katrina A Ka'auomoana
Maria Elena Calso Andaya /et al. Glenn Y
Toyama
Gary L Sisneros /et al.
Kaipo Saiki
Priest (Monk) Of Bang San Ho Temple Casimir K
Ah Yo /et al.
Lenore M Vincent /et al.
Thomas Rapoza

Cultural Contacts
Office of Hawaiian Affairs
Historic Hawaii Foundation
Sam Kaleleiki
Ku'ulei Kiliona
Department of Land and Natural Resources
DLNR State Historic Preservation
The Nature Conservancy, Hawaiian Islands

Additional Agencies and Contacts
US Fish & Wildlife Service US Geological Survey, BRD US National Park Service, Hawaii Volcanos - Rhonda Loh
US Forest Service – Jodi Chew

USDA Natural Resources Conservation Service
Waiakea, Puna, Kau, and Hamakua Soil and Water Conservation Districts
NRCS Hilo Service Center
Senator Brian Schatz
Senator Mazie Hirono Attn:
Peter Peshut
Representative Mark Takai
Representative Tulsi Gabbard
USDA Farm Service Agency
Office of Environmental Quality Control
Dept. of Business, Economic Development & Tourism
Department of Defense
Hawaii Department of Public Safety
Hawaii Department of Hawaiian Home
Hawaii Lands Department of
Transportation
Department of Land and Natural Resources
Hawaii Department of Agriculture
Agribusiness Development Corporation
Hawaii Dept. of Health
Representative Cliff Tsuji
Representative Robert Herkes
University of Hawaii
College of Tropical Agriculture and Human Resources
Hilo Public Library
Mountain View Public and School Library
Keaau Public Library
Edwin H. Mookini Library
County of Hawaii
County Civil Defense
County Fire Department
Council Member J Yoshimoto
Council Member Brittany Smart
Namaka Whitehead
Kamakani Dancil
Collen Cole
Cory Harden
Mr. Alan Murakami
Environment Hawaii
Teresa Dawson
Pat Tumons
Joan Yoshioka – Plant Extension
Prevention Program

William Stormont
Springer Kaye – Big Island Invasive Species Committee
Susan Hicks
Wayne Blyth
Dr. Travis Idol
Patty Moriyasu
Deborah Chang
Rob Pacheco
Dr. J.B. Friday
Pat Conant
Dr. Sheila Conant
Richard Hoeflinger
Steven Araujo
Thomas Medeiros
Dr. David Duffy
Sierra McDaniel
Martha Lockwood
Zach Judd
Ronald Fujiyoshi
Steven Hess
Edwin Ung
Danny Li
George DeCosta
Steve Montgomery
Tracy Johnson, US Forest Service Hilo
Ron Terry
Christine Ogura, US FWS
Don Drake
Dr. Fred Stone
Debbie Ward
Dr. Jon Price
Dr. Becky Ostertag
Dr. Pat Hart
Dr. Jim Juvik
Jack Jeffrey
Kevin Chang

Attachment 2
Comments & Responses

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DAVID Y. IGE

VIRGINIA PRESSLER,

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply,

08031PMHK.16

August 18, 2016

Ms. Montona Futrell-Griggs
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, Virginia 22230

Dear Ms. Futrell-Griggs:

SUBJECT: Comments on the Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve, Hawaii Island

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated July 23, 2016, requesting comments on the subject project. The DOH-CWB has reviewed the document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. The National Science Foundation may be responsible for fulfilling additional requirements related to our program. We recommend that they also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/05/Clean-Water-Branch-Std-Comments.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. The National Science Foundation may be required to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55).

   For NPDES general permit coverage, a Notice of Intent (NOI) form must be submitted at least 30 calendar days before the commencement of the discharge. An application

for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, the National Science Foundation must submit the applicable form ("CWB Individual NPDES Form" or "CWB NOI Form") through the e-Permitting Portal and the hard copy certification statement with the respective filing fee ($1,000 for an individual NPDES permit or $500 for a Notice of General Permit Coverage). The National Science Foundation can open the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/. They will be asked to do a one-time registration to obtain your login and password. After they register, they can click on the Application Finder tool and locate the appropriate form. They can then follow the instructions to complete and submit the form.

3. If the National Science Foundation's project involves work in, over, or under waters of the United States, it is highly recommended that they contact the Army Corp of Engineers, Regulatory Branch (Tel: 835-4303) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and HAR, Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

5. It is the State's position that all projects must reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters. Project planning should:

   a. Treat storm water as a resource to be protected by integrating it into project planning and permitting. Storm water has long been recognized as a source of irrigation that will not deplete potable water resources. What is often overlooked is that storm water recharges ground water supplies and feeds streams and estuaries; to ensure that these water cycles are not disrupted, storm water cannot be relegated as a waste product of impervious surfaces. Any project

planning must recognize storm water as an asset that sustains and protects natural ecosystems and traditional beneficial uses of State waters, like community beautification, beach going, swimming, and fishing. The approaches necessary to do so, including low impact development methods or ecological bio-engineering of drainage ways must be identified in the planning stages to allow designers opportunity to include those approaches up front, prior to seeking zoning, construction, or building permits.

b. Clearly articulate the State's position on water quality and the beneficial uses of State waters. The plan should include statements regarding the implementation of methods to conserve natural resources (e.g., minimizing potable water for irrigation, gray water re-use options, energy conservation through smart design) and improve water quality.

c. Consider storm water Best Management Practice (BMP) approaches that minimize the use of potable water for irrigation through storm water storage and reuse, percolate storm water to recharge groundwater to revitalize natural hydrology, and treat storm water which is to be discharged.

d. Consider the use of green building practices, such as pervious pavement and landscaping with native vegetation, to improve water quality by reducing excessive runoff and the need for excessive fertilization, respectively.

e. Identify opportunities for retrofitting or bio-engineering existing storm water infrastructure to restore ecological function while maintaining, or even enhancing, hydraulic capacity. Particular consideration should be given to areas prone to flooding, or where the infrastructure is aged and will need to be rehabilitated.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

MHK

c: National Science Foundation [via e-mail NEON-EA-comments@nsf.gov]
DOH-EPO [via e-mail Noella.Narimatsu@doh.hawaii.gov only]

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Clean Water Branch
919 Ala Moana Blvd., Rm. 301
Honolulu, HI 96814-4920

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Ms. Montona Futrell-Griggs
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, Virginia 22230

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National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Alec Wong
Chief, Clean Water Branch
State of Hawai'i
Department of Health
P.O. Box 3378
Honolulu, HI 96801-3378

April 26, 2017

RE: 08031PMHK.16; Comments on the Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve

Dear Alec,

I apologize for the delayed response to the letter from the State of Hawai'i Department of Health.

Thank you for the response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The information provided was evaluated and, as appropriate, incorporated into the EA and Biological Evaluation being developed to evaluate the potential impacts of the proposed project on the Hawaiian cultural resources as well as environmental conditions in the area of potential effect in the Pu'u Maka'ala Natural Area Reserve. The information provided will also be used to update proposed management practices and construction plans for the site.

The National Science Foundation anticipates the EA will be published in May 2017. Copies of your comment and this response will be attached in an appendix.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
DBI/BIO
National Science Foundation

United States Department of the Interior

NATIONAL PARK SERVICE
Hawai'i Volcanoes National Park
Post Office Box 52
Hawaii National Park, Hawai'i 96718

IN REPLY REFER TO:
HAVO 1.D. (L7621)

August 18, 2016

Ms. Montona Futrell-Griggs
National Science Foundation
4201 Wilson Blvd, Suite 615N
Arlington, VA 22230

RE: NEON Pu'u Maka'ala Natural Area Reserve

Dear Ms. Futrell-Griggs,

Thank you for the scoping notice sent to the Rhonda Loh at Hawai'i Volcanoes National Park regarding the proposed NEON tower and sampling site at Pu'u Maka'ala Natural Area Reserve.

We recommend that best management practices be included in the project specifications to minimize the potential for introduction and spread of invasive species. We recommend that the best management practices include sanitation procedures for ensuring vehicles, equipment, and materials are free of invasive species, including invasive ants (such as, little fire ants and others), coqui frogs, fungus, and invasive plants. We are including standard operating procedures that we use at the park, for your information.

If any lights are needed for night work, we recommend that dark sky lighting protocols be followed. This will protect threatened and endangered nocturnal seabirds that may be transiting the area, such as the endangered Hawaiian petrel, the threatened Newell's shearwater, and the band-rumped storm-petrel (candidate for listing). While these species may not occur on the project site, they do fly to and from nesting colonies after dark and could be disoriented by artificial lights that are not properly shielded. In order to protect night skies and night-flying birds, it is recommended that only full cut-off, amber (560 nm or longer wavelength), downward directional lighting be considered for this project if lighting is necessary.

An excellent resource for seabird friendly lighting can be found at the following website:
http://www.kauai-seabirdhcp.info/lighting-homes-businesses/
We look forward to working with you in the future on jointly shared resources of concern.

The scoping notice indicates that helicopters may be used for an annual aerial flight. While the proposed location for the tower is not adjacent to the park, Pu'u Maka'ala Natural Area Reserve is adjacent to three sides of an area of the park that is designated wilderness ('Ōla'a). We request that you consider overflight impacts to wilderness character and include mitigations that flights over the nearby wilderness area will be at least 1,500 feet above ground level (if feasible) and the

park will be notified prior to flights. Notifying the park in advance of flights will also ensure there are no airspace conflicts with the occasional flights the park conducts for resource management work in remote areas.

Please include the park as a consulting party on your Section 106 Consultation list. Jadelyn Moniz-Nakamura is the park's Section 106 Coordinator. Her contact information is (808) 985-6136 or jadelyn_moniz-nakamura@nps.gov.

If you have questions on our comments, please contact Danielle Foster, Environmental Protection Specialist, at (808) 985-6073 or danielle_foster@nps.gov. Please include the park on the mailing list for future notifications regarding this project.

Sincerely,

Cynthia L. Orlando
Superintendent

Enclosures

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
HAWAII VOLCANOES NATIONAL PARK
P.O. BOX 52
HAWAII 96718-0052

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AUG 23 2016
By

Ms. Montona Futrell-Griggs
National Science Foundation
4201 Wilson Blvd, Suite 615N
Arlington, VA 22230

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National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Danielle Foster
Environmental Protection Specialist
National Park Service
Hawai'i Volcanoes National Park
P.O. Box 52
Hawai'i National Park, HI 96718

April 26, 2017

RE: HAV0 1.D. (L7621); NEON Pu'u Maka'ala Natural Area Reserve

Dear Danielle,

I apologize for the delayed response to the letter from the NPS Hawai'i Volcanoes National Park.

Thank you for the response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The information provided was evaluated and, as appropriate, incorporated into the EA and Biological Evaluation being developed to evaluate the potential impacts of the proposed project on the Hawaiian cultural resources as well as environmental conditions in the area of potential effect in the Pu'u Maka'ala Natural Area Reserve. The information provided will also be used to update proposed management practices and construction plans for the site. Please note, the annual flyover for data collection in a Twin Otter aircraft is being evaluated and may be reduced.

The National Science Foundation anticipates the EA will be published in May 2017. Copies of your comment and this response will be attached in an appendix.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences
National Science Foundation

DAVID Y. IGE
Governor

SHAN S. TSUTSUI
Lt. Governor

SCOTT E. ENRIGHT
Chairperson, Board of Agriculture

PHYLLIS SHIMABUKURO-GEISER
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 FAX: (808) 973-9613

August 22, 2016

RE: Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawaii Island.

Aloha Ms. Montona Futrell-Griggs and the National Science Foundation:

Thank for the opportunity to comment on this proposal. The Hawaii Department of Agriculture (HDOA) has an overall concern for the potential spread of Rapid Ohia Death (ROD) in regards to this project. As construction begins for this project on Hawaii Island, HDOA would like to know if the National Science Foundation has taken into consideration any sort of decontamination protocols for entering and exiting areas with ROD and if there are any protocols for soil sampling disposal. One of the major vectors of concern for this devastating disease is the use of construction equipment without any decontamination requirements.

HDOA asks the National Science Foundation to provide an explanation of guidelines and protocols to address ROD as it relates to this project's construction equipment movement into and out of the proposed site.

Mahalo for your consideration of HDOA's comments and concerns. Should you have any questions, please feel free to contact the HDOA Deputy Phyllis Shimabukuro-Geiser at Phyllis.Shimabukuro-Geiser@hawaii.gov or 973-9550.

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Phyllis Shimabukuro-Geiser
HDOA Deputy
State of Hawai'i
Department of Agriculture
1428 South King Street
Honolulu, HI 96814-2512

April 26, 2017

RE: 08031PMHK.16; Comments on the Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve

Dear Phyllis,

I apologize for the delayed response to the letter from the State of Hawai'i Department of Agriculture.

Thank you for the response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The National Science Foundation (NSF) and the awardee, Battelle Memorial Institute, appreciate of the concerns related to the Rapid 'Ohi'a Death and are aware of the dangers of its and other invasive species spread into the Pu'u Maka'ala Natural Area Reserve. Decontamination procedures, consistent with those recommended by the resource agencies and used by DOFAW and NARS staff, would be implemented throughout the construction and operation phase of the NEON project. These include avoiding movement or transport of *'ōhi'a* wood, cleaning tools used to cut *'ōhi'a*, cleaning gear and clothing/shoes before and after entering the forest, and washing vehicles that are taken off-road.

The decontamination procedures are listed below; any future modifications or additions to these procedures will be adopted for the proposed project, as appropriate.

- A survey of the proposed project site would be conducted no more than two weeks before any tree cutting to determine if there are any infected *'ōhi'a* trees. If infected *'ōhi'a* are suspected at the site, the appropriate agencies would be contacted for further guidance (including USFWS, University of Hawai'i Cooperative Extension Service, USDA Forest Service, and USDA Agriculture Research Service).

- Tools used to cut *'ōhi'a* would be cleaned with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. If a bleach solution is used, tools would be oiled afterwards to prevent corrosion. Chainsaw blades would be brushed clean, sprayed with the cleaning solution, and run briefly to lubricate the chain.
- Personal gear, including shoes and clothes, would be cleaned before and after entering the forest. Shoes would be brushed to remove soil, then sprayed with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. Other personal gear would also be sprayed with the cleaning solution. Clothing would be washed with hot water and detergent.
- Vehicles used off-road or in infected forest areas would be thoroughly cleaned using a pressure-washer and detergent. All soil would be removed from the tires and vehicle undercarriage.
- If clearing or trimming of *'ōhi'a* is required for the proposed project, the cut wood would be left onsite and would not be transported.

These procedures are included in the EA and Biological Evaluation being developed to evaluate the potential impacts of the proposed project on the Hawaiian cultural resources as well as environmental conditions in the area of potential effect in the Pu'u Maka'ala Natural Area Reserve. The NSF anticipates the EA will be published in May 2017. Copies of your comment and this response will be attached in an appendix.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences
National Science Foundation

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 22, 2016

8/23,
Note: We emailed twice & both times it was rejected. Ou apologies for the dela U.S.P.S. & not email Lydia Mori

National Science Foundation
Attention: Ms. Montona Futrell-Griggs
4201 Wilson Boulevard; Suite 615N
Arlington, Virginia 2230

via email: NEON-EA-comm

Dear Ms. Futrell-Griggs::

SUBJECT: Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from the Land Division – Hawaii District on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure
cc: Central Files

RECEIVED
LAND DIVISION
2016 AUG 18 PM 1:41
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

2016 AUG 17 P 1:33
RECEIVED
LAND DIVISION
HILO, HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 12, 2016

MEMORANDUM

TO: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
_X_ Engineering Division
_X_ Div. of Forestry & Wildlife
___Div. of State Parks
___Commission on Water Resource Management
_X_ Office of Conservation & Coastal Lands
_X_ Land Division – Hawaii District
_X_ Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve
LOCATION: Pu'u Maka'ala Natural Reserve, Island of Hawaii; TMK: (3) 2-4-008:009, 019, 025; 1-8-012:003; & 1-9-001:001
APPLICANT: National Science Foundation

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **August 22, 2016.**

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

FAXED 8/18/16

8/18/16
To: Lydia Morikawa
From: HDLO

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed:

Print Name: GORDON C. HEIT
Date: 8/18/16

cc: Central Files

AFTER 10 DAYS, RETURN TO

DEPARTMENT OF LAND AND NATURAL RESOURCES

LAND DIVISION

P.O. BOX 621

HONOLULU, HAWAII 96809

HONOLULU
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RECEIVED
AUG 29 2016

22230-000299

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Lydia Morikawa
Land Division
State of Hawai'i
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

April 26, 2017

Subject: Response to Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve

Dear Lydia,

I apologize for the delayed response to the letter from the State of Hawai'i Department of Land and Natural Resources Land Division. I also apologize for the fact that the email was rejected.

Thank you for the response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The National Science Foundation anticipates the EA will be published in May 2017. Copies of your comment and this response will be attached in an appendix.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions in the future.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences
National Science Foundation

Subject: FW: scoping Comments for NEON site [correspondence HA 17-37]
Date: Friday, August 26, 2016 at 5:47:52 PM Eastern Daylight Time
From: Mills, Kimberly T
To: Futrell-Griggs, Montona LaNise
Attachments: image001.jpg

Hi!
Sorry I was out of the Office the past 2 days below is our comments for the project
Have a great weekend
~Tiger

K. Tiger Mills, Staff Planner
State of Hawai`i
Department of Land and Natural Resources
Office of Conservation And Coastal Lands
P.O. Box 621
Honolulu, Hawai`i 96809
www.dlnr.hawaii.gov/occl

From: Mills, Kimberly T
Sent: Tuesday, August 23, 2016 2:18 PM
To: 'NEON-EA-comments@nsf.gov'
Subject: scoping Comments for NEON site [correspondence HA 17-37]

My apologies,
These comments are late.

The subject area appears to lie within the Resource subzone of the Conservation District.

With the initial information given, PRELIMINARILY, it appears a Conservation District Use Application (CDUA) should be filed for the proposed use pursuant to the Hawaii Administrative Rules (HAR) Section 13-5-22, P-1 Data Collection (D-1)Data collection, research, education, and resource evaluation that involves permanent facilities or structures larger than 500 square feet or a land use causing significant ground disturbance or impact to a natural resource. This would require a Board permit. To allow, modify or deny the proposed land use would be at the discretion of the Board of Land and Natural Resources.

Chapter 13-5, Hawaii Administrative Rules, the rules and regulations of the Conservation District, are

Subject: Re: scoping Comments for NEON site [correspondence HA 17-37]
Date: Friday, August 26, 2016 at 5:51:00 PM Eastern Daylight Time
From: Futrell-Griggs, Montona LaNise
To: Mills, Kimberly T
Attachments: image001.jpg

Thanks Tiger,

Have a great weekend too!

Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

From: "Mills, Kimberly T" <kimberly.mills@hawaii.gov>
Date: Friday, August 26, 2016 at 5:47 PM
To: "Futrell-Griggs, Montona LaNise" <mfutrell@nsf.gov>
Subject: FW: scoping Comments for NEON site [correspondence HA 17-37]

Hi!
Sorry I was out of the Office the past 2 days below is our comments for the project
Have a great weekend
~Tiger

K. Tiger Mills, Staff Planner
State of Hawai`i
Department of Land and Natural Resources
Office of Conservation And Coastal Lands
P.O. Box 621
Honolulu, Hawai`i 96809
www.dlnr.hawaii.gov/occl




Subject: Re: scoping Comments for NEON site [correspondence HA 17-37]
Date: Friday, April 28, 2017 at 1:35:50 PM Eastern Daylight Time
From: Futrell-Griggs, Montona
To: Mills, Kimberly T
Attachments: image001.jpg

Dear Tiger,

I would like to formally thank you for the information provided in your response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The National Science Foundation anticipates the EA will be published in May 2017. Copies of your letter and this response will be attached in an appendix to the EA.

Best,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

From: "Futrell-Griggs, Montona LaNise" <mfutrell@nsf.gov>
Date: Friday, August 26, 2016 at 5:51 PM
To: "Mills, Kimberly T" <kimberly.mills@hawaii.gov>
Subject: Re: scoping Comments for NEON site [correspondence HA 17-37]

Thanks Tiger,

Have a great weekend too!

Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

William P. Kenoi
Mayor

Darren J. Rosario
Fire Chief

Renwick J. Victorino
Deputy Fire Chief

County of Hawai'i
HAWAI'I FIRE DEPARTMENT
25 Aupuni Street • Suite 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

August 25, 2016

Steven Ellis, Program Director
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

SUBJECT: Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island

In regards to the above-mentioned Use Permit application, the following shall be in accordance:

Hawai'i Fire Department access to Tower and Electrical Infrastructure.

NFPA 1, UNIFORM FIRE CODE, 2006 EDITION
Note: Hawai'i State Fire Code, National Fire Protection Association 2006 version, with County of Hawaii amendments. County amendments are identified with a preceding "C~" of the reference code.

Chapter 18 Fire Department Access and Water Supply, Section 18.2.

18.2 Fire Department Access.

18.2.1 Fire department access and fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2* Access to Structures or Areas.

18.2.2.1 Access Box(es). The AHJ shall have the authority to require an access box(es) to be installed in an accessible location where access to or within a structure or area is difficult because of security.

18.2.2.2 Access to Gated Subdivisions or Developments. The AHJ shall have the authority to require fire department access be provided to gated subdivisions or developments through the use of an approved device or system.

18.2.2.3 Access Maintenance. The owner or occupant of a structure or area, with required fire department access as specified in 18.2.2.1 or 18.2.2.2, shall notify the AHJ when the access is modified in a manner that could prevent fire department access.

18.2.3 Fire Department Access Roads. (*may be referred as FDAR)

18.2.3.1 Required Access.

18.2.3.1.1 Approved fire department access roads shall be provided for every facility, building, or portion of a building hereafter constructed or relocated.

18.2.3.1.2 Fire Department access roads shall consist of roadways, fire lanes, parking lots lanes, or a combination thereof.

18.2.3.1.3* When not more than two one- and two-family dwellings or private garages, carports, sheds, agricultural buildings, and detached buildings or structures 400ft^2 (37 m^2) or less are present, the requirements of 18.2.3.1 through 18.2.3.2.1 shall be permitted to be modified by the AHJ.

18.2.3.1.4 When fire department access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection features.

18.2.3.2 Access to Building.

18.2.3.2.1 A fire department access road shall extend to within in 50 ft (15 m) of at least one exterior door that can be opened from the outside that provides access to the interior of the building. Exception: 1 and 2 single-family dwellings.

18.2.3.2.1.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.1 shall be permitted to be increased to 300 feet.

18.2.3.2.2 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

18.2.3.2.2.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 450 ft (137 m).

18.2.3.3 Multiple Access Roads. More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

18.2.3.4 Specifications.

18.2.3.4.1 Dimensions.

C~ 18.2.3.4.1.1 FDAR shall have an unobstructed width of not less than 20ft with an approved turn around area if the FDAR exceeds 150 feet. **Exception:** FDAR for one and two family dwellings shall have an unobstructed width of not less than 15 feet, with an area of not less than 20 feet wide within 150 feet of the structure being protected. An approved turn around area shall be provided if the FDAR exceeds 250 feet.

C~ 18.2.3.4.1.2 FDAR shall have an unobstructed vertical clearance of not less then 13ft 6 in.

C~ 18.2.3.4.1.2.1 Vertical clearances may be increased or reduced by the AHJ, provided such increase or reduction does not impair access by the fire apparatus, and approved signs are installed and maintained indicating such approved changes.

18.2.3.4.1.2.2 Vertical clearances shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

C~ 18.2.3.4.2 Surface. Fire department access roads and bridges shall be designed and maintained to support the imposed loads (25 Tons) of the fire apparatus. Such FDAR and shall be comprised of an all-weather driving surface.

18.2.3.4.3 Turning Radius.

C~ 18.2.3.4.3.1 Fire department access roads shall have a minimum inside turning radius of 30 feet, and a minimum outside turning radius of 60 feet.

18.2.3.4.3.2 Turns in fire department access road shall maintain the minimum road width.

18.2.3.4.4 Dead Ends. Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around.

18.2.3.4.5 Bridges.

18.2.3.4.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with county requirements.

18.2.3.4.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

18.2.3.4.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

18.2.3.4.6 Grade.

C~ 18.2.3.4.6.1 The maximum gradient of a Fire department access road shall not exceed 12 percent for unpaved surfaces and 15 percent for paved surfaces. In areas of the FDAR where a Fire apparatus would connect to a Fire hydrant or Fire Department Connection, the maximum gradient of such area(s) shall not exceed 10 percent.

18.2.3.4.6.2* The angle of approach and departure for any means of fire department access road shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m) or the design limitations of the fire apparatus of the fire department, and shall be subject to approval by the AHJ.

18.2.3.4.6.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire lane.

18.2.3.4.7 Traffic Calming Devices. The design and use of traffic calming devices shall be approved the AHJ.

18.2.3.5 Marking of Fire Apparatus Access Road.

18.2.3.5.1 Where required by the AHJ, approved signs or other approved notices shall be provided and maintained to identify fire department access roads or to prohibit the obstruction thereof of both.

18.2.3.5.2 A marked fire apparatus access road shall also be known as a fire lane.

18.2.4* Obstruction and Control of Fire Department Access Road.

18.2.4.1 General.

18.2.4.1.1 The required width of a fire department access road shall not be obstructed in any manner, including by the parking of vehicles.

18.2.4.1.2 Minimum required widths and clearances established under 18.2.3.4 shall be maintained at all times.

18.2.4.1.3* Facilities and structures shall be maintained in a manner that does not impair or impede accessibility for fire department operations.

18.2.4.1.4 Entrances to fire departments access roads that have been closed with gates and barriers in accordance with 18.2.4.2.1 shall not be obstructed by parked vehicles.

18.2.4.2 Closure of Accessways.

18.2.4.2.1 The AHJ shall be authorized to require the installation and maintenance of gates or other approved barricades across roads, trails, or other accessways not including public streets, alleys, or highways.

18.2.4.2.2 Where required, gates and barricades shall be secured in an approved manner.

18.2.4.2.3 Roads, trails, and other access ways that have been closed and obstructed in the manner prescribed by 18.2.4.2.1 shall not be trespassed upon or used unless authorized by the owner and the AHJ.

18.2.4.2.4 Public officers acting within their scope of duty shall be permitted to access restricted property identified in 18.2.4.2.1.

18.2.4.2.5 Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by the fire department or by its order or under its control shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

If there are any questions regarding these requirements, please contact the Fire Prevention Bureau at (808) 932-2911.

DARREN J. ROSARIO
Fire Chief

RP:ds

HAWAII COUNTY FIRE DEPARTMENT
25 Aupuni Street, Suite 2501
Hilo, Hawaii 96720

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Steven Ellis, Program Director
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

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National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Darren J. Rosario
Fire Chief
County of Hawai'i
Hawai'I Fire Department
25 Aupuni Street, Suite 2501
Hilo, Hawai'i 96720

Subject: Response to the Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve

Dear Darren,

I apologize for the delayed response to your letter.

Thank you for the information provided in your response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The National Science Foundation anticipates the EA will be published in May 2017. Copies of your letter and this response will be attached in an appendix.

Please contact me (phone: 703-292-7876, email: stellis@nsf.gov) or Montona Futrell-Griggs (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Steven E. Ellis, Ph.D.
Division of Biological Infrastructure
BIO Directorate
National Science Foundation

Subject: FW: NEON Puʻu Makaʻala Natural Area Reserve
Date: Thursday, August 25, 2016 at 4:10:18 PM Eastern Daylight Time
From: Watanabe, Shancy
To: Futrell-Griggs, Montona LaNise
Attachments: Plan Approval Application Form (saved from online 01-31-2014).pdf

Aloha Ms. Montona Futrell-Griggs,

Good morning. Thank you for taking my phone call this morning and providing an alternative email, as the email sent below was returned back to me unsent.

Please see our office comments below.

If you have any questions, please call me at (808)961-8288 ext. 8144.

Thank you,
Mahalo nui loa,
Shancy

From: Watanabe, Shancy
Sent: Thursday, August 25, 2016 9:57 AM
To: 'neon-ea-comments@nsf.gov' <neon-ea-comments@nsf.gov>
Subject: NEON Puʻu Makaʻala Natural Area Reserve

Aloha Ms. Montona Futrell-Griggs,

Good morning. Thank you for your letter inquiry for comments. Please accept my apology for the delay in response. Our office confirmed that zoning below for the subject properties:

TMK: (3)	County Zoning:	State Land Use:	Critical Habitats:
2--4--008:0	Forest Reserve	Conservation	Yes
2--4--008:0	Forest Reserve	Conservation	Yes
1--9--001:0	Forest Reserve	Conservation	Yes
1--8--012:0	Forest Reserve	Conservation	Yes
2--4--008:0	Forest Reserve	Conservation	Yes

Please note that a structure placed on the subject property will require a Plan Approval. The Plan Approval process takes thirty (30) days. Please see the following attachment for the Plan Approval form.

If you have any questions, please call me at (808)961-8288 ext. 8144.

Thank you,
Mahalo nui loa,
Ms. Shancy H. Watanabe

Subject: Re: NEON Pu‘u Maka‘ala Natural Area Reserve
Date: Thursday, August 25, 2016 at 4:11:50 PM Eastern Daylight Time
From: Futrell-Griggs, Montona LaNise
To: Watanabe, Shancy

Good afternoon,

I have received your comments and the Plan Approval form.

Thank you,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

From: "Watanabe, Shancy" <Shancy.Watanabe@hawaiicounty.gov>
Date: Thursday, August 25, 2016 at 4:10 PM
To: "Futrell-Griggs, Montona LaNise" <mfutrell@nsf.gov>
Subject: FW: NEON Pu‘u Maka‘ala Natural Area Reserve

Aloha Ms. Montona Futrell-Griggs,

Good morning. Thank you for taking my phone call this morning and providing an alternative email, as the email sent below was returned back to me unsent.

Please see our office comments below.

If you have any questions, please call me at (808)961-8288 ext. 8144.

Thank you,
Mahalo nui loa,
Shancy

From: Watanabe, Shancy
Sent: Thursday, August 25, 2016 9:57 AM
To: 'neon-ea-comments@nsf.gov' <neon-ea-comments@nsf.gov>
Subject: NEON Pu‘u Maka‘ala Natural Area Reserve

Aloha Ms. Montona Futrell-Griggs,

Good morning. Thank you for your letter inquiry for comments. Please accept my apology for the delay in response. Our office confirmed that zoning below for the subject properties:

Subject: Re: NEON Pu‘u Maka‘ala Natural Area Reserve
Date: Friday, April 28, 2017 at 1:36:35 PM Eastern Daylight Time
From: Futrell-Griggs, Montona
To: Watanabe, Shancy

Dear Shancy,

I would like to formally thank you for the information provided in your response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The National Science Foundation anticipates the EA will be published in May 2017. Copies of your letter and this response will be attached in an appendix to the EA.

Best,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

From: "Watanabe, Shancy" <Shancy.Watanabe@hawaiicounty.gov>
Date: Thursday, August 25, 2016 at 4:10 PM
To: "Futrell-Griggs, Montona LaNise" <mfutrell@nsf.gov>
Subject: FW: NEON Pu‘u Maka‘ala Natural Area Reserve

Aloha Ms. Montona Futrell-Griggs,

Good morning. Thank you for taking my phone call this morning and providing an alternative email, as the email sent below was returned back to me unsent.

Please see our office comments below.

If you have any questions, please call me at (808)961-8288 ext. 8144.

Thank you,
Mahalo nui loa,
Shancy

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
01EPIF00-2016-TA-0479

Mr. Steven Ellis, Program Director
Division of Biological Infrastructure
Biological Sciences Directorate
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

SEP 12 2016

Subject: Technical Assistance for Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve, Hawaii Island

Dear Mr. Ellis:

The U.S. Fish and Wildlife Service (Service) received your letter on August 11, 2016, requesting technical assistance for the National Science Foundation-funded proposed National Ecological Observatory Network (NEON) Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve (Puu Makaala NAR), Hawaii Island. The proposed site is to provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawaii," and would be the only site representing this domain in the United States. Site components would include an ecological research tower proposed to be approximately 30.5 meters tall, instrument hut, soil array, Double Fence Intercomparison Reference (DFIR) precipitation gauge (with required vegetation clearance area), and associated electrical infrastructure with power run. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area in the Puu Makaala NAR. Terrestrial plot sampling and associated plot size would include the following: 20 Tower Plots-40x40 m; 6 Tick Plots-40x40 m; 30 Base Plots-40x40 m; 6-8 Mammal Grids-90x90 m; 5-15 Bird Grids-500x500 m; 2 Phenology Plots-200x200 m; and 10 Mosquito Points-5x5 m. The proposed project area including plots encompasses TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003 and TMK(3) 2-4-008:019, and would be permitted by the State of Hawaii via a Natural Area Reserve System (NARS) Special Use Permit and OCCL Use Permit.

Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Project, there is one federally listed mammal in the vicinity of the project area, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*); eight federally listed birds, including the Hawaiian crow or alala (*Corvus hawaiiensis*), nene (*Branta sandvicensis*), Hawaiian hawk or io (*Buteo solitarius*), akiapolaau (*Hemignathus munroi*), Hawaii creeper, (*Oreomystis mana*), Hawaii akepa (*Loxops coccineus*), Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus newelli*); one

bird species proposed for listing, the band-rumped storm-petrel (*Oceanodroma castro*); and one bird species petitioned for listing, the iiwi (*Vestiaria coccinea*). There are fifteen federally listed plants in the vicinity of the project area: palai laau (*Adenophoros periens*), Mauna Loa silversword (*Argyroxiphum kauense*), *Asplenium peruvianum var. insulare*, oha wai (*Clermontia lindseyana*), oha wai (*Clermontia peleana*), haha (*Cyanea coplanadii*), akuaku (*Cyanea platyphylla*), haha (*Cyanea shipmanii*), haha (*Cyanea stictophylla*), haiwale (*Cyrtandra giffardii*), haiwale (*Cyrtandra tintinnabula*), kiponapona (*Pyllostegia racemosa*), *Phyllostegia velutina*, anunu (*Sicyos alba*), and Hawaiian vetch (*Vicia menziesii*). There is no proposed or final critical habitat within the vicinity of the project area. The Service recommends the following measures to avoid and minimize project impacts to listed species:

Hawaiian hoary bat

The Hawaiian hoary bat is known to occur across a broad range of habitats throughout the State of Hawaii. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June 1 to September 15), there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. The Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service therefore recommends that barbed wire not be used for fencing as part of this proposed action.

Hawaiian hawk

The Hawaiian hawk is known to occur across a broad range of forest habitats throughout the Island of Hawaii. Loud, irregular and unpredictable activities, such as using heavy equipment or building a structure, near an endangered Hawaiian hawk nest may cause nest failure. Harassment of Hawaiian hawk nesting sites can alter feeding and breeding patterns or result in nest or chick abandonment. Nest disturbance can also increase exposure of chicks and juveniles to inclement weather or predators. If any ground clearing or construction will occur during the Hawaiian hawk breeding season (March through September), we recommend a nest search of the project footprint and surrounding areas be conducted by a qualified ornithologist immediately prior to the start of construction activities. Pre-disturbance surveys for Hawaiian hawks are only valid for 14 days. If disturbance for the specific location does not occur within 14 days of the survey, another survey will be required. Surveys should ensure that construction activity will not occur within 1,600 feet of any Hawaiian hawk nest. If nesting Hawaiian hawks are present in the action area or within 1,600 feet of the action area, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Nene

The nene is currently found on all the main islands except Lanai and Kahoolawe. Nene are known to occupy various habitat and vegetation community types ranging from coastal dune vegetation and non-native grasslands (such as golf courses, pastures, and rural areas) to sparsely vegetated low- and high-elevation lava flows, mid-elevation native and non-native shrubland, cinder deserts, native alpine grasslands and shrublands, and open and nonnative alpine shrubland-woodland community interfaces. Nene do not occur in closed forest areas. Nene have an extended breeding season with eggs reported from all months except May, June, and July, although the majority of birds in the wild nest during the rainy (winter) season between October

and March. Nesting peaks in December and most goslings hatch from December to January. Nene nest on the ground, in a shallow scrape in the dense shade of a shrub or other vegetation. To avoid adverse impacts to nene, we recommend a qualified individual conduct surveys at the proposed project site for presence of nene prior to project(s) initiation. We further recommend if a nene is observed, or flies into the site while activities are occurring, all activities be halted within 100-ft (30-m) of the individual(s), and work should not resume until the nene leave the area on their own accord.

Forest Birds

Akiapolaau, Hawaii creeper, and Hawaii akepa, and iiwi (collectively known as forest birds) occur in forest habitats throughout the Island of Hawaii. The Hawaiian crow is planned to be introduced to Puu Makaala NAR in fall 2016. Loud, irregular and unpredictable activities, such as using heavy equipment or building a structure, near a nest of these species may cause nest failure. Harassment of nesting sites can alter feeding and breeding patterns or result in nest or chick abandonment. Nest disturbance can also increase exposure of chicks and juveniles to inclement weather or predators. If any ground clearing or construction will occur during the breeding season for these species (February through July), we recommend a nest search of the project footprint and surrounding areas be conducted by a qualified ornithologist immediately prior to the start of construction activities. Pre-disturbance surveys are only valid for 14 days. If disturbance for the specific location does not occur within 14 days of the survey, another survey will be required. Surveys should ensure that construction activity will not occur within 500 feet of any nest of Akiapolaau, Hawaii creeper, and Hawaii akepa, and 1,600 feet of any nest of Hawaiian crow. If listed forest birds are present in the action area or within 500 feet of the action area for Akiapolaau, Hawaii creeper, and Hawaii akepa and 1,600 feet of the action area for Hawaiian crow, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Seabirds

Hawaiian petrels, Newell's shearwaters and band-rumped storm-petrels (collectively known as seabirds) are known to transit over the project area when flying between the ocean and upland breeding colonies. Many bird species are known to strike objects, such as antennas or guywires, protruding above surrounding vegetation. In Hawaii, seabirds are attracted to lights and are known to collide with buildings, light poles, wires, and other tall objects. Any lights associated with the projects should be cut-off, equipped with a motion sensor, or shielded so that the light cannot be seen from above. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as small Indian mongoose (*Herpestres auropunctatus*), cats (*Felis catus*), and dogs (*Canis familiaris*). We therefore recommend avoiding or minimizing use of artificial lighting and avoiding night work if possible. If artificial lighting must be used we recommend this be shielded so the bulb is not visible at or above bulb-height. If night work must be conducted this should take place outside the sea bird fledging season (September 15 through December 15) and should utilize shielded lighting.

Plants

Listed plants are distributed throughout the Puu Makaala NAR. We recommend close coordination with Hawaii NARS to fully avoid any adverse impacts to listed plants during installation of proposed sampling grids.

Technical Assistance Regarding Rapid Ohia Death

Rapid Ohia Death (ROD), a newly identified disease, has killed large numbers of mature ohia trees (*Metrosideros polymorpha*) in forests and residential areas of Hawaii Island. The disease is caused by a vascular wilt fungus (*Ceratocystis fimbriata*). Crowns of affected trees turn yellowish or brown within days to weeks and dead leaves typically remain on branches for some time. All ages of ohia trees can be affected and can have symptoms of browning of branches or leaves. As of early 2015 the disease was confined to Hilo and the Puna district on Hawaii Island, but has since been confirmed in Volcano, South Kona, and Hamakua districts. Additional information on ROD can be found at http://www2.ctahr.hawaii.edu/forestry/downloads/ROD-trifold-03.2016.pdf and http://www2.ctahr.hawaii.edu/forestry/disease/ohia_wilt.html.

Many of our listed species are reliant on native ohia forest. The following avoidance and minimization measures should be followed for projects working in ohia forests or at sites with ohia trees on Hawaii Island:

- A survey of the proposed project site should be conducted within two weeks prior to any tree cutting to determine if there are any infected ohia trees. If infected ohia are suspected at the site, the following agencies should be contacted for further guidance.
    - USFWS – please contact the name at the bottom of this letter
    - Dr. J.B. Friday, University of Hawaii Cooperative Extension Service, 808-969-8254 or jbfriday@hawaii.edu
    - Dr. Flint Hughes, USDA Forest Service, 808-854-2617, fhughes@fs.fed.us
    - Dr. Lisa Keith, USDA Agriculture Research Service, 808-959-4357, Lisa.Keith@ars.usda.gov

- Both prior to cutting ohia and after the project is complete:
    - Tools used for cutting infected ohia trees should be cleaned with a 70 percent rubbing alcohol solution. A freshly prepared 10 percent solution of chlorine bleach and water can be used as long as tools are oiled afterwards, as chlorine bleach will corrode metal tools. Chainsaw blades should be brushed clean, sprayed with cleaning solution, and run briefly to lubricate the chain.
    - Vehicles used off-road in infected forest areas should be thoroughly cleaned. The tires and undercarriage of the vehicle should be cleaned with detergent if they have travelled from an area with ROD or travelled off-road.
    - Shoes and clothing used in infected forests should also be cleaned. Shoes should be decontaminated by dipping the soles in 10 percent bleach or 70 percent rubbing alcohol to kill the ROD Fungus. Other gear can be sprayed with the same cleaning solutions. Clothing can be washed in hot water and detergent.

- Wood of affected ohia trees should not be transported to other areas of Hawaii Island or interisland. All cut wood should be left on-site to avoid spreading the disease. The pathogen may remain viable for over a year in dead wood. The HDOA has passed a new quarantine rule that prohibits interisland movement, except by permit, of all ohia plant or plant parts.

Thank you for your efforts to conserve listed species and native habitats. Please contact Fish and Wildlife Biologist Jay Nelson (phone: 808-792-9441, email: jay_nelson@fws.gov) if you have any questions or for further guidance.

Sincerely,

Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island

cc: Ms. Emma Yuen, NARS

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Ms. Michelle Bogardus
US FWS
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

RE: 01EP1F00-2016-TA-0479
Technical Assistance for Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve, Hawaii Island

Dear Michelle

I apologize for the delayed response to your letter.

Thank you for your response to the scoping notice for an Environmental Assessment (EA) of potential impacts of the proposed installation of the National Ecological Observatory Network Domain 20 core tower and sampling site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island published in the OEQC Environmental Notice on July 23, 2016.

The information provided was evaluated and, as appropriate, incorporated into the EA and Biological Evaluation being developed to evaluate the potential impacts of the proposed project on the Hawaiian cultural resources as well as environmental conditions in the area of potential effect in the Pu'u Maka'ala Natural Area Reserve.

The National Science Foundation anticipates the EA will be published in May 2017. Your comment and this response will be attached in an appendix.

Please contact me (phone: 703-292-7876, email: stellis@nsf.gov) or Montona Futrell-Griggs (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Steven E. Ellis, Ph.D.
Division of Biological Infrastructure
BIO Directorate
National Science Foundation

Cc: Mr. Jay Nelson

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON
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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

September 12, 2016

IN REPLY REFER TO:
Log No. 2016.01949
Doc No. 1609GC04
Archaeology

Russell Y. Tsuji, Land Administrator
Land Division, Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Tsuji:

SUBJECT: **Chapter 6E-8 and National Historic Preservation Act (NHPA) Section 106 Review – Scoping Notification for the National Science Foundation (NSF) – Funded Proposed National Ecological Observatory Network Domain, Puʻu Makaʻala Natural Area Reserve Waiakea Ahupuaʻa, Hilo District, Island of Hawaiʻi**
TMK: (3) 1-8-012:003, 1-9-001:001, 2-4-008:009, 019, 025

Thank you for the opportunity to comment on the aforementioned proposed project by the National Science Foundation (NSF). The National Ecological Observatory Network Domain (NEON), a continental-scale research network funded by the NSF, proposes to establish a research site within the Puʻu Makaʻala Natural Area Reserve (NAR) on Hawaiʻi Island. The site will include an ecological research tower, instrument hut, soil array, Double Fence Intercomparison Reference (DFIR) precipitation gauge (with required vegetation clearing area), associated electrical infrastructure and other on-site eco-systems collection tools. The proposed project area would occupy approximately 1,000 acres, to be discontinuous within the cumulative 12,000-acres of State owned lands as listed in the above TMKs. SHPD received this submittal on August 18, 2016.

SHPD has insufficient information to determine the potential impacts to historic properties pursuant to both Hawaii Administrative Rules (HAR) §13-275 and 36 CFR 800. **SHPD requests the following information**:

(1) A delegation letter from the NSF that identifies the particular activities and responsibilities they have delegated to NEON on their behalf;
(2) Information indicating that a reasonable and good faith effort to identify historic properties (architectural, archaeological, or traditional cultural properties [TCPs]) within the area of potential effect (APE) pursuant to 36 CFR §800.4(a) and 4(b) has been completed. The identification effort must include consultation efforts with Native Hawaiian Organizations (NHOs) [36 CFR §800.4(a)(4)] and consultation with individuals, organizations and the public with a demonstrated interest in the undertaking [36 CFR §800.2(c)] and should include documentation of the nature of the consultation, the names of the consulted parties, and their comments/concerns; and
(3) A determination of eligibility for any historic properties or potential historic districts within the APE [36 CFR§800.4(c)]; assessment of project effect [36 CFR §800.4(d)]; and if necessary resolution of adverse effects [36 CFR §800.6] for any sites located with the APE.

Per 36 CFR 800, **SHPD looks forward to** receiving a request from the lead federal agency or its delegated authority to initiate NHPA Section 106 consultation with SHPD on the proposed undertaking.

The NSF is the office of record for this undertaking. Please maintain a copy of this letter with your environmental review record.

Please contact Mr. Ikaika Nakahashi at (808) 243-4600 or at Chris.Nakahashi@hawaii.gov for History and Culture concerns for Hawaii Island including Native Hawaiian Organization (NHO) consultations, cultural sites, and burials. Please contact me at Susan.A.Lebo@hawaii.gov or at (808) 692-8019 for any questions regarding archaeological resources or this letter.

Aloha,



Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: David G. Smith, DOFAW (David.G.Smith@hawaii.gov)
Lydia Morikawa, DLNR-Land (Lydia.M.Morikawa@hawaii.gov)
Montona Futrell-Griggs, NSF, Re: NEON (mfutrell@nsf.gov)
Steven Ellis, NSF, Re: NEON (stellis@nsf.gov)
Sam J. Lemmo, OCCL (Sam.J.Lemmo@hawaii.gov)

National Science Foundation
4201 Wilson Blvd
Arlington, VA 22230

Via overnight mail and email

Alan S. Downer, PhD.
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building
601 Kamokila Blvd, Ste. 555
Kapolei, Hawai'i 96707

December 7, 2016

Subject: Initiation of Section106 Consultation for Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i - portions of TMK (3) 2-4-008:009, TMK (3) 2-4-i008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019
Log No. 2016.01949, Doc No. 1609GC04 Archaeology

Dear Dr. Downer:

The National Science Foundation (NSF) Directorate for Biological Sciences (BIO) funds the National Ecological Observatory Network (NEON), a continental-scale research network operated by awardee Battelle Ecology, Inc. NEON proposes to establish a research site within the Pu'u Maka'ala Natural Area Reserve (NAR), Hawai'i Island. The proposed site would provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawai'i," and would be the only site representing this domain in the United States. Site components would include a tower, instrument hut, an array of soil plots, a precipitation gauge, and associated electrical infrastructure with on-grade power lines. The total construction acreage of these components is expected to be less than 0.25 acre. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area; a total of approximately 80-90 (or less) sampling plots would be distributed throughout the Pu'u Maka'ala NAR. The site is located southwest of Hilo and encompasses portions of TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019 (see attached map).

NSF, as the responsible federal agency, is initiating Section 106 consultation under the National Historic Preservation Act (NHPA) for this undertaking as well as complying with Chapter 6E-8, Hawai'i Revised Statutes. NSF is also concurrently preparing an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) to identify and assess any potential environmental effects of establishing a NEON site at the proposed location. The federal NEPA process is being conducted in coordination with state-level review under Chapter 343, Hawai'i

Revised Statutes. NSF has not delegated any of its authority to perform these actions, although NSF may request that its environmental contractor, CH2M Hill, and the NEON awardee, Battelle Ecology, Inc., conduct research and other information gathering activities to support NSF's Section 106 and Chapter 6E-8 compliance.

The NEON Project partitioned the continental United States, including Alaska, Hawai'i and Puer to Rico, into 20 eco-climatic domains. Each domain represents a different region of vegetation, landforms, climate, and ecosystem performance.
Within each of these domains a fully instrumented core site will be established, hosting a tower (approximately 10 meters above the surrounding canopy), instrument hut, soil array, associated electrical infrastructure with power run, a suite of terrestrial sampling protocols, and an annual flight. Each site will collect data on climate and atmosphere, soils, vegetation, and a variety of organisms. Core sites must be
located in minimally managed "wildland" areas and are slated to operate for the 30-
year lifetime of NEON. For the proposed Pu'u Maka'ala site, no additional roads would be constructed and strict construction limits would be implemented during the tower construction phase.

NSF has established a draft Area of Potential Effects (APE) for this undertaking to include all proposed instrument and potential sampling areas, as shown on the attached map. We request your review and approval of the APE.

NSF, after consulting with your staff, has preliminarily identified organizations and individuals who may have an interest in the proposal's potential to affect historic properties. These organizations and individuals may qualify as consulting parties and, accordingly, we have reached out to them to invite their participation:

- Association of Hawaiian Civic Clubs
- Hawaiian Civic Club of Hilo
- George K. Cypher 'Ohana
- Kāko'o 'Ōiwi
- Keoni Kealoha Alvarez
- Ko'olau Foundation
- Maku'u Farmers Association
- Office of Hawaiian Affairs
- Piihonua Hawaiian Homestead Community Association
- Kamehameha Schools (adjacent property owner)
- Hawai'i Island Burial Council
- Hawai'i County Cultural Resources Commission
- Historic Hawai'i Foundation
- Aha Moku Council
- Kua O Ka Lā
- Protect Kaho'olawe 'Ohana

- Hawai'i Volcanoes National Park
- Mauna Kea Watershed Alliance

Please let us know if there are others we should include in our consultation efforts.

Potential consulting parties were invited to attend a meeting on October 26th, 2016, to discuss the draft APE and to assist in identifying any historic properties and cultural practices. Meeting attendees provided input on usage of the Pu'u O'o Trail and the presence of the historic Wright camp, both of which are outside of the draft APE, as well as the Mauna Loa Boys' School, which is within the draft APE. A November 18, 2011, letter from the Deputy State Historic Preservation Officer to the Division of Forestry and Wildlife regarding the Pu'u Maka'ala Natural Area Reserve Management Plan describes the school, which was opened in 1952 and closed the following year. This letter notes that "the Mauna Loa Boys School is within the NAR project area and is currently being used to store fencing materials; this use does not cause or constitute any adverse effects to the structure, which is in poor condition." Meeting attendees likewise noted the poor condition of the former school, and that the proposed NEON site had no potential to affect the building. Attendees were not aware of any cultural practices within the draft APE, noting that this area is challenging to access. NSF acknowledges that there was short notice for this consulting parties meeting due to logistical challenges, and we, therefore, plan to hold an additional consulting parties' meeting during the comment period for the Draft EA. We look forward to receiving further input from consulting parties at that time. In addition to that consultation opportunity, we are copying all potential consulting parties on this letter and will, by separate correspondence, request their review and comment on the information and findings in this letter during a comment period that extends up to and including January 9, 2017.

As part of our effort to identify historic properties in the vicinity of the proposed site, a literature review was completed at the SHPD library, and other research was done to locate previous Environmental Assessments and cultural studies done for the proposed site area. The results from that search are shown in the table below.

Title	**Author**	**Date**	**Findings**
Archaeological Inventory Survey and Limited Cultural Assessment for the Proposed Wastewater Treatment Facility at Kulani Correctional Facility (TMK:3-2-4-08:9)	Rechtman, Robert B. Ph.D.	July 2001	No sites found. Archeological expectations for the general area are very limited due to location in the "rainforest zone."
He Mo'Olelo 'Āina: A Cultural Study of the Pu'u Maka'Ala Natural Area Reserve Districts of Hilo and Puna, Island of Hawai'i	Kumu Pono Associates LLC	May 2004	No references to archaeological sites.
Draft Environmental Assessment - Pu'u Maka'ala Natural Area Reserve Management Plan	Hawaii Branch Natural Area Reserves System	January 2012	SHPD concurred with the finding of No Historic Properties Affected

If there is any other information you can provide or sources you would like to suggest, please let us know.

The 2004 study by Kumu Pono did not note any records or references to specific archaeological sites in the proposed site area. The study notes that "because of the remote nature of the 'Ola'a and Waiakea forest lands which comprise the present-day Pu'u Maka'ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiakea, 'Ola'a, Keauhou and Humu'ula. Based on the native traditions and kama'aina testimonies, it is likely that 'practitioner' trails existed throughout the forest region. Features such as 'kauhale manu' (bird-catcher's shelters), 'kahua kalaiwaa' (canoe-makers clearings), 'oioina' (trailside resting places and shelters), the 'ala hele' (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape" (Kumu Pono Associates LLC, 2004).

We also interviewed NAR staff on any known cultural sites or practices. Mr. Nick Agorastos, NAR Specialist with Hawaii Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), stated that he had never encountered anyone engaged in cultural practices in the site area, even though he and/or his staff are on the property almost daily. He noted that the NAR rules specify the need for a permit to conduct cultural practices within the NAR, and that he is only aware of two previous permit requests for Pu'u Maka'ala NAR, both involving removal of a koa log to build a canoe.

The Kumo Pono Associates report also notes that "the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its 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 'Ola'a and Waiakea Forest Reserves, the Pu'u Maka'ala NAR, and the Endangered Species Act)." NSF recognizes that members of the 'alalā (*Corvus hawaiiensis*) species may also be culturally significant. This species is currently extinct in the wild but is planned for reintroduction beginning in December 2016.

Although the proposed site area has not been surveyed, previous studies indicate that the probability of historic properties being present in the proposed site area is very low. Specifically, the site elevation and difficult accessibility, combined with the ephemeral nature of traditional uses and features, makes the archaeological expectations for the area very low. Should any archaeological historic properties be present, the likelihood of adverse effects to them from the proposal is low because the site components entail only minimal ground disturbance. In summary:

- Proposed site is in remote area in upper elevation with no known archaeological or historic properties.
- Proposed actions involve minimal ground disturbance.
- Archaeological studies in adjacent areas have not found any sites and have determined there is a low likelihood of sites in this wet upper-elevation rain forest.

We look forward to consulting with you on this undertaking. We anticipate preparing our Draft EA in January; any input provided to us by the SHPD and/or consulting parties by January 9th will be incorporated into the cultural resources section of the Draft EA. If you have any questions, or wish to discuss the proposal or our agency's responsibilities in more detail, please contact me at (703) 292-7162.

Sincerely,

Montona Futrell-Griggs

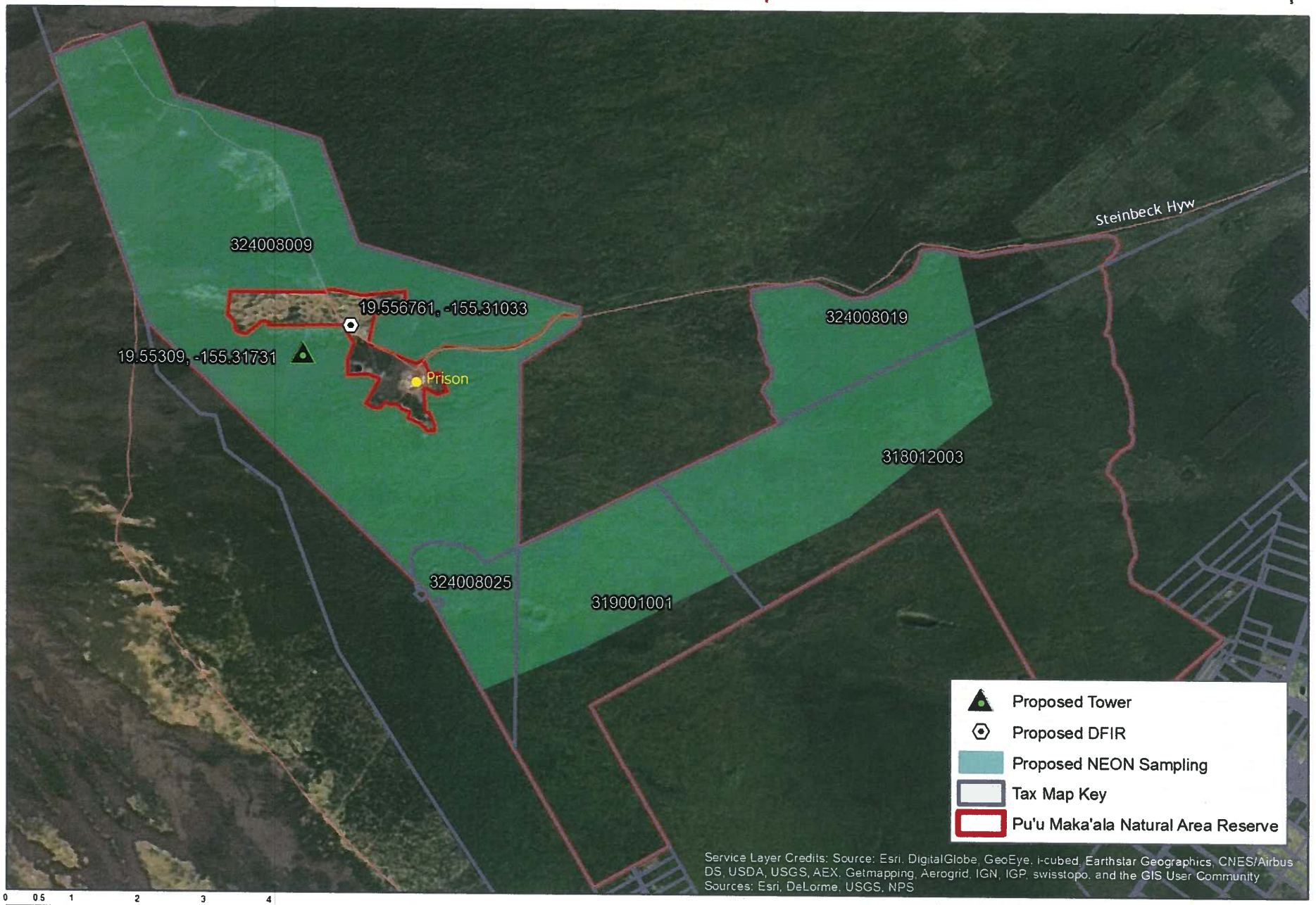
Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

Cc (via mail and email, if available):

Association of Hawaiian Civic Clubs
Hawaiian Civic Club of Hilo
George K. Cypher ʻOhana
Kākoʻo ʻŌiwi
Keoni Kealoha Alvarez
Koʻolau Foundation
Makuʻu Farmers Association
Office of Hawaiian Affairs
Piihonua Hawaiian Homestead Community Association
Kamehameha Schools (adjacent property owner)
Hawai'i Island Burial Council
Hawai'i County Cultural Resources Commission
Historic Hawai'i Foundation
Aha Moku Council
Kua O Ka Lā
Protect Kahoʻolawe ʻOhana
Hawai'i Volcanoes National Park
Mauna Kea Watershed Alliance

Pu'u Maka'ala Natural Area Reserve

Domain 20 - Pacific Tropical



0 0.5 1 2 3 4 Kilometers

0 0.375 0.75 1.5 2.25 3 Miles

1:78,000 WGS 1984 UTM Zone 5N - M. Slater 6/2016

This product is for informational or planning purposes only and has not been prepared for, or suitable for legal, engineering, or surveying purposes. The National Ecological Observatory Network cannot accept any responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties either expressed or implied which accompany this product
Datum: WGS 1984; Projection: UTM Zone 5N

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

IN REPLY REFER TO:

STP 8.2033

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

October 3, 2016

Ms. Montona Futrell-Griggs
NEON Puu Makaala Natural Area Reserve
National Science Foundation
4201 Wilson Boulevard
Suite 615N
Arlington, Virginia 22230

Dear Ms. Futrell-Griggs:

Subject: National Ecological Observatory Network (NEON) Domain 20 Core Tower
and Sampling Site at Puu Makaala Natural Area Reserve
Scoping Notification and Pre-Assessment Consultation under Chapter 343
South Hilo, Hawaii
TMK: (3) 1-8-012:003, 1-9-001:001, 2-4-008:009, 2-4-008:019 & 2-4-008:025

Our Department of Transportation's (DOT) comments on the subject project are as follows:

Airports Division (DOT-AIR)

The proposed project is approximately 21 miles southerly of the Air Operations Area of the Hilo International Airport (ITO) and 53 miles easterly of the Kona International Airport (KOA). DOT-AIR have concerns related to the tower element of the proposal.

1. The developer should submit a Federal Aviation Administration (FAA) Form 7460-1 "Notice of Proposed Construction or Alteration," in accordance with the Code of Federal Regulations, Title 14, Part 77.9. This form and criteria for submittal can be found at the following website: https://oeaaa.faa.gov/oeaaa/external/portal.jsp.

2. We recommend that a red light be placed on the tower.

Highways Division (DOT-HWY)

The subject project is not expected to significantly impact the State highway facility. However, we will defer further comments until we review the Draft Environmental Assessment.

Should you have any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Sincerely,

FORD N. FUCHIGAMI
Director of Transportation

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

Mr. Ford N. Fuchigami
Director of Transportation
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, HI 96813-5097

Re: Response to letter dated October 3, 2016, concerning the proposed NEON Domain 20 site on the Island of Hawai'i: STP 8.2033

Dear Director Fuchigami,

I am in receipt of your letter dated October 3, 2016, in which you state that the National Science Foundation (NSF) should submit Form 7460-1, "Notice of Proposed Construction or Alternation," to the Federal Aeronautical Administration (FAA) in accordance with 14 C.F.R. Part 77. After reviewing the applicable regulations under 14 C.F.R. Part 77, Subparts B and C, however, NSF has concluded that the proposed NEON Domain 20 tower does not meet the height criteria requiring that notice be given to the FAA. In addition to reviewing the regulations, NSF also applied the FAA referenced "Notice Criterial Tool," provided by the FAA to assist in applying the Part 77 Notice Criteria, and the finding was as follows: "Results: You do not exceed Notice Criteria." Accordingly, no notice is required to be submitted to the FAA for the proposed NEON tower for the Domain 20 site on the Island of Hawai'i.

Thank you for responding to our scoping notice and submitting your comments regarding NSF's proposed NEON Domain 20 site. If you have any questions or concerns, please do not hesitate to contact me directly at (703) 292-4820.

Best regards,

Kristen Hamilton

Kristen Hamilton
Environmental Compliance Officer
National Science Foundation
4201 Wilson Boulevard, Suite 1265
Arlington, VA 22230

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Appendix B
Distribution List for Draft EA

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Appendix B
Draft EA Distribution List

FEDERAL AGENCIES	
U.S. Fish and Wildlife Service	U.S.Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)
U.S. Geological Survey	USDA NRCS Soil and Water Conservation Districts
U.S. National Park Service	USDA Farm Service Agency
U.S. Forest Service	Department of the Army, U.S. Army Garrison Pohakuloa
STATE AGENCIES	
Department of Health (DOH) Office of Environmental Quality Control	DLNR Division of Forestry and Wildlife
DOH Environmental Planning Office	DLNR Natural Area Reserves Commission
DOH Environmental Management Division	DLNR Division of Conservation and Resources Enforcement
Dept. of Business, Economic Development & Tourism (DBEDT)	DLNR Division of State Parks
DBEDT Office of Planning	DLNR State Historic Preservation Division (SHPD)
Department of Defense	Hawaii Island Burial Council
Department of Public Safety	Department of Agriculture
Department of Hawaiian Home Lands (DHHL)	Department of Agriculture, Agribusiness Development Corporation
Department of Transportation	Department of Accounting and General Services (DAGS)
Department of Land and Natural Resources (DLNR) Land Division	Office of Hawaiian Affairs
DLNR Office of Conservation and Coastal Lands	
SCHOOLS/LIBRARIES	
University of Hawaii (UH) Environmental Center	Hilo Regional Library
UH College of Tropical Agriculture and Human Resources	Mountain View Public and School Library
UH at Manoa, Thomas H. Hamilton Library	Keaau Public Library
UH at Hilo, Edwin H. Mo'okini Library	Legislative Reference Bureau Library
Hawaii State Library, Hawaii Documents Center	
COUNTY AGENCIES	
Department of Environmental Management	Cepartment of Research and Development
Department of Parks and Recreation	Civil Defense
Department of Water Supply	Fire Department
Planning Department	Police Department
Department of Public Works	
ELECTED OFFICIALS	
U.S. Senator Brian Schatz	State Representative Richard Onishi (District 3)
U.S. Senator Mazie Hirono	State Representative Joy San Buenaventura (District 4)
U.S. Representative Tulsi Gabbard	County Council Member Aaron Chung (District 2)
State Senator Gilbert Kahele (District 1)	County Council Member Sue Lee Loy (District 3)
State Senator Russell Ruderman (District 2)	County Council Member Jen Ruggles (District 5)
State Senator Lorraine Inouye (District 4)	County Council Member Maile David (District 6)
State Representative Mark Nakashima (District 1)	Governor David Ige
State Representative Cliff Tsuji (District 2)	Mayor Harry Kim
ORGANIZATIONS	
ABC Hawaiian Birds Program	Ka Nohona Pono Inc
Aha Kiole	KAHEA
American Association of University Women	Kamehameha Schools
American Forest Management,Inc.	Livable Hawaii Kai Hui
Association of Hawaiian Civic Clubs	Malama O Puna
Big Island Bird Hunters	Mālama O Puna
Big Island Bow Hunters	Malu 'Aina Center for Non-Violent Education and Action
Big Island Invasive Species Committee	Mauna Kea Recreational Users Group
Bishop Museum	Native Hawaiian Advisory Council
Conservation Council of Hawaii	Native Hawaiian Legal Corporation
Earth Justice Legal Defense Fund	Ohana Hoopakele
Edith Kanakaole Foundation	Pacific Cooperative Studies Unit - UH Manoa
Environment Hawaii	Pele Defense Fund
Hawaii Audubon Society	Pig Hunters of Hawaii
Hawaii Community Stewardship Network	Plant Extinction Prevention Program
Hawaii County Economic Opportunity Council	Prince David Kawananakoa Hawaiian Civic Club
Hawaii County Game Management Advisory Commission	San Diego Zoo
Hawaii Forest and Trail	Sierra Club, Moku Loa Chapter
Hawaii Forest Industry Association	Silversword Foundation
Hawaii Hunting Advisory Council	Society of American Foresters Hawaii Chapter
Hawaii Hunting Association	The Alala Project
Hawaiian Botanical Society	The Kohala Center
Hawaiian Civic Club of Hilo	The League of Women Voters of Hawaii
HawCC General Education Division	The Nature Conservancy of Hawaii
Historic Hawaii Foundation	Three Mountain Alliance
Hoopuloa Hawaiian Civic Club	Volcano Art Center
Hui Malama I Na Kupuna O Hawai`i Nei	Volcano Community Association
Island Transitions	Volcano Rare Plant Facility
Ka Lei Maile Ali'i Hawaiian Civic Club	Wildlife Conservation Association of Hawaii, Hilo Chapter
INTERESTED INDIVIDUALS	
Alan Burdick	Martha Lockwood
Becky Ostertag	Nani K M Pogline
Brooks Rownd	Pamela Scheffler
Christian Giardina	Pat Conant
Christina Cornett	Pat Hart

Appendix B
Draft EA Distribution List

Christine Ogura	Paul Banko
Dan Taylor	Rebecca Montgomery
Danny Li	Rhonda Loh
Debbie Ward	Richard Camp
Diane Ley	Rick Warshauer
Don Drake	Rob Shallenberger
Edwin Ung	Ron Terry
Eldridge Naboa	Ronald Fujiyoshi
Fred Stone	Sam Kaleleiki
George DeCosta	Shannon Rudolph
H. Douglas Pratt	Sheila Conant
Hannah Hedrick	Sierra McDaniel
J.B. Friday	Steve Montgomery
Jack Jeffrey	Steven Hess
Janice Palma-Glennie	Susan Cordell
Jim Juvik	Thane and Linda Pratt
Joanne Martin	Tim Tunison
Jon Price	Tlaloc Tokuda
Karl Magnacca	Tracy Johnson
Mark Wasser	Zach Judd
NEIGHBORING LANDOWNERS	
Gene Alan Rynkewicz et. al	Robert W Babick
Christopher J Linden et. al	Kanoe M Mc Tavish et. al
James Cobb	Purdyco Ltd.
Benjamin K S Sr/Ramona Hu Trust	Emily M Eissner et. al
Glenda M White	Bong Hee Park et. al
Palmer Kim et. al	Louie S Ondo et. al
Russell Kaneko	Keith & Betty Wilhelm
James Chow Tust	Sue S Johnson et. al
Tadashi Higaki Trust et. al	Natalie Ann Veriato Trust
Thomas Jerome Canny	Elspeth Kalani Vandaele
W.H. Shipman Ltd.	Richard Lee Pierce Trust et. al
Wilbert Castro Jr Trust et. al	Albert Lindsey Bicknell Jr et. al
Eleanor R Chow Trust	Kirk Black
Dorian Marvin	Manuel Arruda Jr ust
Keith Eric Hompstead et. al	Kathleen Michelle Demello Trust
Lau Family Trust	Daniel Grice and Kathleen Christensen
Jeffrey Robert Noguchi	Wendell G Causey et. al
Vincent Git Kin Chun et. al	Dick Reason et. al
Lance J Wilson Trust et. al	Brigham Nephi Clifton
Delbert T Cambra et. al	Sarah Helena Linfoot
Miriam L Tocman et. al	Marshall A Luke Trust
Duane Rapoza Ttee	Milton Kaneko
Gary R Guenther et. al	David Harold Ung
Gary M Urasaki	Troy Burton Hill et. al
Kathryn Anne Burton Trust	Bruce James Morgan
Lorna S Orteust	Monte Roldan et. al
Carol Kanoelani Lum Trust	Michel Dean Daak
Randolph Schemkes et. al	Dennis Delfin Sr et. al
Lori Ann C Lindsey Trust	Clifford Muragin
Ronald T Toyama Trust et. al	Robin Leinaala Amador
Maria L S Fasone Trust	Cory Harden Trust
Jason T MacMurray	Michael J Donald
Jonathan P Kurtzweil et. al	James T Hiyane et. al
Russell Shibata el. Al	Wendell G Causey et. al
Robert William Patey	Charles and Eleanor Arakaki
Daniel Y N Yee Family Trust et. al	Theresa K Donham et. al
John William Ikaika Crabbe	Katrina A Ka'auomoana
Michael P Kelley et. Al	Maria Elena Calso Andaya et. al
Gary Robert Kozanecki et. al	Glenn Y Toyama
Margaret L Lipinski Trust	Gary L Sisneros et. al
Alberta B Turner et. al	Kaipo Saiki
Lucille Kozanecki Trst	Priest (Monk) Of Bang San Ho Temple
Charlotte Nobue Ng	Casimir K Ah Yo et. al
Daniel J Lutkenhouse et. al	Lenore M Vincent et. al
Francis M Toyama Trust	Thomas Rapoza
Melissa L Pang Ching	
NEWS MEDIA	
Honolulu Star Advertiser	West Hawaii Today
Hawaii Tribune Herald	Honolulu Civil Beat

Appendix C
Draft EA Comments and Responses

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National Ecological Observatory Network
ENVIRONMENTAL ASSESSMENT

National Science Foundation

National Ecological Observatory Network

NSF Environmental Assessment and Section 106 Consultation for NEON Domain 20 Field Site

Public Meeting Written Comment Form

Proposed Domain 20 Field Site for the National Ecological Observatory Network

National Science Foundation

May 25, 2017

5:30pm-7:30pm

Name Susan Cordell
Address 1533 Puia Road
Affiliation
Phone 808 987-4115
Date 5/25/17

We welcome your participation. You may submit comments at the Public Meeting or by either of the following methods:

E-mail: NEON_EA_comments@nsf.gov

Mail to: Ms. Montona Futrell-Griggs at National Science Foundation, Suite 615, 4201 Wilson Blvd., Arlington, VA 22230

Project information will be posted, throughout the EIS process, at https://www.nsf.gov/funding/pgm_summ.jsp?displayFullSite=true&from=fund&orgAbbr=NSF&pims_id=13440

Please note that the deadline for public comments is June 22, 2017

COMMENTS:
(Attach additional sheets if necessary)

I attended the previous meeting where concerns were put forth by various citizens and agencies. I am very pleased to report that NEON really took these comments to heart and tailored all activities to satisfy the concerns put forward. I also want to share that we have been managing several CTFS Forest Dynamics Plots and climate towers in Hawai'i since 2007. Our presence or the presence of the climate towers have had little to no impact on plant or animal mortality. In fact Laupahoehoe - which has the highest concentration of

Hoary bats in the state - we have not seen any impacts from our guy wires or tower infrastructure on birds or bats. In the same project we monitor annually the presence of invasive weeds and once monitored we make a concerted effort to remove these weeds both as a mitigation measure if by chance we carried these weeds into the forest and to be good stewards of the land.

I am very excited to see this process move forward. Hawaii will very much benefit in being part of this network. Thank you for your commitment.

Aloha

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Susan Cordell
1533 Puia Road
Hilo, Hawai'i 96720

Subject: Notice of Draft Environmental Assessment and Public Meeting for Proposed National Ecological Observatory Network Field Site

June 8, 2017

Dear Dr. Cordell,

Thank you for your comments submitted at the May 25, 2017, public meeting on the Proposed Domain 20 Field Site for the National Ecological Observatory Network, indicating your appreciation for how Battelle Ecology, Inc. has addressed stakeholder concerns in the proposed plans for the design and implementation of the NEON site.

We also thank you for your observation that ongoing research and climate towers in forest (since 2007) has had little to no environmental impact (no bird/bat strikes or invasive species).

We appreciate your interest in the proposal and your participation in the public meeting.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

National Ecological Observatory Network
ENVIRONMENTAL ASSESSMENT

National Science Foundation

National Ecological Observatory Network

NSF Environmental Assessment and Section 106 Consultation for NEON Domain 20 Field Site

Public Meeting Written Comment Form

Proposed Domain 20 Field Site for the National Ecological Observatory Network

National Science Foundation

May 25, 2017

5:30pm-7:30pm

Name CORY HARDEN
Address 874 KULALUA RD
Affiliation HILO, HI 96720
Phone 808 959 7747
Date 5-25-17

COMMENTS:
(Attach additional sheets if necessary)

We welcome your participation. You may submit comments at the Public Meeting or by either of the following methods:

E-mail: NEON_EA_comments@nsf.gov

Mail to: Ms. Montona Futrell-Griggs at National Science Foundation, Suite 615, 4201 Wilson Blvd., Arlington, VA 22230

Project information will be posted, throughout the EIS process, at https://www.nsf.gov/funding/pgm_summ.jsp?displayFullSite=true&from=fund&orgAbbr=NSF&pims_id=13440

Please note that the deadline for public comments is June 22, 2017

PLEASE DESIGN PROJECT SO PEOPLE CAN DO PROJECTS (WITH APPROVAL) TO TEST FOR CONTAMINANTS (ROUNDUP, DEPLETED URANIUM PELLETS, ETC.)

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Cory Harden
874 Kulaloa Road
Hilo, HI 96720

June 8, 2017

Dear Ms. Harden,

Thank you for your comments submitted at the May 25, 2017, public meeting on the Proposed Domain 20 Field Site for the National Ecological Observatory Network.

You requested that the project be designed "so people can do projects (with approval) to test for contaminants (roundup, depleted uranium oxides, etc.)". The ability to test for those specific contaminants is outside the scope of the NEON proposal. However, researchers who would want to study this could submit proposals to the relevant agencies or foundations to seek funding. If funding is received, Battelle has developed a process by which adding the capability to NEON infrastructure can be coordinated after successful completion of an evaluation of feasibility. Please see Section 1 of the Draft EA for more information about the proposed uniform and standardized design (in terms of both infrastructure and sampling protocols) across the network of sites, which includes 20 domains across the continental United States, Alaska, Hawai'i (proposed), and Puerto Rico.

We appreciate your interest in the proposal and your participation in the public meeting.

Sincerely,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

National Ecological Observatory Network
ENVIRONMENTAL ASSESSMENT

National Science Foundation

National Ecological Observatory Network

NSF Environmental Assessment and Section 106 Consultation for NEON Domain 20 Field Site

Public Meeting Written Comment Form

Proposed Domain 20 Field Site for the National Ecological Observatory Network

National Science Foundation

May 25, 2017

5:30pm-7:30pm

Name Ronald Fujiyoshi
Address 1196 W Kawailani St.
Affiliation Ohana Hoopakole
Phone 808-959-9775
Date 5/25/17

We welcome your participation. You may submit comments at the Public Meeting or by either of the following methods:

E-mail: NEON_EA_comments@nsf.gov

Mail to: Ms. Montona Futrell-Griggs at National Science Foundation, Suite 615, 4201 Wilson Blvd., Arlington, VA 22230

Project information will be posted, throughout the EIS process, at https://www.nsf.gov/funding/pgm_summ.jsp?displayFullSite=true&from=fund&orgAbbr=NSF&pims_id=13440

Please note that the deadline for public comments is June 22, 2017

COMMENTS:
(Attach additional sheets if necessary)

1) The EA should include a section on how this project will affect Article XII Section 7 of the Hawaii State Constitution protecting the customary and traditional practices of Native Hawaiians.

2) The EA should include a section on how this project will affect the management plans of Hawaii island.

3) NEON must invite the Pele Defense Fund as a stakeholder to comment on this EA.

4) NEON must invite the Game Management Commission of the Hawaii County as a stakeholder to comment on this EA.

5) Please test the impact of the firing of weapons by the military at the nearby Tohakuja Training Area on the ecology. Specifically, I request a testing of Depleted Uranium in the air particles be measured over the 30 year period.

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Mr. Ronald Fujiyoshi
1196 W Kawailani Street
Hilo, HI 96720

Dear Mr. Fujiyoshi,

Thank you for your comments submitted at the May 25, 2017, public meeting on the Proposed Domain 20 Field Site for the National Ecological Observatory Network.

In response to your comment that the Environmental Assessment (EA) should address how the project will protect customary and traditional practices of Native Hawaiians, please see Section 3.6.6 of the Draft EA for a description of cultural uses, practices, and properties that may occur in the vicinity of the project, and Section 4.6.1.3 for a discussion of potential impacts. The proposed project is not expected to conflict with any cultural practices that could occur in this area.

You also noted that the EA should address how project will affect the management of game. Please see Sections 3.2 and 4.2 for a full discussion on Land Use and Recreation. As described, the proposed site at the Pu'u Maka'ala Natural Area Reserve (NAR) was selected in coordination with Division of Forestry and Wildlife and NAR staff in order that it would have minimal imposition on NAR management activities and other ongoing research efforts.

Thank you for the recommendations regarding two additional stakeholders, the Hawaii County Game Management Advisory Commission (GMAC) and the Pele Defense Fund. The notification we provided to the Office of the Mayor will be shared with GMAC, which is a County-authorized commission (confirmed via telephone call to Ms. Donna Urban-Higuchi on June 6, 2017). We also emailed a notification directly to GMAC on June 6, 2017. We mailed a notification about the Draft EA to the Pele Defense Fund on June 7, 2017.

Finally, you requested that NSF test "the impact of the firing of weapons at Pohakuloa Training Area on ecology; specifically, test uranium in the air particles over the 30 year period." The study you describe is outside the scope of the NEON proposal. Please see Section 1 of the Draft EA that describes how there is a uniform and standardized design (in terms of both infrastructure and sampling protocols) across the network of sites, which includes 20 domains across the continental United States, Alaska, Hawai'i (proposed), and Puerto Rico. Please note researchers who would want to study this could submit proposals to the relevant agencies or foundations to seek funding. If funding is received, Battelle has developed a process by which adding the

capability to NEON infrastructure can be coordinated after successful completion of an evaluation of feasibility.

We appreciate your interest in the proposal and your participation in the public meeting.

Sincerely,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

RE: NEON Pu'u Maka'ala Natural Area Reserve

PV Peter Vitousek <vitousek@stanford.edu>

Reply all |

Fri 5/26, 11:17 PM

BIO_NEON_EA_comments

Inbox

You forwarded this message on 5/30/2017 1:31 PM

To whom it concerns:

I am an ecologist with extensive experience studying Hawaiian ecosystems, and a reasonable familiarity with the Puu Makaala Natural Area Reserve. The relatively high-elevation site selected for the NEON core site is representative of upper montane Hawaiian rainforest, and I don't see any serious environmental damage coming from developing the site as proposed. The work there will provide useful information; I support it going forward.

Peter Vitousek

Subject: Re: NEON Pu'u Maka'ala Natural Area Reserve
Date: Wednesday, June 28, 2017 at 5:16:48 PM Eastern Daylight Time
From: BIO_NEON_EA_comments
To: Peter Vitousek
CC: Futrell-Griggs, Montona

Dear Dr. Vitousek,

Thank you for your comments, emailed May 26, 2017, regarding the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network. We appreciate your input regarding the selected site as being representative of the upper montane Hawaiian rainforest and the lack of serious environmental damage that could result from the proposed project.

Please contact me (via phone: 703-292-7162 or email) if you have any questions.

Sincerely,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

EPO 17-124

June 1, 2017

Ms. Lisa Kettley
CH2M
1132 Bishop Street, Suite 1100
Honolulu, Hawaii 96813
Email: lisa.kettley@ch2m.com

Dear Ms. Kettley:

SUBJECT: Draft Environmental Assessment (DEA) for Domain 20 Field Site for the National Ecological Observatory Network (NEON), Hilo, Hawaii
TMK: (3) 2-4-008:009, 025(por), 1-9-001:001 (por), 1-8-012:013 (por), 2-4-008:019 (por)

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your DEA to our office via the OEQC link: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2017-05-23-HA-DEA-NEON-Domain-20-Field-Site.pdf

We understand from the OEQC publication form project summary that *"The National Ecological Observatory Network {NEON) is a continental-scale ecological observation facility sponsored by the National Science Foundation (NSF) and operated by Battelle Ecology, Inc. It is designed to gather and synthesize data needed to study the impacts of climate change, land use change and invasive species on natural resources and biodiversity. NSF is proposing to establish a NEON field study site within the Pu'u Maka'ala Natural Area Reserve (NAR) on the eastern side of Hawai'i Island. The proposed field study site would provide data for NEON's Pacific Tropical domain (Domain 20), and would be the only site representing this domain for the continental-wide network. Similar to other NEON core sites, the Domain 20 site in Hawai'i would include a standard set of scientific infrastructure and equipment to collect biological, biophysical, biogeochemical, and land use data. The proposed scientific infrastructure and equipment would include a tower, a panelized modular enclosure (i.e. instrument hut), an array of soil plots with soil sensors, a precipitation gauge, electrical equipment, and a suite of distributed terrestrial sampling protocols. The site would be operated for 30 years, and the resulting data would be made available to the scientific community and general public through the online NEON portal."*

In the development and implementation of all projects, EPO strongly recommends regular review of State and Federal environmental health land use guidance. State standard comments and available strategies to support sustainable and healthy design are provided at: http://health.hawaii.gov/epo/landuse. Projects are required to adhere to all applicable standard comments. EPO has recently updated the environmental Geographic Information System (GIS) website page. It now compiles various maps and viewers from our environmental health programs. The eGIS website page is continually updated so please visit it regularly at: http://health.hawaii.gov/epo/egis

EPO also encourages you to examine and utilize the Hawaii Environmental Health Portal at: https://eha-cloud.doh.hawaii.gov. This site provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings.

We request that you utilize all this information on your proposed project to increase sustainable, innovative, inspirational, transparent and healthy design. Thank you for the opportunity to comment.

Mahalo nui loa,

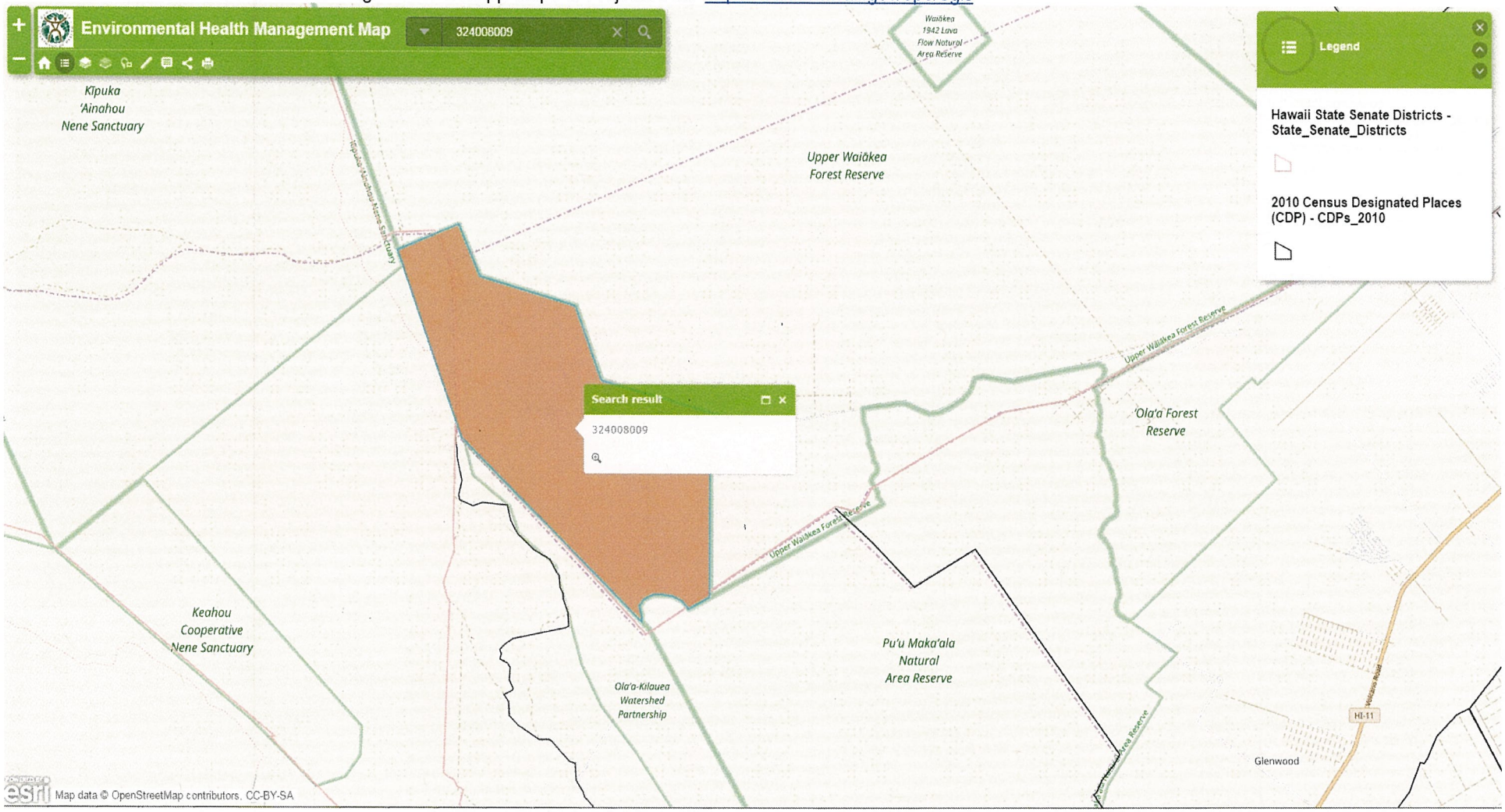
Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

LM:nn

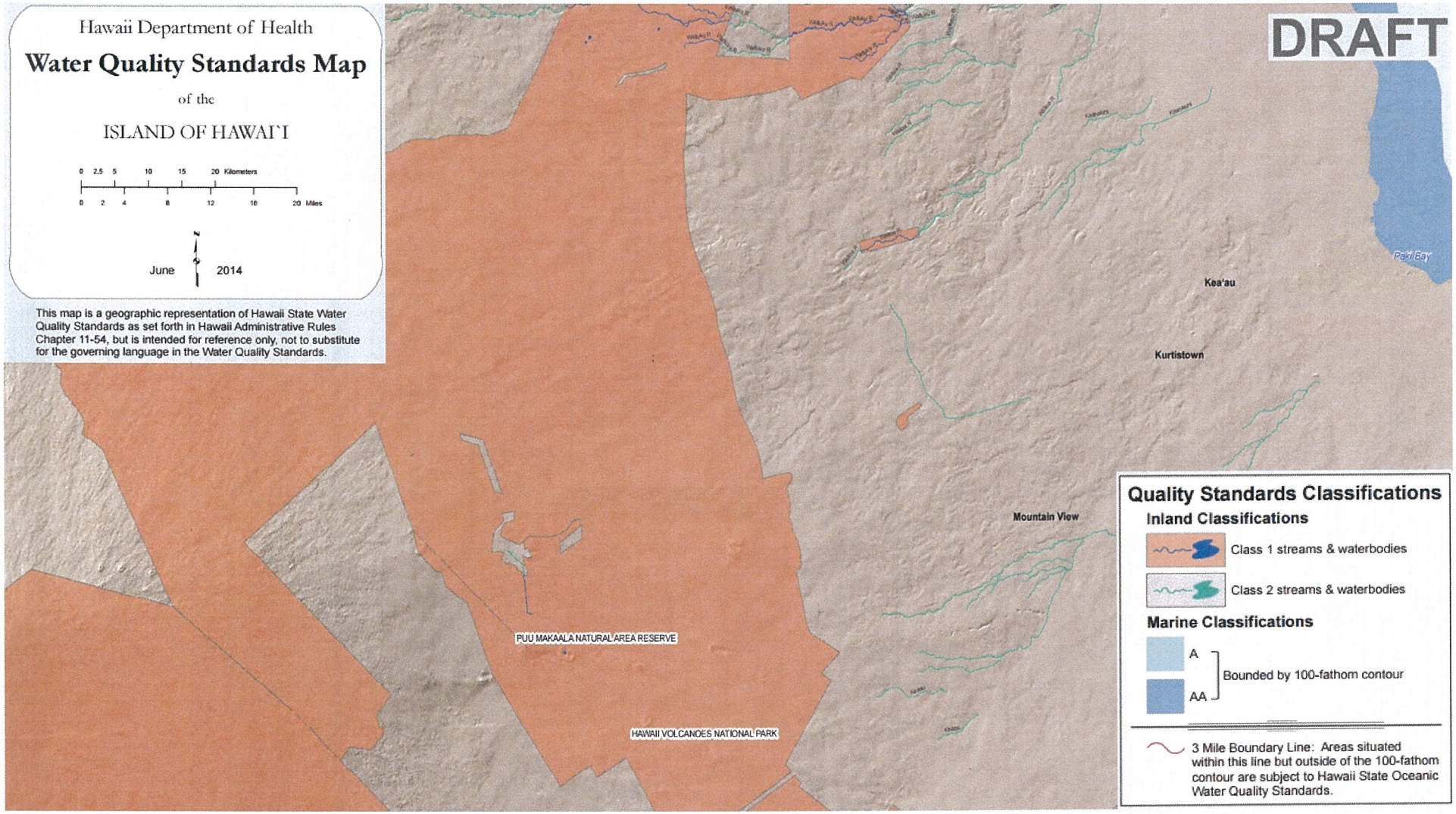
Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis
Attachment 2: Clean Water Branch: Water Quality Standards Map - Hawaii

c: Montana Futrell-Griggs, National Science Foundation (via email: mfutrell@nsf.gov)
Tiger Mills, DLNR (via email: kimberly.mills@hawaii.gov)
DOH: DHO HI {via email only)

Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis



Attachment 2: Clean Water Branch: Water Quality Standards Map - Hawaii



National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Ms. Laura Leialoha Phillips McIntyre
Department of Health
Environmental Planning Office
P.O. Box 3378
Honolulu, HI 96801-3378

June 8, 2017

Dear Ms. Phillips McIntyre,

Thank you for your comment letter, dated June 1, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network.

In response to your recommendation that the project conform to State and Federal environmental health land use guidance, please note that the managing organization (Battelle Memorial), who would be responsible for constructing and operating the field site, would be required to do so in a manner consistent with Federal, State, and local requirements. This includes the development and implementation of any plans needed to address health, safety, and environmental requirements. In addition, implementation by Battelle Memorial would also be subject to conditions contained within any permits from land managing agencies, such as any Conservation District Use Permit and Natural Area Reserve System Special Use Permit, as well as in any construction permits. We will share your link to the Hawaii Environmental Health Portal with Battelle Memorial, for its use in planning efforts should this project move forward.

Regarding your note that this information be used to "increase sustainable, innovative, inspirational, transparent and healthy design," please note that a uniform and standardized design across the network of sites is essential to informing the science, testing the hypotheses, and conducting research at a continental scale. Infrastructure is minimal, to have the least impact possible on the ecosystem being studied while still supporting the research goals.

We appreciate your review of the Draft EA and your comments.

Sincerely,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

Harry Kim
Mayor

Paul K. Ferreira
Police Chief

Kenneth Bugado Jr.
Deputy Police Chief

County of Hawai`i

POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawai`i 96720-3998
(808) 935-3311 • Fax (808) 961-8865

June 2, 2017

Ms. Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, VA 22230

Dear Ms. Futrell-Griggs:

Subject: Notice of Draft Environmental Assessment and Public Meeting for Proposed National Ecological Observatory Network Field Site

Staff, upon reviewing the provided documents, does not anticipate any significant impact to traffic and/or public safety concerns.

Thank you for allowing us the opportunity to comment.

If you have any questions, please contact Captain Gregory Esteban, South Hilo Patrol, at 961-2214.

Sincerely,

HENRY J. TAVARES, JR.
ASSISTANT POLICE CHIEF
AREA I OPERATIONS

GE:lli/170425

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Henry J. Tavares, Jr
Assistant Police Chief
Area I Operations
Hawai'i Police Department
Hilo, Hawai'i 96720

Subject: Notice of Draft Environmental Assessment and Public Meeting for Proposed National Ecological Observatory Network Field Site

June 8, 2017

Dear Mr. Tavares,

Thank you for your comment letter, dated June 2, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network indicating the staff of the Hawai'i Police department does not anticipate any significant impact to traffic and/or public safety concerns.

We appreciate your review of the Draft EA and your comment.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

Subject: (none)
Date: Wednesday, June 7, 2017 at 3:27:40 PM Eastern Daylight Time
From: Dwayne Yoshina
To: BIO_NEON_EA_comments

NO! We do not need yet another "private terrarium" in the community. It should be kept open for use as a food resource habitat.

Mahalo!

Subject: Re: NEON Proposed Field Study Site at the Pu'u Maka'ala Natural Area Reserve
Date: Wednesday, June 28, 2017 at 5:19:38 PM Eastern Daylight Time
From: BIO_NEON_EA_comments
To: Dwayne Yoshina
CC: Futrell-Griggs, Montona

Dear Mr. Yoshina,

Thank you for your comment, received June 7, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network.

In response to your comments, please note the NEON project is not a private project. NEON data are publicly available to enable users to address scientific questions at scales not accessible to previous generations of ecologists. In addition, and in the interest of minimizing potential conflicts with recreational use by the local community, the State of Hawai'i, Division of Forestry and Wildlife staff recommended the proposed field study site location within the Pu'u Maka'ala Natural Area Reserve, as there is minimal visitation from the public and hunting is not allowed. As such, the proposed project is not expected to have impacts on public lands used for food resources.

We appreciate your review of the Draft EA and the submission of your comments.

Please contact me (via phone: 703-292-7162 or email) if you have any questions.

Sincerely,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

Subject: Proposed Domain 20 Field Site for the National Ecological Observatory Network
From: Jim Albertini <ja@malu-aina.org>
Date: 6/9/2017 9:43 PM
To: "NEON EA comments"@nsf.gov
BCC: Ron Fujiyoshi <ronsan2224@aol.com>, Jim Albertini <ja@malu-aina.org>

Proposed Domain 20 Field Site for the National Ecological Observatory Network
June 9, 2017

NEON EA comments@nsf.gov

Aloha,

I am sorry I was unable to attend the May 25, 2017 meeting in Hilo Hawaii but I wanted to submit comments for the record.

I would like to bring to your attention factors that may have a significant impact or the environment, especially endangered species --plants and animals, and the ecosystems of which such species depend, including our human species. My concern is that in immediate proximity to the Pu'uMaka'ala Natural Area Reserve is the site of numerous secret military tests of deadly chemical and biological weapons in the 1960s and early 70s including what was code named "Green Mist" --Sarin nerve gas that kills in 1/50th of a drop. Fact sheets on these secret tests were finally released in 10/9/2002 by the Office of the Assistant Secretary of Defense (health Affairs), Deployment Health Support Directorate. Some of the tests for which I have code names and fact sheets, besides "Green Mist" include the following

Pine Ridge

Yellow Leaf

Red Oak

Tall Timber

Blue Tango

The military lease obtained from the State of the Hawaii in forest lands off Staineback Highway said the military wanted to do "WEATHER TESTING." The military was lying. They were testing some of the most deadly chemical/biological weapons in the US arsenal. I have had reports from hunters and even DLNR staff that old drums from the testing still remain in the forest and there are some areas where nothing grows nearly 50 years after the tests.

Testing in the general area should be done for possible long lasting residue and effects from such chemical/biological agents as well as from the long list of toxins, including Depleted Uranium (DU) used at the military Pohakuloa Training Area.

Thank you for your response to these concerns.

--

Jim Albertini, President

Malu 'Aina Center for Non-violent Education & Action
P.O. Box 489
Kurtistown, Hawaii 96760
Phone 808-966-7622
email ja@malu-aina.org
visit us on the web at www.malu-aina.org

PS
I Tried to email these comments twice
but the emails bounced

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Mr. Jim Albertini
Malu Aina
Center for Non-Violent Education and Action
P.O. Box 489
Kurtistown, HI 96760

Dear Mr. Albertini,

Thank you for your comment letter, dated June 9, 2017 and received June 19, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network. We, too, are sorry you were unable to attend the public meeting held May 25, 2017. If you would like to review the materials for that meeting, they are posted online on the NSF NEON Program webpage (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13440&org=DBI&from=home).

Thank you for the information you conveyed about chemical and biological testing conducted on the Island of Hawai'i in the 1960's and 1970's. You also requested that testing "be done for possible long lasting residue and effects from such chemical/biological agents as well as from the long list of toxins, including Depleted Uranium (DU) used at the military Pohakuloa Training Area." Testing for residues of those agents is outside the scope of the NEON proposal. Please see Section 1 of the Draft EA that describes how there is a uniform and standardized design (in terms of both infrastructure and sampling protocols) across the network of sites, which includes 20 domains across the continental United States, Alaska, Hawai'i (proposed), and Puerto Rico. However, researchers who would want to study this could submit proposals to the relevant agencies, foundations or organizations to seek funding. If funding is received, Battelle has developed a process by which adding the capability to NEON infrastructure can be coordinated after successful completion of an evaluation of feasibility.

We appreciate your interest in the proposal and your comments.

Sincerely,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
DOH/CWB

06025PCTM.17

June 16, 2017

Ms. Montona Futrell-Griggs
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, Virginia 22230

Dear Ms. Futrell-Griggs:

SUBJECT: Comments on the Draft Environmental Assessment (DEA) for the proposed National Ecological Observatory Network Field Site South Hilo, Island of Hawaii, Hawaii TMKs: (3)2-4-008:009, 025 (por.), (3)1-9-001:001 (por.), (3)1-8-012:003 (por.), (3)2-4-008:019 (por.)

The Department of Health (DOH), Clean Water Branch (CWB), has reviewed the subject document and has no comments at this time. The DOH-CWB provided comments on the Scoping Notification for the National Science Foundation-Funded Proposed National Ecological Observatory Network Domain Core Tower and Sampling Site at Puu Makaala for this project (Letter No. 08031PMHK.16, dated August 18, 2016).

Please note that our review is based solely on the information provided in the subject document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/10/CWB_Oct22.pdf.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

CTM

c: DOH-EPO [via e-mail only]

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Alec Wong, P.E., Chief
State of Hawai'i
Department of Health
P. 0. Box 3378
Honolulu, HI 96801-3378

Subject: Comments on the Draft Environmental Assessment (DEA) for the proposed National Ecological Observatory Network Field Site South Hilo, Island of Hawaii, Hawaii
TMKs: (3)2-4-008:009, 025 (por.), (3)1-9-001:001 (por.), (3)1-8-012:003 (por.), (3)2-4-008:019 (por.)

June 28, 2017

Dear Mr. Wong,

Thank you for your comment letter, dated June 16, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network indicating the staff of the Department of Health, Clean Water Branch (DOH-CWB) has no comments on the Draft EA.

The comments received from DOH-CWB in response to the Scoping Notice were used in the development of the Draft EA. In response to your comment regarding fulfilling additional requirements related to the DOH-CWB program, please note that the managing organization (Battelle Memorial), who would be responsible for constructing and operating the field site, would be required to do so in a manner consistent with Federal, State, and local requirements. This includes the development and implementation of any plans needed to address health, safety, and environmental requirements. We will share your link to your standard comments with Battelle Memorial, for its use in planning efforts should this project move forward.

We appreciate your review of the Draft EA and your comment.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

DAVID Y. IGE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF PUBLIC SAFETY
919 Ala Moana Boulevard, 4th Floor
Honolulu, Hawaii 96814

NOLAN P. ESPINDA
DIRECTOR

Cathy Ross
Deputy Director
Administration

Jodie F. Maesaka-Hirata
Deputy Director
Corrections

Renee R. Sonobe Hong
Deputy Director
Law Enforcement

No. _____

June 20, 2017

By Electronic Mail
Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, Virginia 22230

Dear Montona Futrell-Griggs:

RE: NEON Pu'u Maka'ala Natural Area Reserve

Thank you for the Notice of Draft Environmental Assessment and public meeting for proposed National Ecological Observatory Network field site. The following information is being provided for your consideration.

KCF is a 200-bed minimum security facility and sits on 279.76 acres of Kulani property, belonging to Pu'u Maka'ala Natural Area Reserve (NAR), which is managed by the Department of Land and Natural Resources, Division of Forestry and Wildlife. I have attached a map of the area for your review.

Stainback Hwy (shown as a white on black "dashed" line) is utilized for staff to report to and from work and for inmates being transported for medical appointments, court dates, airport transports, parole to Men of Pa'a, work furlough to Hale Nani, and to special holding at Hawaii Community Correctional Center. There are also visitation hours on the weekends where inmates' family members are allowed to enter the facility.

Finally, there are many County and State of Hawaii personnel and private sector companies who access the cone (shown as a pink triangle on the map) via Stainback Hwy, through our facility gate, and via a management access road (shown as gray "dashed" line).

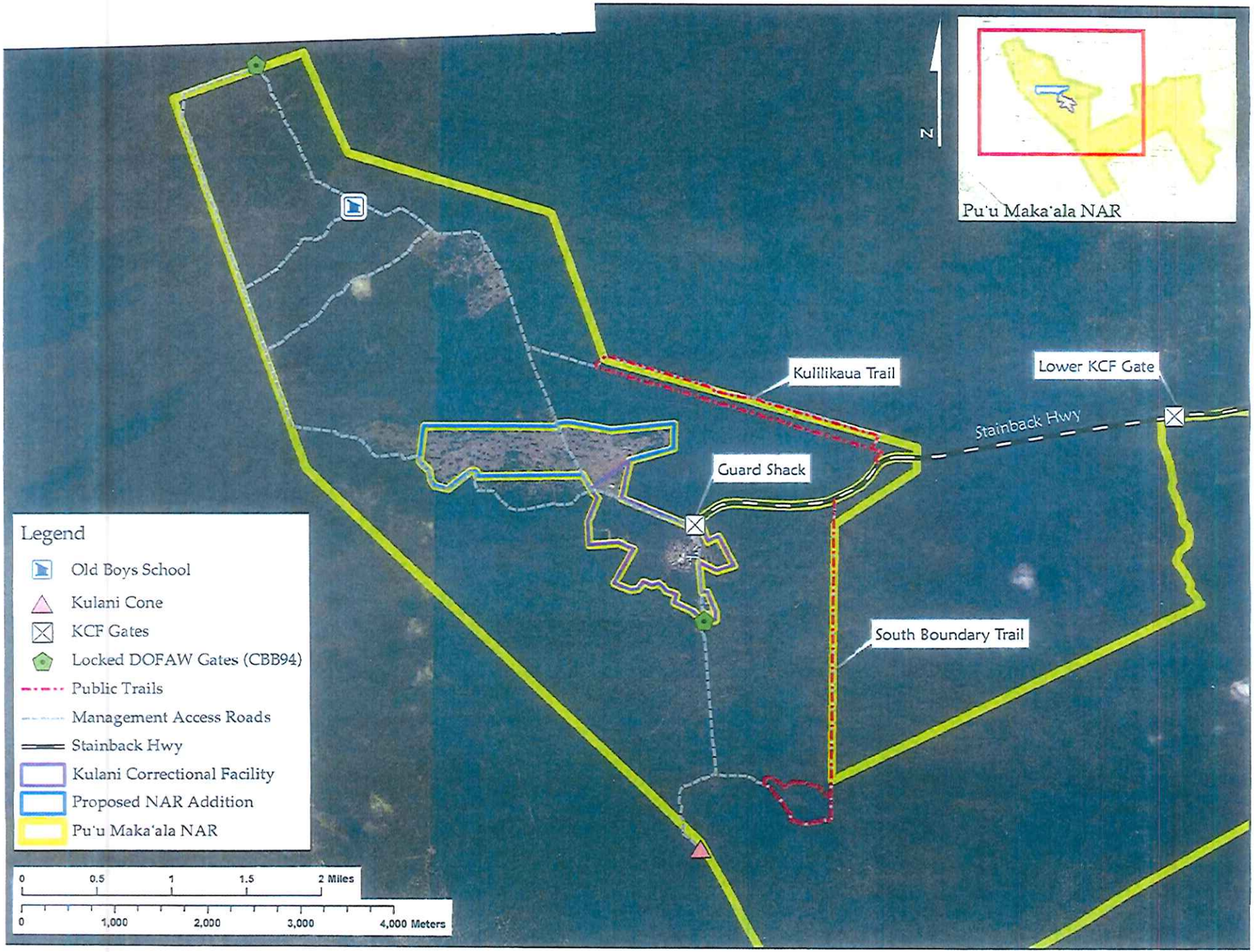
Please feel free to contact me at (808) 932-4462 if you have any further questions.

Sincerely,

Wanda Craig
Acting Warden
Kulani Correctional Facility

cc: Shari Kimoto, IDA

Attachment


N
Pu'u Maka'ala NAR
Kulilikaua Trail
Lower KCF Gate
Stainback Hwy
Guard Shack
South Boundary Trail
Legend
Old Boys School
Kulani Cone
KCF Gates
Locked DOFAW Gates (CBB94)
Public Trails
Management Access Roads
Stainback Hwy
Kulani Correctional Facility
Proposed NAR Addition
Pu'u Maka'ala NAR
0 0.5 1 1.5 2 Miles
0 1,000 2,000 3,000 4,000 Meters

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Wanda Craig, Warden
Kulani Correctional Facility
State of Hawai'i
Department of Public Safety
919 Ala Moana Boulevard, 4th Floor
Honolulu, HI 96814

Subject: NEON Proposed Pu'u Maka'ala Natural Area Reserve

June 28, 2017

Dear Ms. Craig,

Thank you for your comment letter, dated June 20, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network providing information related to Kulani Correctional Facility (KCF) operations.

We acknowledge that Stainback Highway is used by KCF staff, inmates, inmates' families, County and State of Hawai'i personnel and private sector companies. As noted in Section 4.11.1 of the EA, the managing organization (Battelle Memorial), who would be responsible for constructing and operating the field site, would coordinate the timing of large vehicle deliveries with Kūlani Correctional Facility to minimize impacts to your staff and visitors, as appropriate.

We appreciate your review of the Draft EA and your comment.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

RECEIVED

JUN 26 2017

DEPARTMENT OF WATER SUPPLY · COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 · HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 · FAX (808) 961-8657

June 21, 2017

Ms. Montona Futrell-Griggs
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, VA 22230

Dear Ms. Futrell-Griggs:

Subject: Draft Environmental Assessment for
National Ecological Observatory Network Field Site
at Pu'u Maka'ala Natural Area Reserve
Tax Map Key 1-8-012:003, 1-9-001:001 and 2-4-008:009 (Portion), 019, 021, and 025 (Portion)

We have reviewed the subject Draft Environmental Assessment and have no objection or comments to offer as the proposed project sites are not within the service limits of our existing water system in the area. The nearest Department of Water Supply facility is an existing 4-inch waterline at the intersection of North Peck Road and North Glenwood Road, approximately five (5) miles away.

Should there be any questions, please contact Mr. Ryan Quitoriano of our Water Resources and Planning Branch at 961-8070, extension 256.

Sincerely yours,

Keith K. Okamoto, P.E.
Manager-Chief Engineer

RQ:dfg

copy – Ms. Tiger Mills, State of Hawai'i, Department of Land and Natural Resources
Ms. Lisa Kettley, CH2M

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Keith K. Okamoto, P.E.
Department of Water Supply
County of Hawai'i
345 Kekūanaō'a Street, Ste. 20
Hilo, HI 96720

Subject: Draft Environmental Assessment for National Ecological Observatory Network Field Site at Pu'u Maka'ala Natural Area Reserve
Tax Map Key 1-8-012:003, 1-9-001:001 and 2-4-008:009 (Portion), 019, 021, and 025 (Portion)

June 28, 2017

Dear Mr. Okamoto,

Thank you for your comment letter, dated June 21, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network indicating the staff of the Department of Water Supply has no objection or comments to offer on the Draft EA as the proposed project is not within the service limits of your existing water system in the area.

We appreciate your review of the Draft EA.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
DIR 0713
STP 8.2161

June 27, 2017

Ms. Montona Futrell-Griggs
NEON Puu Makaala Natural Area Reserve
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, Virginia 22230

Dear Ms. Futrell-Griggs:

Subject: National Ecological Observatory Network Domain 20 Core Tower
and Field Site
Draft Environmental Assessment
South Hilo, Hawaii
TMK: (3) 1-8-012:003, 1-9-001:001, 2-4-008:009, 2-4-008:019 and 2-4-008:025

Our Department of Transportation's (DOT) comments on the subject project are as follows:

Airports Division (DOT-AIR)

While the subject project may not meet the criteria for filing a Federal Aviation Administration (FAA) Form 7460-1, we recommend the form be filed for safety concerns because the area is subject to helicopter traffic, including low-level survey and search missions. This project has been forwarded to FAA for their appropriate attention.

Highways Division (DOT-HWY)

The subject project is not expected to significantly impact the State highway facility. However, the National Science Foundation and Battelie Ecology, Inc. should coordinate their construction and heavy vehicle activity with the DOT-HWY through the Hawaii District Engineer.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Sincerely,

FORD N. FUCHIGAMI
Director of Transportation

EKT:gm
bc: AIR-EP, AIR-H, HWY-H, HWY-P (2016-140), STP (1-8-012-003)

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Ford Fuchigami
Director of Transportation
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Subject: National Ecological Observatory Network Domain 20 Core Tower and Field Site
Draft Environmental Assessment
South Hilo, Hawaii
TMK: (3) 1-8-012:003, 1-9-001:001, 2-4-008:009, 2-4-008:019, and 2-4-008:025
Reference: DIR 0713; STP 8.2161

July 12, 2017

Dear Mr. Fuchigami,

Thank you for your comment letter, dated June 27, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network.

In regards to your recommendation that the Federal Aviation Administration Form 7460-1 be completed for safety concerns, though the tower height does not meet the criteria, Battelle Ecology, Inc. (Battelle) will submit the notice.

As noted in Section 4.11.1 of the EA, Battelle, who would be responsible for constructing the field site, would implement traffic controls (including signage, flagging, or other similar methods) as needed to further minimize impacts to other vehicles travelling on Stainback Highway. This would be done in coordination with the HDOT District Engineer. Please note, the construction of the field site would not use any "wide loads", and all equipment would be brought to the site or staging area on standard sized trailers.

We appreciate your review of the Draft EA and your comment.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

DAVID Y. IGE
GOVERNOR

NOLAN P. ESPINDA
DIRECTOR

Cathy Ross
Deputy Director
Administration
Jodie Maesaka-Hirata
Deputy Director
Corrections

Renee Sonobe-Hong
Deputy Director
Law Enforcement

STATE OF HAWAII
DEPARTMENT OF PUBLIC SAFETY
HAWAII COMMUNITY CORRECTIONAL CENTER
60 Punahele Street
Hilo, Hawaii 96720-2031

No._____

June 30, 2017

Ms. Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences
National Science Foundation
4201 Wilson Boulevard, Suite 615N
Arlington, Virginia 22230

Re: NEON Pu'u Maka'ala Natural Area Reserve

Dear Ms. Futrell-Griggs:

Thank you for the Notice of Draft Environmental Assessment and public meeting for the proposed National Ecological Observatory Network field site. The following information is being provided for your consideration.

The proposed National Ecological Observatory Network field site at the Pu`u Maka`ala National Area Reserve (NAR) is approximately (30) miles South of the Hawaii Community Correctional Center (HCCC). HCCC is located in the vicinity of Hilo town, away from the Pu'u Maka'ala Natural Area Reserve. Although located away from the concerned site, HCCC does travel to Kulani Correctional Facility which is located in the area of concern for training, meetings or exchange of prisoners.

Please feel free to contact me at (808) 933-0428 if you have any further questions.

Sincerely,

Peter Cabreros
Warden

c: Shari Kimoto, IDA
Teresita Fernandez, ASO

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

Peter Cabreros, Warden
Hawai'I Community Correctional Center
State of Hawai'i
Department of Public Safety
60 Punahele Street
Hilo, HI 96720-2031

Subject: NEON Proposed Pu'u Maka'ala Natural Area Reserve

July 11, 2017

Dear Mr. Cabreros,

Thank you for your comment letter, dated June 30, 2017, on the Draft Environmental Assessment (EA) for the proposed Domain 20 Field Site for the National Ecological Observatory Network providing information related to Hawai'i Community Correctional Center (HCCC) operations.

We acknowledge there is traffic in the area by HCCC to the Kulani Correctional Facility for training, meetings, or exchange of prisoners. As noted in Section 4.11.1 of the EA, the managing organization (Battelle Memorial), who would be responsible for constructing and operating the field site, would coordinate the timing of large vehicle deliveries with the Kulani Correctional Facility to minimize impacts to HCCC staff, as appropriate.

We appreciate your review of the Draft EA and your comment.

Please contact me (phone: 703-292-7162, email: mfutrell@nsf.gov) if you have any questions.

Best,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

Appendix D
National Historic Preservation Act Section 106 and HRS Chapter 6E Consultation Documentation

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DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON
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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

September 12, 2016

IN REPLY REFER TO:
Log No. 2016.01949
Doc No. 1609GC04
Archaeology

Russell Y. Tsuji, Land Administrator
Land Division, Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Tsuji:

SUBJECT: **Chapter 6E-8 and National Historic Preservation Act (NHPA) Section 106 Review – Scoping Notification for the National Science Foundation (NSF) – Funded Proposed National Ecological Observatory Network Domain, Puʻu Makaʻala Natural Area Reserve Waiakea Ahupuaʻa, Hilo District, Island of Hawaiʻi**
TMK: (3) 1-8-012:003, 1-9-001:001, 2-4-008:009, 019, 025

Thank you for the opportunity to comment on the aforementioned proposed project by the National Science Foundation (NSF). The National Ecological Observatory Network Domain (NEON), a continental-scale research network funded by the NSF, proposes to establish a research site within the Puʻu Makaʻala Natural Area Reserve (NAR) on Hawaiʻi Island. The site will include an ecological research tower, instrument hut, soil array, Double Fence Intercomparison Reference (DFIR) precipitation gauge (with required vegetation clearing area), associated electrical infrastructure and other on-site eco-systems collection tools. The proposed project area would occupy approximately 1,000 acres, to be discontinuous within the cumulative 12,000-acres of State owned lands as listed in the above TMKs. SHPD received this submittal on August 18, 2016.

SHPD has insufficient information to determine the potential impacts to historic properties pursuant to both Hawaii Administrative Rules (HAR) §13-275 and 36 CFR 800. **SHPD requests the following information**:

(1) A delegation letter from the NSF that identifies the particular activities and responsibilities they have delegated to NEON on their behalf;
(2) Information indicating that a reasonable and good faith effort to identify historic properties (architectural, archaeological, or traditional cultural properties [TCPs]) within the area of potential effect (APE) pursuant to 36 CFR §800.4(a) and 4(b) has been completed. The identification effort must include consultation efforts with Native Hawaiian Organizations (NHOs) [36 CFR §800.4(a)(4)] and consultation with individuals, organizations and the public with a demonstrated interest in the undertaking [36 CFR §800.2(c)] and should include documentation of the nature of the consultation, the names of the consulted parties, and their comments/concerns; and
(3) A determination of eligibility for any historic properties or potential historic districts within the APE [36 CFR§800.4(c)]; assessment of project effect [36 CFR §800.4(d)]; and if necessary resolution of adverse effects [36 CFR §800.6] for any sites located with the APE.

Per 36 CFR 800, **SHPD looks forward to** receiving a request from the lead federal agency or its delegated authority to initiate NHPA Section 106 consultation with SHPD on the proposed undertaking.

The NSF is the office of record for this undertaking. Please maintain a copy of this letter with your environmental review record.

Please contact Mr. Ikaika Nakahashi at (808) 243-4600 or at Chris.Nakahashi@hawaii.gov for History and Culture concerns for Hawaii Island including Native Hawaiian Organization (NHO) consultations, cultural sites, and burials. Please contact me at Susan.A.Lebo@hawaii.gov or at (808) 692-8019 for any questions regarding archaeological resources or this letter.

Aloha,



Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: David G. Smith, DOFAW (David.G.Smith@hawaii.gov)
Lydia Morikawa, DLNR-Land (Lydia.M.Morikawa@hawaii.gov)
Montona Futrell-Griggs, NSF, Re: NEON (mfutrell@nsf.gov)
Steven Ellis, NSF, Re: NEON (stellis@nsf.gov)
Sam J. Lemmo, OCCL (Sam.J.Lemmo@hawaii.gov)

From:	Price, Lori/TPA
To:	Kettley, Lisa/HNL; Rau, Michelle/COS
Subject:	FW: NSF NEON project at Pu"u Maka"ala [EXTERNAL]
Date:	Friday, September 30, 2016 7:59:59 AM

From: Nakahashi, Chris [mailto:chris.nakahashi@hawaii.gov]
Sent: Thursday, September 29, 2016 9:00 PM
To: Price, Lori/TPA <Lori.Price@CH2M.com>
Subject: RE: NSF NEON project at Pu'u Maka'ala [EXTERNAL]

Aloha Lori,
Other organizations to consult with regarding your project are:

- Aha Moku Council for the island of Hawai‘i - http://www.ahamoku.org/index.php/hawaii-moku-o-keawe/
- Kua O Ka La - http://kuaokala.org/index.html
- Protect Kaho‘olawe ‘Ohana - http://www.protectkahoolaweohana.org/

If I find additional organizations, I will forward them to you.
Mahalo,

Christopher “Ikaika” Nakahashi, M.S.
Cultural Historian
State Historic Preservation Division
130 Mahalani Street
Wailuku, HI 96793
Phone: (808)243-4600
Fax: (808)243-5838
Email: chris.nakahashi@hawaii.gov
http://dlnr.hawaii.gov/shpd/about/branches/ibc/

From: Lori.Price@CH2M.com [mailto:Lori.Price@CH2M.com]
Sent: Thursday, September 22, 2016 4:46 PM
To: Nakahashi, Chris <chris.nakahashi@hawaii.gov>; Lebo, Susan A <susan.a.lebo@hawaii.gov>
Subject: NSF NEON project at Pu'u Maka'ala

Dear Dr. Lebo and Mr. Nakahashi,
I have received a copy of the response letter from SHPD, dated September 12, sent in response to the NSF NEPA scoping letter.
We are preparing to initiate our Section 106 consultation, and are gathering names of NHOs and others that might be interested in consulting on the proposed project.
I have reviewed the Dept of the Interior’s NHO notification list, and have gathered other names of groups that might be interested.
We would very much appreciate your input on any other NHOs or others that your office recommends that we reach out to as we begin consultation.
The list we have compiled so far is:

From DOI NHO list:

Association of Hawaiian Civic Clubs

George K. Cypher ʻOhana

Hawaiian Civic Club of Hilo

Kakoʻo ʻOiwi

Keoni Kealoha Alvarez

Koʻolau Foundation

Makuʻu Farmers Association

Office of Hawaiian Affairs

Piihonua Hawaiian Homestead Community Association

Others:
Kamehameha schools (adjacent property owner)

Hawai'i Island Burial Council

Hawai'i County Cultural Resources Commission

Historic Hawai'i Foundation

Thank you for your attention to this and we look forward to receiving any input you may have. I am hoping to get consulting party letters sent out as soon as possible, so I would greatly appreciate your response before the end of next week, if possible.

Thank you!

Lori Durio Price
Senior Cultural Resources Specialist
CH2M
Office: 813-874-6522 ext 57723
Mobile: 727-560-4503

Subject: Section106 Consultation and Meeting on Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i

Date: Tuesday, October 18, 2016 at 9:38:16 PM Eastern Daylight Time

From: Futrell-Griggs, Montona LaNise

CC: Hamilton, Kristen, Blanco, Caroline M, Futrell-Griggs, Montona LaNise

BCC: DLNR.Intake.SHPD@hawaii.gov, acamaral@yahoo.com, mallow@hawaii.edu, jhd6@hawaii.edu, kanekoaks@gmail.com, Keonialvarez@aol.com, malamapono744@aol.com, makuufarmersassociation@gmail.com, kamanaoc@oha.or, phhcahilo@gmail.com, pihanoha@ksbe.edu, kiersten@historichawaii.org, Punatita7@yahoo.com, Info@kuaokala.org, contact@protectkahoolaweohana.org

Attachments: NEON - Hawaii - Consulting Parties Letter_101816.pdf

Good afternoon,

Attached is a letter with information about a proposed National Science Foundation-funded National Ecological Observatory Network (NEON) field study site within the Pu'u Maka'ala Natural Area Reserve, located on the eastern side of Hawai'i Island. With this letter, we are seeking to identify consulting parties for consultation regarding this undertaking under Section 106 of the National Historic Preservation Act. In addition, we would like to invite consulting parties to a meeting next Wednesday, October 26th. Due to the short notice, we are sending the letter via email and would be happy to speak with you directly about the process ahead of the meeting- please feel free to contact my colleague, Kristen Hamilton, at 703-292-4820 with any questions or concerns.

Meeting details:
Date: Wednesday, October 26th
Time: 6:00-7:30 p.m.
Location: Division of Forestry and Wildlife office located at19 E. Kawili Street, Hilo, HI 96720

Thank you in advance for your interest and participation in this process.

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

October 18, 2016

Subject: Section106 Consultation on Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i

To Whom It May Concern:

The National Science Foundation (NSF) Directorate for Biological Sciences (MPS) funds the National Ecological Observatory Network (NEON), a continental-scale research network operated by awardee Battelle Ecology, Inc. NEON proposes to establish a research site within the Pu'u Maka'ala Natural Area Reserve (NAR), Hawai'i Island. The proposed site would provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawai'i," and would be the only site representing this domain in the United States. Site components would include a tower, instrument hut, an array of soil plots, a precipitation gauge, and associated electrical infrastructure with on-grade power lines. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area. The proposed project area would occupy approximately 1,000 acres, distributed throughout the Pu'u Maka'ala NAR, with approximately 0.18 acre of ground disturbance. The site is located southwest of Hilo and includes portions of TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019 (see attached map).

NSF is initiating Section 106 consultation under the National Historic Preservation Act (NHPA) for this undertaking as well as complying with Chapter 6E-8, Hawai'i Revised Statutes. NSF is also conducting a NEPA review to identify and assess any potential environmental effects of establishing a NEON site at the proposed location. The federal NEPA process is being conducted in coordination with a state-level review under Chapter 343, Hawai'i Revised Statutes.

The NEON Project partitioned the continental United States, including Alaska, Hawai'i and Puer to Rico, into 20 eco-climatic domains. Each domain represents a different region of vegetation, landforms, climate, and ecosystem performance. Within each of these domains a fully instrumented core site will be established, hosting a tower (approximately 10 meters above the surrounding canopy), instrument hut, soil array, associated electrical infrastructure with power run, a suite of terrestrial sampling protocols, and an annual flight. Each site will collect data on climate and atmosphere, soils, vegetation, and a variety of organisms. Core sites must be located in minimally managed "wildland" areas and are slated to operate for the 30-year lifetime of NEON. For the proposed Pu'u Maka'ala site, no additional roads would be constructed and strict construction limits would be implemented during the tower construction phase.

NSF is identifying organizations and individuals with an interest in the proposal's potential to affect historic properties who may qualify as consulting parties. Consulting parties can include

individuals and organizations with a demonstrated interest in the proposal "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties" (30 CFR Part 800.2[5]). The Section 106 process is described in greater detail at http://www.achp.gov/citizensguide.html. The purpose of this letter is to inquire whether you wish to be a consulting party under Section 106 for this undertaking, as well as to provide notice of an upcoming meeting (see below).

In addition, we would especially appreciate input on the following issues in the proposed site area:

1. History, land use, and cultural sites;
2. Traditional gathering practices in the proposed site area – both past and present;
3. Cultural associations through traditions, legends, traditional use, or otherwise; and
4. Referrals of kupuna who might be willing to share their cultural knowledge of the area.

This information will help us identify any potential impacts to cultural resources by the proposed action, ensure that all potential impacts to cultural resources are appropriately considered, and avoid or minimize any adverse effects, to the greatest extent possible.

The list of potential consulting parties we are contacting includes:

- Association of Hawaiian Civic Clubs
- Hawaiian Civic Club of Hilo
- George K. Cypher ʻOhana
- Kākoʻo ʻŌiwi
- Keoni Kealoha Alvarez
- Koʻolau Foundation
- Makuʻu Farmers Association
- Office of Hawaiian Affairs
- Piihonua Hawaiian Homestead Community Association
- Kamehameha schools (adjacent property owner)
- Hawai'i Island Burial Council
- Hawai'i County Cultural Resources Commission
- Historic Hawai'i Foundation
- Aha Moku Council for the island of Hawaiʻi
- Kua O Ka Lā
- Protect Kahoʻolawe ʻOhana

If you know of others we should reach out to, please provide their contact information so that we may reach out to them as well.

As a consulting party, you would be actively informed of and able to participate in the Section 106 process, including any consultation meetings, and your views would be actively sought. If you would like to request consulting party status on this project, please respond no later than October 21, 2016 by contacting:

> Ms. Montona LaNise Futrell-Griggs, National Science Foundation, Division of Biological Infrastructure, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292–7162; email: mfutrell@nsf.gov.

If you do not respond within this time-frame, you may request consulting party status in the future; however, the undertaking may advance without your input and you won't have an opportunity to comment on the previous steps. If you are requesting consulting party status, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public.

NSF is planning on being in Hawai'i the week of October 24, 2016. We plan to hold a Section 106 consulting parties meeting on Wednesday, October 26th, from 6:00-7:30 p.m. at the Division of Forestry and Wildlife office located at19 E. Kawili Street, Hilo, HI 96720.

We look forward to your response to this request and to your role as a consulting party on this undertaking, should you choose to participate. If you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at (703) 292-7162.

Sincerely,

Montona L. Futrell-Griggs

Montona Futrell-Griggs

Project Manager

Division of Biological Infrastructure

National Science Foundation

CC: SHPD

National Science Foundation
4201 Wilson Blvd
Arlington, VA 22230

Via overnight mail and email

Alan S. Downer, PhD.
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building
601 Kamokila Blvd, Ste. 555
Kapolei, Hawai'i 96707

December 7, 2016

Subject: Initiation of Section106 Consultation for Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i - portions of TMK (3) 2-4-008:009, TMK (3) 2-4-i008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019
Log No. 2016.01949, Doc No. 1609GC04 Archaeology

Dear Dr. Downer:

The National Science Foundation (NSF) Directorate for Biological Sciences (BIO) funds the National Ecological Observatory Network (NEON), a continental-scale research network operated by awardee Battelle Ecology, Inc. NEON proposes to establish a research site within the Pu'u Maka'ala Natural Area Reserve (NAR), Hawai'i Island. The proposed site would provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawai'i," and would be the only site representing this domain in the United States. Site components would include a tower, instrument hut, an array of soil plots, a precipitation gauge, and associated electrical infrastructure with on-grade power lines. The total construction acreage of these components is expected to be less than 0.25 acre. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area; a total of approximately 80-90 (or less) sampling plots would be distributed throughout the Pu'u Maka'ala NAR. The site is located southwest of Hilo and encompasses portions of TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019 (see attached map).

NSF, as the responsible federal agency, is initiating Section 106 consultation under the National Historic Preservation Act (NHPA) for this undertaking as well as complying with Chapter 6E-8, Hawai'i Revised Statutes. NSF is also concurrently preparing an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) to identify and assess any potential environmental effects of establishing a NEON site at the proposed location. The federal NEPA process is being conducted in coordination with state-level review under Chapter 343, Hawai'i

Revised Statutes. NSF has not delegated any of its authority to perform these actions, although NSF may request that its environmental contractor, CH2M Hill, and the NEON awardee, Battelle Ecology, Inc., conduct research and other information gathering activities to support NSF's Section 106 and Chapter 6E-8 compliance.

The NEON Project partitioned the continental United States, including Alaska, Hawai'i and Puer to Rico, into 20 eco-climatic domains. Each domain represents a different region of vegetation, landforms, climate, and ecosystem performance.
Within each of these domains a fully instrumented core site will be established, hosting a tower (approximately 10 meters above the surrounding canopy), instrument hut, soil array, associated electrical infrastructure with power run, a suite of terrestrial sampling protocols, and an annual flight. Each site will collect data on climate and atmosphere, soils, vegetation, and a variety of organisms. Core sites must be
located in minimally managed "wildland" areas and are slated to operate for the 30-
year lifetime of NEON. For the proposed Pu'u Maka'ala site, no additional roads would be constructed and strict construction limits would be implemented during the tower construction phase.

NSF has established a draft Area of Potential Effects (APE) for this undertaking to include all proposed instrument and potential sampling areas, as shown on the attached map. We request your review and approval of the APE.

NSF, after consulting with your staff, has preliminarily identified organizations and individuals who may have an interest in the proposal's potential to affect historic properties. These organizations and individuals may qualify as consulting parties and, accordingly, we have reached out to them to invite their participation:

- Association of Hawaiian Civic Clubs
- Hawaiian Civic Club of Hilo
- George K. Cypher 'Ohana
- Kāko'o 'Ōiwi
- Keoni Kealoha Alvarez
- Ko'olau Foundation
- Maku'u Farmers Association
- Office of Hawaiian Affairs
- Piihonua Hawaiian Homestead Community Association
- Kamehameha Schools (adjacent property owner)
- Hawai'i Island Burial Council
- Hawai'i County Cultural Resources Commission
- Historic Hawai'i Foundation
- Aha Moku Council
- Kua O Ka Lā
- Protect Kaho'olawe 'Ohana

- Hawai'i Volcanoes National Park
- Mauna Kea Watershed Alliance

Please let us know if there are others we should include in our consultation efforts.

Potential consulting parties were invited to attend a meeting on October 26th, 2016, to discuss the draft APE and to assist in identifying any historic properties and cultural practices. Meeting attendees provided input on usage of the Pu'u O'o Trail and the presence of the historic Wright camp, both of which are outside of the draft APE, as well as the Mauna Loa Boys' School, which is within the draft APE. A November 18, 2011, letter from the Deputy State Historic Preservation Officer to the Division of Forestry and Wildlife regarding the Pu'u Maka'ala Natural Area Reserve Management Plan describes the school, which was opened in 1952 and closed the following year. This letter notes that "the Mauna Loa Boys School is within the NAR project area and is currently being used to store fencing materials; this use does not cause or constitute any adverse effects to the structure, which is in poor condition." Meeting attendees likewise noted the poor condition of the former school, and that the proposed NEON site had no potential to affect the building. Attendees were not aware of any cultural practices within the draft APE, noting that this area is challenging to access. NSF acknowledges that there was short notice for this consulting parties meeting due to logistical challenges, and we, therefore, plan to hold an additional consulting parties' meeting during the comment period for the Draft EA. We look forward to receiving further input from consulting parties at that time. In addition to that consultation opportunity, we are copying all potential consulting parties on this letter and will, by separate correspondence, request their review and comment on the information and findings in this letter during a comment period that extends up to and including January 9, 2017.

As part of our effort to identify historic properties in the vicinity of the proposed site, a literature review was completed at the SHPD library, and other research was done to locate previous Environmental Assessments and cultural studies done for the proposed site area. The results from that search are shown in the table below.

Title	**Author**	**Date**	**Findings**
Archaeological Inventory Survey and Limited Cultural Assessment for the Proposed Wastewater Treatment Facility at Kulani Correctional Facility (TMK:3-2-4-08:9)	Rechtman, Robert B. Ph.D.	July 2001	No sites found. Archeological expectations for the general area are very limited due to location in the "rainforest zone."
He Mo'Olelo 'Āina: A Cultural Study of the Pu'u Maka'Ala Natural Area Reserve Districts of Hilo and Puna, Island of Hawai'i	Kumu Pono Associates LLC	May 2004	No references to archaeological sites.
Draft Environmental Assessment - Pu'u Maka'ala Natural Area Reserve Management Plan	Hawaii Branch Natural Area Reserves System	January 2012	SHPD concurred with the finding of No Historic Properties Affected

If there is any other information you can provide or sources you would like to suggest, please let us know.

The 2004 study by Kumu Pono did not note any records or references to specific archaeological sites in the proposed site area. The study notes that "because of the remote nature of the 'Ola'a and Waiakea forest lands which comprise the present-day Pu'u Maka'ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiakea, 'Ola'a, Keauhou and Humu'ula. Based on the native traditions and kama'aina testimonies, it is likely that 'practitioner' trails existed throughout the forest region. Features such as 'kauhale manu' (bird-catcher's shelters), 'kahua kalaiwaa' (canoe-makers clearings), 'oioina' (trailside resting places and shelters), the 'ala hele' (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape" (Kumu Pono Associates LLC, 2004).

We also interviewed NAR staff on any known cultural sites or practices. Mr. Nick Agorastos, NAR Specialist with Hawaii Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), stated that he had never encountered anyone engaged in cultural practices in the site area, even though he and/or his staff are on the property almost daily. He noted that the NAR rules specify the need for a permit to conduct cultural practices within the NAR, and that he is only aware of two previous permit requests for Pu'u Maka'ala NAR, both involving removal of a koa log to build a canoe.

The Kumo Pono Associates report also notes that "the mountain landscape, its' native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its 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 'Ola'a and Waiakea Forest Reserves, the Pu'u Maka'ala NAR, and the Endangered Species Act)." NSF recognizes that members of the 'alalā (*Corvus hawaiiensis*) species may also be culturally significant. This species is currently extinct in the wild but is planned for reintroduction beginning in December 2016.

Although the proposed site area has not been surveyed, previous studies indicate that the probability of historic properties being present in the proposed site area is very low. Specifically, the site elevation and difficult accessibility, combined with the ephemeral nature of traditional uses and features, makes the archaeological expectations for the area very low. Should any archaeological historic properties be present, the likelihood of adverse effects to them from the proposal is low because the site components entail only minimal ground disturbance. In summary:

- Proposed site is in remote area in upper elevation with no known archaeological or historic properties.
- Proposed actions involve minimal ground disturbance.
- Archaeological studies in adjacent areas have not found any sites and have determined there is a low likelihood of sites in this wet upper-elevation rain forest.

We look forward to consulting with you on this undertaking. We anticipate preparing our Draft EA in January; any input provided to us by the SHPD and/or consulting parties by January 9th will be incorporated into the cultural resources section of the Draft EA. If you have any questions, or wish to discuss the proposal or our agency's responsibilities in more detail, please contact me at (703) 292-7162.

Sincerely,

Montona Futrell-Griggs

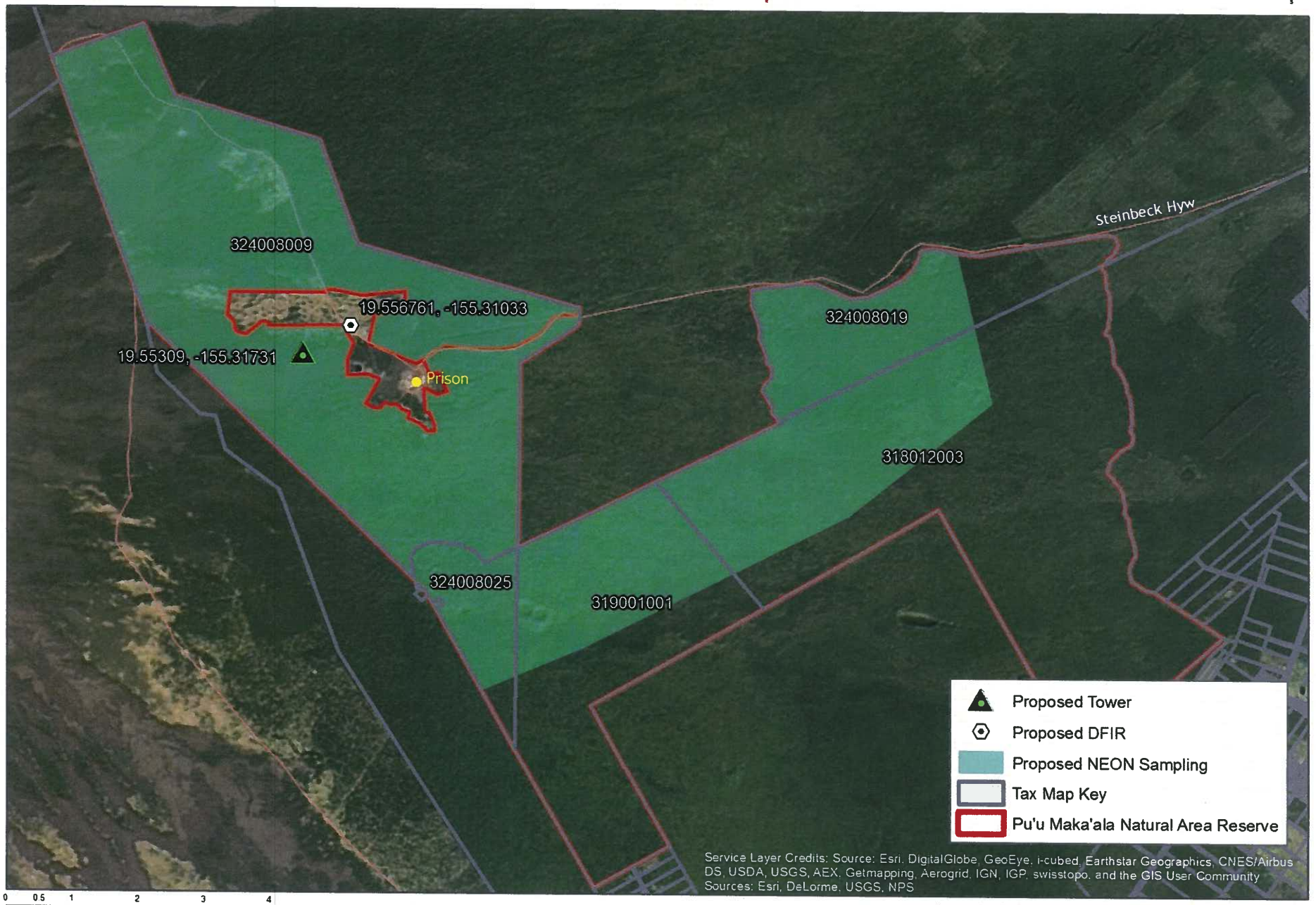
Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

Cc (via mail and email, if available):

Association of Hawaiian Civic Clubs
Hawaiian Civic Club of Hilo
George K. Cypher ʻOhana
Kākoʻo ʻŌiwi
Keoni Kealoha Alvarez
Koʻolau Foundation
Makuʻu Farmers Association
Office of Hawaiian Affairs
Piihonua Hawaiian Homestead Community Association
Kamehameha Schools (adjacent property owner)
Hawai'i Island Burial Council
Hawai'i County Cultural Resources Commission
Historic Hawai'i Foundation
Aha Moku Council
Kua O Ka Lā
Protect Kahoʻolawe ʻOhana
Hawai'i Volcanoes National Park
Mauna Kea Watershed Alliance

Pu'u Maka'ala Natural Area Reserve

Domain 20 - Pacific Tropical



0 0.5 1 2 3 4 Kilometers

0 0.375 0.75 1.5 2.25 3 Miles

1:78,000 WGS 1984 UTM Zone 5N - M. Slater 6/2016

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Datum: WGS 1984; Projection: UTM Zone 5N

Subject: Section 106 Initiation Letter to the HI State Historic Preservation Division

Date: Tuesday, December 13, 2016 at 8:55:32 AM Eastern Standard Time

From: Futrell-Griggs, Montona

To: DLNR.Intake.SHPD@hawaii.gov, acamaral@yahoo.com, mallow@hawaii.edu, jhd6@hawaii.edu, kanekoaks@gmail.com, Keonialvarez@aol.com, malamapono744@aol.com, makuufarmersassociation@gmail.com, kamanaoc@oha.org, phhcahilo@gmail.com, pihanoha@ksbe.edu, lucas.mead@hawaiicounty.gov, kiersten@historichawaii.org, Punatita7@yahoo.com, Info@kuaokala.org, contact@protectkahoolaweohana.org, chperry@hawaii.edu

CC: Andrea@historichawaii.org

Attachments: Signed HI SHPO Initiation Letter.pdf

Good morning,

Because you have been identified as a potential consulting party interested in the National Science Foundation's proposed funding of a National Ecological Observatory Network research site within the Pu'u Maka'ala Natural Area Reserve, we invite you to review the attached letter to the State Historic Preservation Division (attached). This letter identifies the Draft APE and contains our evaluation regarding the presence of any historic properties within the Draft APE. A hard copy of the letter has been mailed to you as well, if a mailing address was available to us. If you have input on the Draft APE and any historic properties, or any other concerns with regard to the proposal, we respectfully request that you submit your comments to us by January 9th so that they may inform the cultural resources section of our draft Environmental Assessment. Please email any comments to mfutrell@nsf.gov Or mail them to 4201 Wilson Blvd, Suite 615 Arlington, VA 22230. If you have any questions, contact me at (703) 292-7162.

Note: Upon release of the draft EA for the project, a comment period will start during which comments related to the presence of historic properties and cultural practices can also be submitted. In addition, NSF is planning to hold two other meetings in February or March 2017 during this period to solicit comments (one meeting will be on the draft EA and the other meeting will be a Section 106 consultation meeting).

Thank you,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

Wednesday, June 28, 2017 at 5:49:37 PM Eastern Daylight Time

Subject: FW: NHPA Section 106 Consultation with SHPD Initiation Letter for Funded Proposed National Ecological Observatory Network Domain, Pu‘u Maka‘ala Natural Area Reserve Waiakea Ahupua‘a, Hilo District, Island of Hawai‘i; Re: Log No. 2016.01949 Doc No. 1609...

Date: Tuesday, January 10, 2017 at 8:52:25 AM Eastern Standard Time

From: Futrell-Griggs, Montona

To: Susan.A.Lebo@hawaii.gov, chris.nakahashi@hawaii.gov

Attachments: Signed HI SHPO Initiation Letter.pdf

Good morning,

I am following up on the email sent last month related to a consultation initiation letter for the NEON site that is proposed to be in the Pu‘u Maka‘ala Natural Area Reserve Waiakea Ahupua‘a on the Island of Hawai’i. Have you had a chance to review the letter? We would like to schedule a call with you to discuss the consultation and the proposed project. Could you let me know your availability?

Best,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

Subject: RE: Section106 Consultation and Meeting on Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i

Date: Thursday, January 12, 2017 at 7:36:50 PM Eastern Standard Time

From: Kiersten Faulkner

To: Futrell-Griggs, Montona

CC: planning@co.hawaii.hi.us, Jessica Puff (jessica.l.puff@hawaii.gov), Susan Lebo (Susan.A.Lebo@hawaii.gov), Sean Naleimaile (sean.p.naleimaile@hawaii.gov), Lucas Mead (Lucas.Mead@hawaiicounty.gov)

Attachments: HHF Comments_NSF NEON_PuuMakaalaNAR_011217.pdf

Aloha,
Please see attached comments from Historic Hawai'i Foundation on the NEON project at the Pu'u Maka'ala Natural Area Reserve.

We have concerns that the APE is too narrowly drawn, but also acknowledge the low probability of the presence of National Register-eligible historic properties. Unless additional information about the presence of cultural resources is revealed, HHF agrees with the finding of no historic properties affected.

Hard copy of the letter will follow by mail.

Thank you,
Kiersten Faulkner

Kiersten Faulkner
Executive Director
Historic Hawai'i Foundation
680 Iwilei Rd. Ste. 690
Honolulu, HI 96817
Email: Kiersten@historichawaii.org
Phone: 808-523-2900
FAX: 808-523-0800
WEB: www.historichawaii.org

From: Futrell-Griggs, Montona [mailto:mfutrell@nsf.gov]
Sent: Tuesday, December 13, 2016 3:28 AM
To: Kiersten Faulkner <Kiersten@historichawaii.org>; planning@co.hawaii.hi.us
Subject: Re: Section106 Consultation and Meeting on Proposed National Science Foundation-Funded

HISTORIC HAWAI'I FOUNDATION

January 12, 2017

Ms. Montona LaNise Futrell-Griggs
Project Manager, NEON Program
Division of Biological Infrastructure
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230
Via email: mfutrell@nsf.gov

Re: NHPA Section106 Consultation on Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i
TMK: portions of (3) 2-4-008:009; (3) 2-4-i008:025; (3) 1-9-001:001; (3) 1-8-012:003; and (3) 2-4-008:019

Dear Ms. Futrell-Griggs,

Thank you for the invitation via email on December 13, 2016 to continue participation in the National Historic Preservation Act (NHPA) Section 106 Consultation on the proposed research site within the Pu'u Maka'ala Natural Reserve Area. Historic Hawai'i Foundation (HHF) is in receipt of materials distributed at the October 26, 2016 meeting and was copied on the letter dated December 7, 2016 to the State Historic Preservation Division (SHPD) of the Department of Land and Natural Resources initiating Section 106 Consultation

HHF accepts the invitation to continue consultation for the proposed National Ecological Observatory Network (NEON) research site number 20 and efforts to avoid, minimize and mitigate adverse effects on historic properties.

Undertaking: The project proposes to establish a research station within the Pu'u Maka'ala Natural Reserve Area southwest of Hilo on the Island of Hawai'i. The NEON Project partitioned the United States, including Alaska, Hawai'i and Puerto Rico, into 20 eco-climatic domains. Each domain represents a different region of vegetation, landforms, climate, and ecosystem performance. Within each of these domains a fully instrumented core site will be established, hosting a tower (approximately 10 meters above the surrounding canopy), instrument hut, soil array, associated electrical infrastructure with power run, a suite of terrestrial sampling protocols, and an annual flight. Each site will collect data on climate and atmosphere, soils, vegetation, and a variety of organisms. Core sites must be located in minimally managed "wildland" areas and are slated to operate for the 30-year lifetime of NEON.

APE: The proposed Area of Potential Effect (APE) is described as "all proposed instrument and potential sampling areas" as shown on the map submitted with the consultation letter.

HHF notes that the photographs of other NEON sites also show above-ground utility connections between the separate instrument and sampling areas. For that reason we believe that the APE is actually the entire Pu'u Maka'ala Natural Area Reserve (NAR), including that portion fully surrounded by the reserve for the proposed DFIR.

In addition, the proposed tower would rise 10-meters above the tree canopy and would be visible from a distance. The APE for visual effects should include areas from which the tower could be seen.

Identification of Historic Resources: The NSF determined that no historic properties are present at the site, based on:

- Literature review of previous studies found no known archaeological or historic sites;
- Archaeological studies in adjacent areas indicate that the probability of historic properties being present in the proposed site is very low due to the site's remote location in the wet upper-elevation rain forest; and
- Discussions with NAR staff

HHF does not know of any historic or cultural resources in the NAR. However, if Native Hawaiian Organizations or individuals have knowledge of cultural or other sites, that information should be taken into account. It may be necessary to provide for cultural or archaeological monitoring during construction to guard against inadvertent effects.

Determination of Effect: The NSF proposes a preliminary determination of "no historic properties affected".

Based on the materials presented HHF concurs with the preliminary finding of no historic properties affected. However, if the scope of the proposed work changes, or previously unidentified historic or cultural resources are identified during the project, please notify HHF so we may reevaluate if our involvement is warranted at that time.

We wish you well with your project and efforts to monitor and protect natural resources in the NAR.

Very truly yours,

Kiersten Faulkner

Kiersten Faulkner, AICP
Executive Director

Copies via email:

SHPD: Susan Lebo, Jessica Puff, Sean Naleimaile
Hawai'i County Cultural Resources Commission: Deborah Chang, Chair (planning@co.hawaii.hi.us)

From:	Futrell-Griggs, Montona
To:	Susan.A.Lebo@hawaii.gov
Cc:	Blanco, Caroline M; Hamilton, Kristen
Subject:	Re: NHPA Section 106 Consultation with SHPD Initiation Letter for Funded Proposed National Ecological Observatory Network Domain, Puʻu Makaʻala Natural Area Reserve Waiakea Ahupuaʻa, Hilo District, Island of Hawaiʻi; Re: Log No. 2016.01949 Doc No. 1609...
Date:	Thursday, March 23, 2017 10:27:40 AM
Attachments:	Signed HI SHPO Initiation Letter[2].pdf

Good afternoon Dr. Lebo,

I just left a voicemail message for you. I called to schedule a call with you to discuss the initiation letter we sent to you in December (attached) and our plans for the process going forward. We would like to update you on the progress of the concurrence request and to get your opinion on a few items we are planning. If you have time for a call next week, we would love to get on your schedule.

Please feel free to call me back at 703-292-7162 or respond directly to this email. I will attempt to reach you again tomorrow.

Best,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
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Susan Lebo, PhD.
Administrator, State Historic Preservation Division
Department of Land and Natural Resources
Kakuhihewa Building
601 Kamokila Blvd, Ste. 555
Kapolei, Hawai'i 96707

April 24, 2017

Subject: Section106 Consultation for Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i - portions of TMK (3) 2-4-008:009, TMK (3) 2-4-i008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019
Log No. 2016.01949, Doc No. 1609GC04 Archaeology

Dear Dr. Lebo:

The National Science Foundation (NSF) Directorate for Biological Sciences funds the National Ecological Observatory Network (NEON), a continental-scale research network operated by awardee Battelle Memorial Institute. NEON proposes to establish a research site within the Pu'u Maka'ala Natural Area Reserve (NAR), Hawai'i Island. The proposed site would provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawai'i," and would be the only site representing this domain in the United States. Site components would include a tower, instrument hut, an array of soil plots, a soil horizon pit, a precipitation gauge, and associated electrical infrastructure with on-grade power lines. The total construction acreage of these components is expected to be less than 0.25 acre. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area; a total of approximately 80-90 sampling plots would be distributed throughout the Pu'u Maka'ala NAR. The site is located southwest of Hilo and encompasses portions of TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003, and TMK (3) 2-4-008:019.

NSF, as the responsible federal agency responsible for Section 106 consultation under the National Historic Preservation Act (NHPA) and Chapter 6E-8, Hawai'i Revised Statutes compliance for this undertaking, initiated consultation with the State Historic Preservation Division (SHPD) by letter dated December 7, 2016 (see Appendix A of the attached report). NSF is also preparing an Environmental Assessment (EA) to identify and assess any potential environmental effects of establishing a NEON site at the proposed location, per the National Environmental Policy Act and Chapter 343, Hawai'i Revised Statutes. We anticipate the EA to be published in May 2017.

NSF conducted a consulting parties meeting on October 26, 2016 to gather input on any historic properties in the APE. Our December letter to your office proposed a Draft Area of Potential Effects (APE) for this undertaking for your review and approval, described the process whereby NSF has engaged with consulting parties to identify any historic properties within the APE, and summarized the

results of our literature review to identify historic properties within the APE. The consulting parties were provided a copy of the December letter. We have followed up with you and Mr. Sean Naleimaile of your office via email to provide an opportunity for input as we finalized our Assessment of Effects and the cultural resources section of the EA. No comments regarding either NSF's determination of the APE or NSF's identification of historic properties within the APE have been received from either the SHPD or the consulting parties.

With this letter, the attached Cultural Resources Assessment of Effects is submitted for your review. Although there are no known historic properties within the APE, this assessment considers potential impacts to the cultural landscape, archaeological resources, and Traditional Cultural Properties (TCPs). In summary, with implementation of best management practices to address any unanticipated discovery of buried cultural resources (see Section 3.1.1), NSF expects no historic properties to be affected by the proposed undertaking. In addition, due to the nature of the proposed research site components, NSF finds that the undertaking would result in no adverse effects to TCPs such as the cultural landscape, as well as to cultural uses, practices, and properties.

We seek your concurrence on our finding of No Adverse Effect to Historic Properties. If you have any questions, or wish to discuss this proposed undertaking, please contact me at (703) 292-7162. Note that we will be holding a public meeting following the publishing of the EA, and the agenda will include an informational presentation on the Cultural Resources Assessment of Effects and consulting parties will be invited to attend.

Sincerely,

Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program
Division of Biological Infrastructure
Directorate for Biological Sciences

cc (via email, if available): Alan S. Downer
Sean Naleimaile
Ikaika Nakahashi
Consulting parties

TECHNICAL REPORT

Domain 20 Field Site for the National Ecological Observatory Network Pu'u Maka'ala Natural Area Reserve South Hilo District, Hawai'i Island, Hawai'i: Cultural Resources Assessment of Effects

April 2017

Prepared for
National Science Foundation

Prepared by
ch2m

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A Section 106 Consultation Correspondence

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Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effects
CFR	*Code of Federal Regulations*
DFIR	double-fenced intercomparison reference
DLNR	State of Hawai'i Department of Land and Natural Resources
DOFAW	DLNR Division of Forestry and Wildlife
EA	Environmental Assessment
HRS	Hawaii Revised Statutes
MOA	Memorandum of Agreement
NAR	Natural Area Reserve
NARS	Natural Area Reserves System
NEON	National Ecological Observatory Network
NHPA	National Historic Preservation Act
NRC	National Research Council
NRHP	National Register of Historic Places
NSF	National Science Foundation
PVC	polyvinyl chloride
RFI	request for information
SHPO	State Historic Preservation Officer
SHPD	State Historic Preservation Division
TCP	traditional cultural property
TMK	tax map key

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SECTION 1

Introduction

The National Ecological Observatory Network (NEON) is a continental-scale ecological observation facility sponsored by the National Science Foundation (NSF) and operated by Battelle Memorial Institute. NSF is proposing to establish a NEON field study site within the Pu'u Maka'ala Natural Area Reserve (NAR) on the eastern side of Hawai'i Island, part of the statewide Natural Area Reserves System (NARS). The proposed field study site would provide data for NEON's Pacific Tropical domain (Domain 20), and would be the only site representing this domain for the continental-wide network. Site components would include a research tower, instrument hut, a soil horizon pit, an array of soil plots, walkways, a precipitation gauge, and associated electrical infrastructure with on-grade power lines. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area. The infrastructure would occupy less than 0.25 acre. Terrestrial sampling plots, with a total footprint of approximately 650 acres, would be distributed throughout approximately 11,660 acres of the surrounding NAR property. This technical report identifies cultural resources located within the proposed project area and provides an assessment of effects on cultural resources as a result of the proposed project.

1.1 Definition of Proposed Undertaking

The use of federal funds for the proposed project is considered an undertaking and establishes the need for consultation under Section 106 of the National Historic Preservation Act (NHPA). NSF, as the responsible federal agency, initiated Section 106 consultation with the Hawai'i State Historic Preservation Officer (SHPO) on December 7, 2016. In Hawai'i, the SHPO is housed in the State Historic Preservation Division (SHPD). Consultation with SHPD is ongoing.

Cultural resources include prehistoric and historic archaeological sites, historic architectural properties (including buildings, structures, and objects), historic districts, designed landscapes, and traditional cultural properties (TCPs). Section 106 of the NHPA requires federal agencies to consider the effects of actions they fund or approve on any resource that is listed in or eligible for listing in the National Register of Historic Places (NRHP). The implementing regulation for NHPA is the Protection of Historic Properties (36 *Code of Federal Regulations* [CFR] §800). Historic properties are defined in 36 CFR §800.16 as any historic and prehistoric archaeological sites, districts, buildings, structures, objects, and landscapes included in or eligible for the NRHP.

In addition, there are other federal and state laws that protect cultural resources that are not necessarily listed in or eligible for listing in the NRHP. These laws include the National Environmental Policy Act (NEPA) and Hawaii Revised Statutes (HRS) Chapter 6E-8. In addition, HRS Chapter 343 and its implementing rules (Hawaii Administrative Rules 11-200) require consideration of a proposed project's potential effect on cultural beliefs, practices, and resources.

In coordination with the Section 106 process, NSF is also complying with HRS Chapter 6E-8 and concurrently preparing an Environmental Assessment (EA) under NEPA. The federal NEPA process is being conducted in coordination with state-level review under HRS Chapter 343. Effects to non-NRHP properties that are considered under NEPA, HRS Chapter 6E, and HRS Chapter 343, are discussed and analyzed in the EA. This technical memorandum is in compliance with Section 106 of the NHPA and assesses effects to historic properties as defined in 36 CFR §800. However, in order to address all cultural resources identified in the EA, this assessment of effects technical report also includes discussion of effects to non-NRHP cultural resources that have been considered during the EA process.

1.2 Project Location

The proposed Domain 20 core field study site is within the Pu'u Maka'ala NAR, which is located on the northeast slopes of Mauna Loa, in the South Hilo District, approximately 30 kilometers (19 miles) southwest of the town of Hilo (Figure 1). Pu'u Maka'ala NAR is approximately 18,730 acres in size, and is managed by State of Hawai'i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) for the protection of unique natural resources. It is bordered by the Upper Waiakea Forest Reserve of the north and east, the Ola'a Forest Reserve on the east, the Ola'a Tract of Hawai'i Volcanoes National Park to the south, and private property to the west (Kamehameha Schools), southwest and southeast (various agricultural parcels). The Kulani Correctional Facility, which occupies approximately 280 acres, is located within an interior portion of the NAR. Stainback Highway provides access from Mamalahoa Highway (State Route 11) to the eastern edge of Pu'u Maka'ala NAR and the Kulani Correctional Facility. A series of existing unimproved roads provide limited access within the NAR.

The proposed Domain 20 core site would be located in the western portion of the NAR, with the proposed infrastructure for the site located approximately 1.7 kilometers (1 mile) northwest of the Kulani Correctional Facility. The proposed infrastructure would be located within tax map key (TMK) (3)2-4-008:009. Terrestrial sampling would occur within the surrounding lands, with distributed sampling plots located within the following TMKs: (3)2-4-008:009, (3)2-4-008:025 (portion), (3)1-9-001:001 (portion), (3)1-8-012:003 (portion), and (3)2-4-008:019 (portion).

1.3 Project Background

For nearly two decades, the ecological sciences research community has called for the national research and observation capability needed to promote understanding of the biosphere. Two reports published by the National Research Council (NRC), *Grand Challenges in Environmental Science* (2001) and *NEON: Addressing the Nation's Environmental Challenges* (2003), identified the "Grand Environmental Challenges" and the associated research questions which were deemed critically important to address now, cannot be addressed with existing research infrastructure, and require environmental measurements on a regional to continental scale.

To provide the basis to respond to these critical research questions, NEON was developed as a continental-scale ecological observation facility, comprised of a network of long-term scientific infrastructure deployments to collect high-quality, standardized data. The design divides the continental United States, Alaska, Hawai'i, and Puerto Rico into 20 domains, with each domain representing a specific range of eco-climatic conditions, thereby encompassing the full range of environmental variability. Within each domain, infrastructure is deployed to field study sites strategically selected to represent different regions of vegetation, landforms, climate, and ecosystem performance. Data collection methods are standardized across the field study sites and include *in situ* instrument measurements, field sampling, and airborne remote sensing. This network of deployments forms a fully integrated continental-scale research platform. Under this system, measurement of a variable over time in all 20 domains facilitates understanding of the quantity, changes in, and spatial heterogeneity of that variable at a continental scale. Given the time required to observe changes in some ecological parameters, NEON is designed to have a 30-year operational lifespan. Overall, this platform enables scientists to analyze, understand, and forecast the nature and pace of biological change at scales ranging from local to continental.

A thorough process was conducted to identify, evaluate, and select sites for deployment of NEON infrastructure within each of the 20 domains. The NEON project team established site criteria and a detailed selection and review process (involving research community workshops, Blue Ribbon committees, and NRC and NSF merit reviews). In October 2006, the NEON project team announced a request for information (RFI) inviting members of the ecological research community to submit ideas

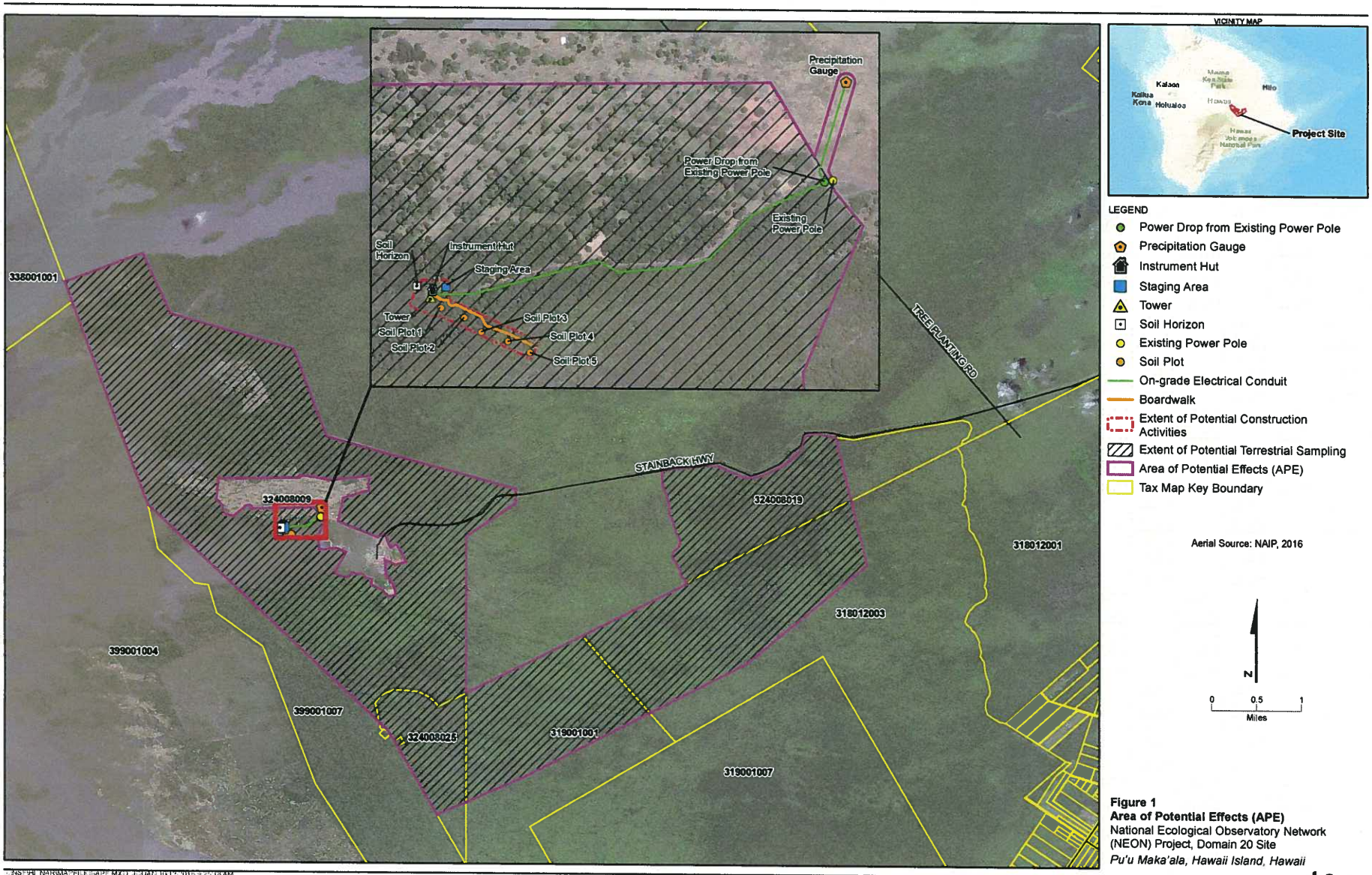

Figure 1
Area of Potential Effects (APE)
National Ecological Observatory Network (NEON) Project, Domain 20 Site
Pu'u Maka'ala, Hawaii Island, Hawaii

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over the course of this process and the site suitability requirements for NEON, only a single alternative has been identified as viable for consideration (in addition to the No Action alternative).

1.4.1 Proposed Action Alternative

Under the Proposed Action, the Domain 20 core site would be constructed within Pu'u Maka'ala NAR, and would be operated as part of the continental-scale network of long-term ecological infrastructure deployments for NEON. Per the designations used to evaluate possible sites within Pu'u Maka'ala NAR, the proposed infrastructure would be located in the northwestern portion of the NAR, approximately 1.7 kilometers (1 mile) northwest of the Kulani Correctional Facility (field study Site 11). Terrestrial sampling protocols would be conducted within distributed sampling plots located in the surrounding areas within Pu'u Maka'ala NAR. Site-specific characteristics that make the selected location highly suitable for construction and operation of the Domain 20 core field study site include:

- The forest in this area is highly representative of similar habitat across the Hawaiian Islands. It is relatively high-quality, intact forest with very little development, which meets the NEON criteria for a "wildland" area. However, it is within an area that has been subject to some degree of disturbance, such that the project would not be affecting otherwise pristine forest habitat. The site includes adequate space such that the infrastructure can be installed with a very minimal amount of vegetation clearing/trimming. In addition, former pastureland located adjacent to the forested area would allow for the precipitation gauge to be proximate to the tower without impacting native species.
- The soils are deeper than those encountered at alternative sites, which provides better opportunity to implement NEON's proposed soil protocols and installation of soil sensors.
- The site is readily accessible by existing access roads, but does not overlap with any trails or other recreational resources. The area does not support hunting (as it is located within ungulate fencing), and given its proximity to the Kulani Correctional Facility, the site is rarely (if ever) accessed by the public.
- Existing electrical lines are located reasonably close to the proposed site, thus minimizing the distance of the proposed power run.

As a core field study site in NEON, the Proposed Action includes deployment of standardized infrastructure and equipment, as well as terrestrial sampling and data collection consistent with NEON protocols. These project components, including the associated construction and site closure activities, are detailed below

1.4.1.1 Project Components

Core Site Infrastructure and Equipment

Similar to other NEON core field study sites, the Domain 20 site would be fully instrumented with standardized infrastructure and equipment designed to collect biological, biophysical, biogeochemical, and land use data. The following infrastructure and equipment would be deployed to the site; all proposed infrastructure would be located adjacent to existing roads, and no new roads would be required for access to or within the site.

- Research Tower: The site would include a single scaffold lattice tower, which would support an array of sensors to collect data on climate, canopy microclimate, and air quality. The tower would extend 10 meters above the forest canopy and would be approximately 30 meters (105 feet) tall. It would be constructed on a concrete foundation pad (approximately 6.5 foot square). An adjacent set of stairs with a landing would provide access to the tower. Four guy wires would be installed to stabilize the tower. The wires would attach toward the top of the tower (but below the canopy top, to minimize the potential for bird strikes), and would attach to concrete

anchors located approximately 30 meters from the tower base. Minor vegetation trimming would likely be required to maintain proper clearance around the guy wires. If needed, the guy wires could be fitted with bird flight diverters to increase the visibility of the guy wires for forest birds.

- Instrument Hut: The instrument hut would be a prefabricated module that would house gas-analyzer instruments, data recording equipment, and communications and control hardware. It would be mounted on a buried concrete foundation (approximately 9 feet wide by 22 feet long), and would have a raised boardwalk (46 inches wide) installed around the perimeter with a 10-foot-long ramp to facilitate equipment delivery. The instrument hut would include a climate control system; a small drainage trench would be installed to collect condensation generated by this system.
- Soil Horizon Pit: A 6-foot by 6-foot pit would be temporarily excavated to a depth of 7 feet (or as deep as reasonably possible based on substrate conditions and depth to bedrock) to allow for inspection and research of soil horizons. The pit would be properly stabilized, covered with plywood and surrounded with construction fencing for safety purposes. The excavated materials would be stockpiled onsite, and once inspection and research activities have been completed, the pit would be backfilled. These activities would all occur during the construction phase.
- Soil Array: The soil array would include a series of five sequential soil plots. Each plot would be 5 meters (16.4 feet) square, and would include a network of in-ground soil sensors. The sensors would be installed using minimally intrusive methods, as the goal is to maintain undisturbed native soil for research purposes. Polyvinyl chloride (PVC) conduit with power and communication lines would be routed to each plot (in conjunction with the walkway described immediately below); device posts and metal arbors would be installed at the edge of each plot to support the power and communications equipment needed to operate the soil sensors.
- Walkways: Designated walkways would be installed from the access road to the proposed infrastructure within forested habitat to provide a focused point of access and minimize the potential extent of disturbance from repeated visits for maintenance or data collection. The walkways would be approximately 2 feet wide and would consist of flexible honeycomb paver mats designed to reduce soil compaction.
- Precipitation Gauge: The precipitation gauge would be a DFIR system. The gauge would be mounted to a pipe installed with a 2-foot-diameter concrete foundation. Two concentric fences (each between 5 and 6 feet high) would be installed around the gauge, with diameters of approximately 13 feet and 26 feet, respectively. Clearing of woody vegetation is typically needed within and surrounding the fenced area to preclude interference with the gauge. However, to minimize impacts to native vegetation, the gauge would be located in a former pastureland dominated by grass species, such that no woody vegetation clearing or trimming is expected to be required.
- Electrical Equipment: Power would be obtained from an existing electrical line located at the edge of the Kulani Correctional Facility property. Secondary power service would extend from an existing pole on this line to a meter socket and transfer switch, which would be owned and used by the local utility to deliver electricity. An auxiliary portal would be installed adjacent to the transfer switch. It would consist of a step-up transformer and communication pedestal, and would serve the research tower and instrument hut. It would also include a plug for a generator, which would only be brought onsite and used in the case of a long-term electrical system outage. The auxiliary portal would be pad-mounted, with the fiberglass pad (approximately 8 feet by 2 feet) installed at existing grade. A second portal (approximately 3 feet by 3 feet) would be installed to serve the precipitation gauge. From the portals, on-grade electrical and

communication lines (contained within PVC conduit) would be laid along an existing fence line to the instrument hut (approximately 2,520 linear feet), and through former pastureland to the precipitation gauge (approximately 600 linear feet). The conduit would be installed above ground and would kept in place using fiberglass uni-strut supports, placed at regular intervals and staked into the ground. In a single location, the conduit would be trenched (and capped with concrete) across the existing access road.

- Staging Area: A temporary staging area would be near the research tower and instrument hut to provide for parking and staging of equipment during construction. The staging area would be approximately 40 feet by 40 feet, and would consist of approximately 6 inches of base course underlain by geotextile fabric. All materials associated with the staging area would be removed from the site at the end of the construction period.

The locations of the proposed infrastructure are shown in Figure 1.

Long-Term Terrestrial Sampling

Following construction and over the course of the 30-year operational period for NEON, a suite of terrestrial sampling protocols would be implemented on a routine basis. Sampling would occur at designated plots and grids established in locations throughout the surrounding lands of Pu'u Maka'ala NAR. Based on stakeholder concerns regarding potential environmental impacts, the density and total footprint of sampling plots and grids was substantially reduced from the levels implemented at other NEON field study sites to the minimum level needed to ensure scientific viability of the project. Up to 62 plots or grids, with a total footprint of approximately 650 acres, would be distributed over approximately 11,660 acres of the NAR. The sampling plots and grids would include the following:

- Tower Base Plots: Approximately 20 plots, 16 measuring 20 by 20 meters and 4 measuring 40 by 40 meters
- Distributed Base Plots: Approximately 20 plots, each 40 by 40 meters
- Bird Grids: Approximately 10 grids, each 500 by 500 meters
- Phenology Plots: an 800m transect
- Mosquito Plots: Approximately 10 plots, each 0.5 by 0.5 meters

There would be minimal disturbance associated with the sampling plots and grids, limited to (1) NEON technicians visiting each plot to confirm the scientific validity of the location and (2) placement of permanent markers at a fixed sample point or at the ends of a sample transect. Permanent markers would consist of rebar or survey caps (or similar marking device approved by NARS staff) driven into the ground and would be placed only at the start of the project. If the plot or grid were to be relocated during the project, the original marker(s) would be removed and new permanent marker(s) would be placed.

Over the 30-year operational period, research technicians would visit each sampling plot and grid on a routine basis, as needed to conduct the prescribed sampling activities. The sampling protocols are consistent with the standardized requirements for NEON, but have been tailored as appropriate based on the local ecology and site-specific conditions. The sampling protocols are designed to be passive, with minimal ground disturbance.

Similar to the determination of plot and grid location, the timing for sampling activities is designed to avoid or minimize impacts, including activities during sensitive periods (e.g., breeding season), to the extent possible. In addition, to further minimize disturbance, sampling visits would be combined where possible to minimize the number of times researchers are at the site. It is currently expected that three full-time staff (one domain manager and two research technicians) would be needed to conduct the

sampling and other operational requirements. The staff would be supplemented with up to eight temporary technicians during peak sampling periods.

The sampling data collected from the site would be reviewed, synthesized, and packaged by the NEON project team. The resulting data set would be uploaded to an online portal, where it would be made available to the scientific community and general public as part of the continental NEON data set. The Domain 20 data would also be transferred directly to DOFAW and NARS staff to assist with management of the site.

Aerial Observations

In addition to the terrestrial sampling effort, an aerial flight would be conducted on an annual basis. The aerial flight would use a small aircraft outfitted with remote sensing equipment (including a hyperspectral imager, Light Detection and Ranging sensor, and high-resolution camera). The typical flight elevation would be approximately 1,000 meters, but would vary based on topography. Data collected from the flight would provide detailed spatial information on the structure and biogeochemical properties of vegetation, and would also facilitate the development of algorithms for scaling up site-specific data.

Infrastructure and Equipment Maintenance

Long-term operation of the NEON project would require ongoing maintenance to ensure the infrastructure and equipment are in optimal working order and remain properly calibrated. Standard maintenance activities are planned to occur approximately every 2 weeks, with one larger maintenance event conducted annually. In addition, emergency repairs would be conducted as needed.

Project Duration and Site Closure

NEON is projected to operate for 30 years. The exact nature of site closure at the end of the operational period is based on the interests of DOFAW, as the site host. If requested, it is possible that some or all of the infrastructure or equipment may be retained onsite. The specific decommissioning and closure plans are undefined at this time. It is assumed that all sampling infrastructure (including the tower and instrument hut) would be removed, but below-grade material (such as the tower foundation) would be left in place. All boardwalk materials and electrical equipment (including power lines and conduits) would be removed.

Any materials removed during these processes would be reused, recycled, or properly disposed of at an approved location. All disturbed ground would be stabilized with biodegradable materials and revegetated with species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Compacted soil would be loosened and aerated prior to revegetation. If needed, topsoil appropriate for the area would be brought in and spread over the loosened soil prior to revegetation.

1.4.2 No Action Alternative

Under the No Action Alteration, NEON research infrastructure and equipment would not be deployed to the site within Pu'u Maka'ala NAR to represent Domain 20. Biological, biophysical, biogeochemical, and land use data would not be collected and/or made available to the ecological sciences research community. Implementation of the No Action Alternative would eliminate the opportunity to study ecosystem responses and changes at the local scale as part of NEON. In addition, it would preclude integration of data from the Pacific Tropical domain into the continental-wide dataset, thus reducing the potential for broad-scale analysis and the overall integrity of NEON.

1.5 Area of Potential Effects

NSF has established the Area of Potential Effects (APE) for this undertaking to include all proposed instrument and sampling areas, as shown on Figure 1.

1.6 Methodology

A literature review was completed at the Hawai'i SHPD library in order to identify historic properties in the vicinity of the proposed site. Additional research was conducted to locate previous cultural resources studies that have occurred within the APE. Interviews were conducted with the NAR staff in order to identify any known cultural sites or practices, including any significant resources that may not be listed in or eligible for listing in the NRHP.

NSF initiated Section 106 consultation with the Hawai'i SHPD on December 7, 2016. As stipulated in 36 CFR §800.1(a), the goal of consultation is to identify historic properties potentially affected by the undertaking, assess effects to them, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. After historic properties within the APE are identified, the Criteria of Adverse Effect are applied to each Alternative. These criteria are used to make a determination of whether the proposed undertaking could change the characteristics that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Section 106 of the NHPA allows three findings for effects on historic properties:

- No Historic Properties Affected
- No Adverse Effect
- Adverse Effect

When an undertaking is found to have an adverse effect, Section 106 requires notification to the Advisory Council on Historic Preservation (ACHP) and consultation with SHPO and other interested parties regarding appropriate avoidance or mitigation measures. Examples of mitigation measures include such things as redesigning aspects of a project, or relocating or documenting buildings and/or structures. For a finding of adverse effect, the product of consultation is usually a Memorandum of Agreement (MOA) per 36 CFR §800.6(c) among the SHPO, federal agency, ACHP if it chooses to participate, and other consulting parties. This agreement contains stipulations specifying measures to be implemented that would avoid, minimize, and/or mitigate the adverse effects.

1.6.1 Consultation

NSF identified organizations and individuals with an interest in the proposed project's potential to affect historic properties who may qualify as Section 106 consulting parties. The following potential consulting parties were identified:

- Association of Hawaiian Civic Clubs
- Hawaiian Civic Club of Hilo
- George K. Cypher 'Ohana
- Kāko'o 'Ōiwi
- Keoni Kealoha Alvarez
- Ko'olau Foundation
- Maku'u Farmers Association
- Office of Hawaiian Affairs

- Piihonua Hawaiian Homestead Community Association
- Kamehameha schools (adjacent property owner)
- Hawai'i Island Burial Council
- Hawai'i County Cultural Resources Commission
- Historic Hawai'i Foundation
- Aha Moku Council for the island of Hawai'i
- Kua O Ka Lā
- Protect Kaho'olawe 'Ohana
- National Park Service

As part of a good faith effort to identify historic properties, NSF asked them to provide any information they would like to share on history, land use, and cultural sites; traditional gathering practices in the proposed site area – both past and present; cultural associations through traditions, legends, traditional use, or otherwise; and referrals of kupuna who might be willing to share their cultural knowledge of the area.

SECTION 2

Identified Historic Properties

2.1 Historical Context

Early Hawaiian settlement is traced back to A.D. 300 and was primarily concentrated along the "watered, windward (ko'olau) shores" of Hawai'i's main islands (Maly and Maly, 2004). With an abundant supply of reliable water, these areas were conducive to agricultural production and the establishment of communities. The population primarily "engaged in subsistence practices in the form of fishing, and in agriculture on lands extending towards the uplands from the bays" (Maly and Maly, 2004). Hilo Bay attracted a large concentration of settlers due to its "lush tropical verdure and beauty" (Maly and Maly, 2004). As the population increased, settlers moved away from the more naturally rich areas and towards the more inaccessible areas of the islands.

Traditionally, natural and cultural resources are considered indistinguishable from one another in Hawaiian culture (Maly and Maly, 2004):

> *Native traditions described the formation (literally the birth) of the Hawaiian Islands and the presence of life on, and around them, in the context of genealogical accounts. All forms of the natural environment, from the skies and mountain peaks, to the watered valleys and lava plains, and to the shore line and ocean depths are believed to be embodiments of Hawaiian gods and deities.*

Hawai'i, the largest of the islands, was the first island to be "born." Since ancient times, Hawaiians have established land and resource management systems. By circa 1525, the island of Hawai'i had been divided into six districts (moku-o-loko), one of which was Hilo. The "district of Hilo itself, extends from the shore up to the 9,000 foot level on Mauna Kea, and up to the summit of Mauna Loa, where it joins the districts of Ka'u, Kona and Hamakua" (Maly and Maly, 2004). Hilo itself was subdivided into three traditional regions: Hilo Hanakeahi, Hilo One, and Hilo Paliku. Today, the district is divided into North and South Hilo. As a whole, "Hilo has been most famed for its rains, and is commemorated in many traditional mele (chants) and 'olelo no'eau (poetical sayings) by reference to the rains" (Maly and Maly, 2004).

Archibald Menzies and Captain George Vancouver were among the first Europeans to visit Hawai'i. They arrived in 1793-1794 and were the first foreigners to reach the top of Mauna Loa, a feat that would not be repeated by another foreigner until 1834. Because of the remoteness of the 'Ola'a and Waiakea forest lands that make up the Pu'u Maka'ala NAR, the area remained largely untouched by government infrastructure projects, including trails or roads (Maly and Maly, 2004). With the arrival of more European explorers, however, came new plant and animal species that often posed a threat to the natural Hawaiian landscape. In 1876, King David Kalākaua established the Act for the Protection and Preservation of Wood and Forests, which authorized the Minister of the Interior to "set apart and protect from 'damage by trespass of animals or otherwise, such woods and forest lands, the property of government...best suited for the protection of water resources...'" (Maly and Maly, 2004). In 1904, the Board of Commissioners of Agriculture and Forestry enacted further legislation to protect the district of Hilo; "the Commissioners approved the recommendation that "all government and other lands in the district of Hilo, Island of Hawai'i, lying above a line approximately 1750 feet above the sea, be set apart as forestry reservation'" (Maly and Maly, 2004). More land was added to the reservation in 1905 and 1913, including sections of the 'Ola'a tract and upland sections of the Waiakea, "thus, making a contiguous line of forest across the Hilo District, and adjoining the Puna District" (Maly and Maly, 2004).

Records indicate that 'practitioner' trails associated with traditional and customary activities such as bird catching and canoe-making likely existed in the region (Maly and Maly, 2004). It was not until the 1940s that a road was constructed through the 'Ola'a and Waiakea forest lands, around the same time that the

Kulani Prison Farm (now Kulani Correctional Facility) was opened. An access road was constructed in the early 1950s that connected the prison to Mauna Loa's summit region (Maly and Maly, 2004).

Hawai'i was among the first states in the United States to establish a system of NARs. In 1981, Executive Order (E.O.) 3102, enacted by Governor Waihe'e, dedicated sections of the Waiakea and 'Ola'a Forest Reserve lands as the Pu'u Maka'ala NAR (Maly and Maly, 2004).

2.2 Literature Review Results

A literature review was completed at the SHPD library and additional research was conducted to locate previous EAs and cultural studies done for the proposed site area. Three documents have been produced relating to the APE and are listed in Table 1.

Table 1. Cultural Resources Studies Conducted within the APE

Title	Author	Date	Findings
Archaeological Inventory Survey and Limited Cultural Assessment for the Proposed Wastewater Treatment Facility at Kulani Correctional Facility (TMK:3-2-4-08:9)	Rechtman, Robert B. Ph.D.	July 2001	No sites found. Archeological expectations for the general area are very limited due to location in the "rainforest zone."
He Mo'Olelo 'Āina: A Cultural Study of the Pu'u Maka'Ala Natural Area Reserve Districts of Hilo and Puna, Island of Hawai'i	Maly, Kepa and Onaona Maly (Kumu Pono Associates LLC)	May 2004	No references to archaeological sites. The overall NAR was characterized as a cultural landscape, but no formal determination of eligibility was made.
SHPD Consultation for the Pu'u Maka'ala Natural Area Reserve Management Plan	DOFAW/SHPD	September, November 2011	DOFAW requested concurrence with determination of "no historic properties affected" (dated September 23, 2011); SHPD concurred with determination (dated November 18, 2011).

2.2.1 Archaeological Resources

The literature review indicated that no archaeological sites have been previously identified within the APE. No records or references to specific archaeological sites within the APE were mentioned in the 2004 cultural study by Kumu Pono and the findings were negative for the other two reports listed in Table 7. No additional archaeological survey work was conducted for this undertaking.

2.2.2 Architectural Resources

One architectural resource that is more than 50 years old is located within the APE: the Mauna Loa Boys School building. The school was constructed in 1952 and remained open for only one year, closing in 1953. At various points in its history, it was used by the Kulani Correctional Facility and for military training activities. Currently, the dilapidated building is used to store fencing materials. Original fenestration has been removed and replaced with plywood, large sections of the roof are missing, and the surrounding landscape is overgrown. The building has not been used as a school since 1953. The building lacks integrity of materials, design, workmanship, feeling, association, and setting. A November 18, 2011, letter from the Deputy SHPO to DOFAW regarding the Pu'u Maka'ala NAR Management Plan describes the school as in "poor condition." During a Section 106 Consulting Parties meeting held for the proposed project on October 26, 2016, meeting attendees likewise noted the poor condition of the former school and that the proposed NEON site would have no potential to affect the building. The building was not identified as a historic property. In addition to the Mauna Loa Boys School, there are several water tanks in the APE; however, these are less than 50 years old and do not meet the age

criterion for NRHP eligibility. Because the Proposed Action Alternative has no potential to affect the Mauna Loa Boys School, architectural resources are not further analyzed

2.2.3 Traditional Cultural Properties

TCPs are sites, areas, and materials associated with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. Landscapes can acquire cultural and historical meaning through traditional use "by the peoples who have traveled, used, and interwoven these places into generations of practices" (ACHP, 2016). Because cultural landscapes gain their significance through traditional cultural practices, they are viewed as a type of TCP. Physical characteristics as well as visual and audio aspects can all contribute to the significance of a landscape (ACHP, 2016). The 2004 study by Kumu Pono (Maly and Maly, 2004), which was a cultural study of the Pu'u Maka'ala NAR (including the entire APE), notes:

> *...the mountain landscape, its native species, and the intangible components therein, are a part of a sacred Hawaiian landscape. Thus, the landscape itself is a highly valued cultural property. Its 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 'Ola'a and Waiakea Forest Reserves, the Pu'u Maka'ala NAR, and the Endangered Species Act).*

As such, the overall NAR has been characterized as a cultural landscape, but no formal determination of NRHP-eligibility for the landscape as a TCP has occurred. The NAR is an approximately 18,730-acre site and a determination of eligibility for this large property as a cultural landscape is beyond the scope of this Proposed Action. Although the cultural landscape has not been determined NRHP eligible, it has been identified as a significant cultural resource under NEPA, and NSF is treating the cultural landscape as a potential historic property for the purposes of this project.

2.2.4 Cultural Uses, Practices, and Properties

Other cultural resources can include plant or animal species, objects, places, uses, or practices that are considered culturally or spiritually significant. While these properties may be culturally significant, they are not eligible as historic properties under the NRHP and thus are not covered by the NHPA. However, potential effects to such cultural resources are considered in the EA under NEPA and in this report to address all potentially significant cultural resources present within the APE.

Individual species in the NAR may be culturally significant, such as the *'alalā* or *'io*, both of which are regarded as *'aumakua* (Hawaiian ancestral spirits). While living species with spiritual or cultural significance are not eligible for inclusion in the NRHP, they may be considered potentially significant cultural properties.

Historically, areas of the NAR were used to build bird-catcher's shelters, canoes, trails, and trailside resting places and shelters. The 2004 Kumu Pono report notes:

> *Because of the remote nature of the 'Ola'a and Waiakea forest lands which comprise the present-day Pu'u Maka'ala NAR, no government communications pertaining to historic trails or government road projects exist for the region. Boundary Commission testimonies describe trails through the forest lands, rising from the lowlands of Waiakea, 'Ola'a, Keauhou and Humu'ula. Based on the native traditions and kama'aina testimonies, it is likely that 'practitioner' trails existed throughout the forest region. Features such as 'kauhale manu' (bird-catcher's shelters), 'kahua kalaiwaa' (canoe-makers clearings), 'oioina' (trailside resting places and shelters), the 'ala hele' (trails), and other features associated with traditional and customary accesses, would leave little evidence in the present-day, as the traditional features and uses generally had minimal*

> *impact on the natural landscape. Those things left behind, not cared for or maintained, were simply reabsorbed into the landscape.*

NARS staff were interviewed to identify any known cultural sites or practices. Mr. Nick Agorastos, NAR Specialist with DLNR DOFAW, stated that he had never encountered anyone engaged in cultural practices in the APE, even though he or his staff are on the property almost daily. He noted that the NAR rules specify the need for a permit to conduct cultural practices within the NAR, and that he is only aware of two previous permit requests for Pu'u Maka'ala NAR, both involving removal of a *koa* log to build a canoe (Rau, 2016). There are no cultural uses or practices that are currently known to occur within the APE or the greater NAR.

SECTION 3

Assessment of Effects

3.1 Proposed Action Alternative

There are no known historic properties that are eligible for or listed in the NRHP located within the APE. In addition, there are no known cultural practices or specific sites associated with the APE. However, the overall NAR has been characterized as a cultural landscape and there are other culturally significant resources, including species such as the *'alalā*, present within the APE. Because potential effects to such cultural resources are considered in the EA under NEPA, they are being addressed in this report so that it includes all potentially significant cultural resources present within the APE.

Effects from the Proposed Action would not be detectable and are not anticipated to alter the significant aspects of the cultural landscape or other cultural resources present within the APE. Therefore, the Proposed Action would result in a finding of no adverse effects to historic properties. An unanticipated discovery plan would be in place before initiating project activities to address any archaeological resources that might be inadvertently found.

3.1.1 Archaeological Resources

There are no known archaeological resources within the APE. Although the proposed site area has not been surveyed, previous cultural resources studies indicate that the probability of historic properties being present in the proposed site area is very low. Several factors diminish the likelihood for archaeological resources to be present within the APE: the property site is in a remote area with a high elevation, there are no known archaeological or historic properties in the vicinity, and archaeological studies in adjacent areas have not found any sites and have determined that there is a low likelihood of sites in the western upper-elevation of the rain forest. The area was not historically inhabited and the historic uses associated with the area were limited to transient activities, such as bird catching, canoe making, and trail building that did not alter the natural landscape (Maly and Maly, 2004). No physical evidence of features associated with these historic uses is extant. Therefore, the site elevation and difficult accessibility, combined with the ephemeral nature of traditional uses and features, make the archaeological expectations for the area very low. Should any historic properties be present, the likelihood of adverse effects to them from the Proposed Action is low because the site components entail only minimal ground disturbance.

As with any ground-disturbing project, there remains a potential for discovery of buried cultural resources. If previously unidentified archaeological resources were discovered during project activities, ground-disturbing activities would be halted in the vicinity of the find and NSF would consult with the SHPD and other consulting parties, as appropriate, regarding eligibility for listing in the NRHP, project effects, necessary mitigation, or other treatment measures. An unanticipated discovery plan would be in place before initiating project activities to address any archaeological resources that might be discovered.

With implementation of these best management practices, the Proposed Action Alternative is expected to result in no historic properties affected.

3.1.2 Traditional Cultural Properties

There are no known TCPs within the APE that have been determined eligible for or are listed in the NRHP. The NAR is characterized as a cultural landscape, although it has never been formally evaluated for the NRHP. The Proposed Action would encompass the scientific infrastructure and a total of approximately 62 sampling plots (comprising approximately 650 acres) that would be distributed throughout approximately 11,663 acres of the 18,730-acre Pu'u Maka'ala NAR, with a permanent project footprint of less than 0.25 acre. Because of the dense forest vegetation and remote nature of

this area, potential visual changes associated with the project would be very limited and are not expected to significantly affect the visual quality of the site. The proposed site components are small intrusions into the expansive cultural landscape, and their presence should not inhibit traditional or customary practices, should they occur. Therefore, the Proposed Action Alternative would result in no adverse effects to TCPs such as the cultural landscape.

3.1.3 Cultural Uses, Practices, and Properties

There are certain species in the NAR that are considered culturally or spiritually significant, such as the *ʻalalā*. The Proposed Action is not anticipated to alter the cultural or spiritual associations of these species. The research towers could result in slight changes to the visual character of the species' habitat, but this is not expected to diminish their cultural or spiritual significance. In addition, the types of activities associated with the Proposed Action (pedestrian access to conduct terrestrial sampling and research) are consistent with the activities associated with cultural practices that have occurred in the area historically, including access for establishing bird-catcher shelters, canoe-makers clearings, trailside resting places and shelters, and trails. There are no cultural uses or practices that are currently known to occur within the APE or other portions of the NAR. Therefore, the Proposed Action Alternative would result in no adverse effects to cultural uses, practices, and properties.

3.2 No-Action Alternative

Under the No Action Alternative there would be no change from the existing conditions. The No Action Alternative would result in a finding of no historic properties affected.

SECTION 4

Conclusion

There are no known historic properties that are listed in or determined eligible for listing in the NRHP located within the APE. Other significant cultural resources that are not listed in or determined eligible for the NRHP have been identified within the APE, including the cultural landscape and the *ʻalalā*. The proposed site components would not diminish the cultural or spiritual significance of these resources and would not inhibit traditional or customary practices, should they occur. Therefore, the Proposed Action Alternative and the No Action Alternative would result in a finding of No Adverse Effect to Historic Properties.

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SECTION 5

References

Advisory Council on Historic Preservation (ACHP). 2016. Information paper on Cultural Landscapes: Understanding and Interpreting Indigenous Places and Landscapes. October 11. http://www.achp.gov/docs/Information%20on%20Cultural%20Landscapes.pdf. Accessed December 15, 2016.

DOFAW/SHPD. 2011. SHPD Consultation for the Pu'u Maka'ala Natural Area Reserve Management Plan. Correspondence from September and November.

Maly, Kepa and Onaoan Maly. 2004. He Mo'olelo 'Aina: A Cultural Study of the Pu'u Maka'ala Natural Area Reserve Districts of Hilo and Puna, Island of Hawai'i. Huma Pono Associates LLC. Prepared for the Department of Land and Natural Resources – Natural Area Reserves. May 31.

Rau, Michelle. 2016. Pu'u Maka'ala Environmental Compliance – Site Visit and Regulatory Meetings. Meeting Summary. CH2M. September 20-22.

Rechtman, Robert B. Ph.D. 2001. Archaeological Inventory Survey and Limited Cultural Assessment for the Proposed Wastewater Treatment Facility at Kulani Correctional Facility (TMK:3-2-4-08:9). July.

Subject: FW: Letter Seeking Concurrence for Finding related to NEON Site within the Pu'u Maka'ala Natural Area Reserve, re Log No. 2016.01949 and Doc No. 1609GC04
Date: Thursday, June 22, 2017 at 6:07:49 PM Eastern Daylight Time
From: Futrell-Griggs, Montona
To: Phyllis.L.Cayan@hawaii.gov
Attachments: HI SHPD Concurrence Request Letter_042417.pdf

Good afternoon,

Would it be possible for you to tell me to whom the concurrence request for a finding related to NEON Site within the Pu'u Maka'ala Natural Area Reserve, re Log No. 2016.01949 and Doc No. 1609GC04 was assigned? We are wondering about the status of the review as we have received no response and the email dated May 1, 2017 received from the DLNR Intake address stated that we should allow 30 days review completion.

Thank you,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

Appendix E
Endangered Species Act Section 7 Consultation Documentation

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
01EPIF00-2016-TA-0479

Mr. Steven Ellis, Program Director
Division of Biological Infrastructure
Biological Sciences Directorate
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

SEP 12 2016

Subject: Technical Assistance for Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve, Hawaii Island

Dear Mr. Ellis:

The U.S. Fish and Wildlife Service (Service) received your letter on August 11, 2016, requesting technical assistance for the National Science Foundation-funded proposed National Ecological Observatory Network (NEON) Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve (Puu Makaala NAR), Hawaii Island. The proposed site is to provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawaii," and would be the only site representing this domain in the United States. Site components would include an ecological research tower proposed to be approximately 30.5 meters tall, instrument hut, soil array, Double Fence Intercomparison Reference (DFIR) precipitation gauge (with required vegetation clearance area), and associated electrical infrastructure with power run. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area in the Puu Makaala NAR. Terrestrial plot sampling and associated plot size would include the following: 20 Tower Plots-40x40 m; 6 Tick Plots-40x40 m; 30 Base Plots-40x40 m; 6-8 Mammal Grids-90x90 m; 5-15 Bird Grids-500x500 m; 2 Phenology Plots-200x200 m; and 10 Mosquito Points-5x5 m. The proposed project area including plots encompasses TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003 and TMK(3) 2-4-008:019, and would be permitted by the State of Hawaii via a Natural Area Reserve System (NARS) Special Use Permit and OCCL Use Permit.

Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Project, there is one federally listed mammal in the vicinity of the project area, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*); eight federally listed birds, including the Hawaiian crow or alala (*Corvus hawaiiensis*), nene (*Branta sandvicensis*), Hawaiian hawk or io (*Buteo solitarius*), akiapolaau (*Hemignathus munroi*), Hawaii creeper, (*Oreomystis mana*), Hawaii akepa (*Loxops coccineus*), Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus newelli*); one

bird species proposed for listing, the band-rumped storm-petrel (*Oceanodroma castro*); and one bird species petitioned for listing, the iiwi (*Vestiaria coccinea*). There are fifteen federally listed plants in the vicinity of the project area: palai laau (*Adenophoros periens*), Mauna Loa silversword (*Argyroxiphum kauense*), *Asplenium peruvianum var. insulare*, oha wai (*Clermontia lindseyana*), oha wai (*Clermontia peleana*), haha (*Cyanea coplanadii*), akuaku (*Cyanea platyphylla*), haha (*Cyanea shipmanii*), haha (*Cyanea stictophylla*), haiwale (*Cyrtandra giffardii*), haiwale (*Cyrtandra tintinnabula*), kiponapona (*Pyllostegia racemosa*), *Phyllostegia velutina*, anunu (*Sicyos alba*), and Hawaiian vetch (*Vicia menziesii*). There is no proposed or final critical habitat within the vicinity of the project area. The Service recommends the following measures to avoid and minimize project impacts to listed species:

Hawaiian hoary bat

The Hawaiian hoary bat is known to occur across a broad range of habitats throughout the State of Hawaii. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June 1 to September 15), there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. The Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service therefore recommends that barbed wire not be used for fencing as part of this proposed action.

Hawaiian hawk

The Hawaiian hawk is known to occur across a broad range of forest habitats throughout the Island of Hawaii. Loud, irregular and unpredictable activities, such as using heavy equipment or building a structure, near an endangered Hawaiian hawk nest may cause nest failure. Harassment of Hawaiian hawk nesting sites can alter feeding and breeding patterns or result in nest or chick abandonment. Nest disturbance can also increase exposure of chicks and juveniles to inclement weather or predators. If any ground clearing or construction will occur during the Hawaiian hawk breeding season (March through September), we recommend a nest search of the project footprint and surrounding areas be conducted by a qualified ornithologist immediately prior to the start of construction activities. Pre-disturbance surveys for Hawaiian hawks are only valid for 14 days. If disturbance for the specific location does not occur within 14 days of the survey, another survey will be required. Surveys should ensure that construction activity will not occur within 1,600 feet of any Hawaiian hawk nest. If nesting Hawaiian hawks are present in the action area or within 1,600 feet of the action area, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Nene

The nene is currently found on all the main islands except Lanai and Kahoolawe. Nene are known to occupy various habitat and vegetation community types ranging from coastal dune vegetation and non-native grasslands (such as golf courses, pastures, and rural areas) to sparsely vegetated low- and high-elevation lava flows, mid-elevation native and non-native shrubland, cinder deserts, native alpine grasslands and shrublands, and open and nonnative alpine shrubland-woodland community interfaces. Nene do not occur in closed forest areas. Nene have an extended breeding season with eggs reported from all months except May, June, and July, although the majority of birds in the wild nest during the rainy (winter) season between October

and March. Nesting peaks in December and most goslings hatch from December to January. Nene nest on the ground, in a shallow scrape in the dense shade of a shrub or other vegetation. To avoid adverse impacts to nene, we recommend a qualified individual conduct surveys at the proposed project site for presence of nene prior to project(s) initiation. We further recommend if a nene is observed, or flies into the site while activities are occurring, all activities be halted within 100-ft (30-m) of the individual(s), and work should not resume until the nene leave the area on their own accord.

Forest Birds

Akiapolaau, Hawaii creeper, and Hawaii akepa, and iiwi (collectively known as forest birds) occur in forest habitats throughout the Island of Hawaii. The Hawaiian crow is planned to be introduced to Puu Makaala NAR in fall 2016. Loud, irregular and unpredictable activities, such as using heavy equipment or building a structure, near a nest of these species may cause nest failure. Harassment of nesting sites can alter feeding and breeding patterns or result in nest or chick abandonment. Nest disturbance can also increase exposure of chicks and juveniles to inclement weather or predators. If any ground clearing or construction will occur during the breeding season for these species (February through July), we recommend a nest search of the project footprint and surrounding areas be conducted by a qualified ornithologist immediately prior to the start of construction activities. Pre-disturbance surveys are only valid for 14 days. If disturbance for the specific location does not occur within 14 days of the survey, another survey will be required. Surveys should ensure that construction activity will not occur within 500 feet of any nest of Akiapolaau, Hawaii creeper, and Hawaii akepa, and 1,600 feet of any nest of Hawaiian crow. If listed forest birds are present in the action area or within 500 feet of the action area for Akiapolaau, Hawaii creeper, and Hawaii akepa and 1,600 feet of the action area for Hawaiian crow, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Seabirds

Hawaiian petrels, Newell's shearwaters and band-rumped storm-petrels (collectively known as seabirds) are known to transit over the project area when flying between the ocean and upland breeding colonies. Many bird species are known to strike objects, such as antennas or guywires, protruding above surrounding vegetation. In Hawaii, seabirds are attracted to lights and are known to collide with buildings, light poles, wires, and other tall objects. Any lights associated with the projects should be cut-off, equipped with a motion sensor, or shielded so that the light cannot be seen from above. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as small Indian mongoose (*Herpestres auropunctatus*), cats (*Felis catus*), and dogs (*Canis familiaris*). We therefore recommend avoiding or minimizing use of artificial lighting and avoiding night work if possible. If artificial lighting must be used we recommend this be shielded so the bulb is not visible at or above bulb-height. If night work must be conducted this should take place outside the sea bird fledging season (September 15 through December 15) and should utilize shielded lighting.

Plants

Listed plants are distributed throughout the Puu Makaala NAR. We recommend close coordination with Hawaii NARS to fully avoid any adverse impacts to listed plants during installation of proposed sampling grids.

Technical Assistance Regarding Rapid Ohia Death

Rapid Ohia Death (ROD), a newly identified disease, has killed large numbers of mature ohia trees (*Metrosideros polymorpha*) in forests and residential areas of Hawaii Island. The disease is caused by a vascular wilt fungus (*Ceratocystis fimbriata*). Crowns of affected trees turn yellowish or brown within days to weeks and dead leaves typically remain on branches for some time. All ages of ohia trees can be affected and can have symptoms of browning of branches or leaves. As of early 2015 the disease was confined to Hilo and the Puna district on Hawaii Island, but has since been confirmed in Volcano, South Kona, and Hamakua districts. Additional information on ROD can be found at http://www2.ctahr.hawaii.edu/forestry/downloads/ROD-trifold-03.2016.pdf and http://www2.ctahr.hawaii.edu/forestry/disease/ohia_wilt.html.

Many of our listed species are reliant on native ohia forest. The following avoidance and minimization measures should be followed for projects working in ohia forests or at sites with ohia trees on Hawaii Island:

- A survey of the proposed project site should be conducted within two weeks prior to any tree cutting to determine if there are any infected ohia trees. If infected ohia are suspected at the site, the following agencies should be contacted for further guidance.
    - USFWS – please contact the name at the bottom of this letter
    - Dr. J.B. Friday, University of Hawaii Cooperative Extension Service, 808-969-8254 or jbfriday@hawaii.edu
    - Dr. Flint Hughes, USDA Forest Service, 808-854-2617, fhughes@fs.fed.us
    - Dr. Lisa Keith, USDA Agriculture Research Service, 808-959-4357, Lisa.Keith@ars.usda.gov

- Both prior to cutting ohia and after the project is complete:
    - Tools used for cutting infected ohia trees should be cleaned with a 70 percent rubbing alcohol solution. A freshly prepared 10 percent solution of chlorine bleach and water can be used as long as tools are oiled afterwards, as chlorine bleach will corrode metal tools. Chainsaw blades should be brushed clean, sprayed with cleaning solution, and run briefly to lubricate the chain.
    - Vehicles used off-road in infected forest areas should be thoroughly cleaned. The tires and undercarriage of the vehicle should be cleaned with detergent if they have travelled from an area with ROD or travelled off-road.
    - Shoes and clothing used in infected forests should also be cleaned. Shoes should be decontaminated by dipping the soles in 10 percent bleach or 70 percent rubbing alcohol to kill the ROD Fungus. Other gear can be sprayed with the same cleaning solutions. Clothing can be washed in hot water and detergent.

- Wood of affected ohia trees should not be transported to other areas of Hawaii Island or interisland. All cut wood should be left on-site to avoid spreading the disease. The pathogen may remain viable for over a year in dead wood. The HDOA has passed a new quarantine rule that prohibits interisland movement, except by permit, of all ohia plant or plant parts.

Thank you for your efforts to conserve listed species and native habitats. Please contact Fish and Wildlife Biologist Jay Nelson (phone: 808-792-9441, email: jay_nelson@fws.gov) if you have any questions or for further guidance.

Sincerely,

Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island

cc: Ms. Emma Yuen, NARS

Subject: Meeting on Proposed National Science Foundation-Funded National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Pu'u Maka'ala Natural Area Reserve, Hawai'i Island, Hawai'i

Date: Wednesday, October 19, 2016 at 3:31:24 PM Eastern Daylight Time

From: Futrell-Griggs, Montona LaNise

To: gaudioso@hawaii.edu, axwang@hawaii.edu, Steven.T.Bergfeld@hawaii.gov, kimberly.mills@hawaii.gov, emma.yuen@hawaii.gov, cgiardina@fs.fed.us, fhughes@fs.fed.us, Michelle_Bogardus@fws.gov, Donna_L_Ball@fws.gov, Mary_Abrams@fws.gov, jpprice@hawaii.edu, conant@hawaii.edu, ostertag@hawaii.edu, tcolleencole@gmail.com, Susan.A.Lebo@hawaii.gov, chris.nakahashi@hawaii.gov, lyman.perry@hawaii.gov

CC: Gagne, Betsy H, Agorastos, Nicholas R, Blanco, Caroline M, Amy Little, Hamilton, Kristen

BCC: Lisa.Kettley@CH2M.com, Michelle.Rau@CH2M.com

Attachments: NAR_TOS_TargetedPlots[1][1].jpg, Proposed Arthropod Plot Guide.pdf, Proposed Bird Plot Guide.pdf, Proposed Mammal Plot Guide.pdf, Proposed Veg Soil Plot Guide.pdf

Hello,

The National Ecological Observatory Network (NEON), a continental-scale research network funded by the National Science Foundation (NSF) and operated by awardee Battelle Ecology, Inc. (BEI), proposes to establish a research site within the Pu'u Maka'ala Natural Area Reserve, Hawai'i Island. The site is needed in order to provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawai'i," and would be the only site representing this domain in the United States. Site components include a tower, instrument hut, soil array, Double Fence Intercomparison Reference (DFIR) precipitation gauge, and associated electrical infrastructure with power run; no additional roads are anticipated. Additionally, a suite of terrestrial sampling protocols would be implemented and an annual aerial flight would occur over the Pu'u Maka'ala Natural Area Reserve. Additional information can be found in the attached pre-consultation notice. Attached are a map of the proposed elements and summaries of proposed sampling plans for the site.

The NSF is holding a stakeholder meeting to discuss questions and concerns regarding the potential impacts on threatened and endangered species and their habitats as a result of the proposed NEON project. This meeting will occur on October 26 from 2:30 – 4:30 PM in the DOFAW office located at 19 E Kawili St, Hilo, HI 96720. Please respond to this e-mail if you plan to attend the stakeholder meeting. A conference line will be set up for those unable to attend in person.

Additionally, an evening meeting will be held at the DOFAW office from 6:00 –7:30 PM to discuss potential cultural resources within the proposed project area and, if there are any such resources, to consult on ways to avoid, minimize, and/or mitigate any adverse effects on them. This meeting will be held in compliance with Section 106 of the National Historic Preservation Act and the State Historic Preservation Division regulations; this meeting will be open to the public.

Please RSVP by Friday, October 21.

Hope to see you there!
Montona Futrell-Griggs

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison

Subject: HI NEON Site Stakeholders Meeting Follow-up
Date: Monday, January 23, 2017 at 9:42:52 PM Eastern Standard Time
From: Futrell-Griggs, Montona
CC: Gagne, Betsy H, Agorastos, Nicholas R
BCC: gaudioso@hawaii.edu, axwang@hawaii.edu, cgiardina@fs.fed.us, fhughes@fs.fed.us, Donna_L_Ball@fws.gov, jpprice@hawaii.edu, conant@hawaii.edu, ostertag@hawaii.edu, tcolleencole@gmail.com
Attachments: D20 Hawaii Stakeholder Meeting 10262016.docx, HI Proposed Sampling Protocols.docx, Draft Identification of Biological Resources, Impact and Measures.docx

Hello,

Attached are meeting minutes from the Stakeholders meeting for the proposed NEON research site within the Pu'u Maka'ala Natural Area Reserve, Hawai'i Island held at the DOFAW offices on October 26, 2016. Amy Little with Battelle Ecology, Inc. has indicated in red font the action items identified during the meeting and updates associated with each item.

We have also attached a table detailing revised protocols which have been vetted for scientific viability to meet the scientific objectives of the NEON program for this site. The revised protocols were developed in response to the concerns expressed during the about the potential impact of human presence to the site and on rare, endangered and threatened species and sea birds. Most of the proposed sampling protocols have been reduced in frequency or located near existing roads or paths. The table details the frequency and number of staff required per visit to the site.

The last document attached is a draft of the biological resources discussion that would be included in the draft Environmental Assessment and identifies resources, evaluates impact and describes mitigation strategies for the site.

If wanted we would be happy to schedule calls with you this week and next to discuss your review of the attached documents.

Best,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

Subject: Biological Assessment for the NEON Domain 20 site at Pu'u Maka'ala NAR
Date: Thursday, March 23, 2017 at 10:31:39 AM Eastern Daylight Time
From: Futrell-Griggs, Montona
To: donna_l_ball@fws.gov, jay_nelson@fws.gov, rachel_rounds@fws.gov
Attachments: PuuMakaala_BiologicalEvaluation_DRAFT_11Jan2016.docx, PuuMakaala_BiolgicalEvaluation_Appendix_Combined_DRAFT.pdf

Good morning,

When Lisa, Caroline and I met with you in late October 2016, we discussed providing you with a document to begin reviewing and providing comments on which would include avoidance and mitigation strategies for NEON construction and operations activities that could potentially impact rare, threatened and endangered species located in the Pu'u Maka'ala NAR.

Based on feedback from stakeholders and discussions arising during the development of the environmental assessment, CH2M Hill was able to develop a draft biological evaluation. However due to funding decisions that were being made internally at NSF, we put off sending you the document until now.

We would like you to review the attached document to provide us with your comments on it. We would then like to schedule a call with you to discuss your comments and concerns on it, perhaps in 2 weeks. Please note that we will include this draft as an attachment to the draft EA that will be released in April or May. Revisions based on your comments and public comments received will be used to draft the final versions of the EA and biological evaluation.

Let me know if you have any questions or concerns.

Thank you for your time,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

National Science Foundation
4201 Wilson Blvd
Suite 615
Arlington, VA 22230

June 19, 2017

ATTN: Michelle Bogardus
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd Rm 3-122
Honolulu, HI 96850

Subject: Biological Assessment and request for concurrence regarding NSF's proposed National Ecological Observatory Network field study site at Pu'u Maka'ala Natural Area Reserve

Dear Ms. Bogardus:

The National Science Foundation (NSF) seeks to consult with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) on the proposed National Ecological Observatory Network (NEON) field study site at Pu'u Maka'ala Natural Area Reserve (NAR) and is submitting the attached Biological Assessment (BA), which includes a determination of effects, for your review. The NEON site would be funded by NSF and operated by Battelle Memorial. Table 1, below, shows the consultation that has occurred under Section 7 of ESA for this proposed project thus far.

TABLE 1
Endangered Species Act Section 7 Consultation Log

Action	Date	Details
Letter from USFWS (in response to NEPA/HRS Chapter 343 scoping)	September 12, 2016	Letter offering technical assistance for the proposed NEON project at Pu'u Maka'ala NAR, including list of federally listed species that occur in the project vicinity and measures to avoid and minimize project impacts to those species, and measures to minimize impacts related to Rapid *'ōhi'a* Death (see Appendix B)
Email to USFWS and other project stakeholders	October 19, 2016	Email inviting USFWS and other project stakeholders (including scientists and researchers conducting work in Pu'u Maka'ala NAR) to consultation meeting, with detailed information regarding the proposed infrastructure and sampling protocols
Consultation meeting with USFWS	October 25, 2016	Meeting to discuss the ESA Section 7 consultation process, potential impacts to federally listed species, and measures to avoid and minimize project impacts to those species

Action	Date	Details
Consultation meeting with USFWS and other project stakeholders	October 26, 2016	Meeting with USFWS and other project stakeholders (including scientists and researchers conducting work in Pu‘u Maka‘ala NAR) to provide proposed project overview and discuss stakeholder issues to inform ESA compliance
Email to USFWS and other project stakeholders	January 23, 2017	Email to participants of October 26, 2016 meeting containing meeting minutes, revisions to terrestrial sampling protocols and proposed mitigation measures developed in response to concerns raised at meeting
Email to USFWS	March 23, 2017	Email transmitting information regarding listed species and preliminary effects analysis
Coordination with USFWS	April 26, 2017	Conference call to obtain input from USFWS on information regarding listed species and preliminary effects analysis
Consultation meeting with USFWS	May 23, 2017	Meeting with USFWS to discuss NSF’s preliminary findings on potential impacts to federally listed species and their critical habitat and measures to avoid and minimize project impacts to those species

The attached BA analyzes potential impacts of constructing and operating the NEON site at Pu’u Maka’ala NAR on 32 species listed as threatened or endangered (including one that is proposed for listing) under the ESA that the U.S. Fish and Wildlife Service (USFWS) identified as potentially occurring in the project area. These include a variety of vascular plants and ferns, birds, mammals and invertebrate species. Critical habitat has been designated within the action area for 9 of these species, including 8 plant species and 1 invertebrate species. Two listed species (*hāhā* [*Cyanea copelandii*] *and ‘ō‘ū* [*Psittirostra psittacea*]) previously occurred in the action area, but are believed to be extirpated (or extinct).

Potential impacts of the proposed action to listed species are expected to be temporary, discountable, and insignificant. As detailed in the BA, implementation of seasonal restrictions on construction activities and other conservation measures and best management practices would likely preclude any major or long-term effects to these federally protected species. Similarly, project implementation would not significantly affect any physical or biological features within designated critical habitat. Based on this evaluation, the Proposed Action ***may affect, but is not likely to adversely affect*** the federally listed (or proposed listed) vascular plant and fern, bird, mammal, and invertebrate species that are known to occur (or may occur) in the action area. The Proposed Action is ***not likely to jeopardize the continued existence*** of species proposed for listing. The Proposed Action is ***not likely to result in destruction or adverse modification*** of critical habitat for six species. As the proposed infrastructure would displace a small amount of critical habitat for three species over the lifetime of the project, the Proposed Action is **Likely to result in destruction or adverse modification of critical habitat** for those three species. The determination of effect for each species and designated critical habitat is summarized in Table 6 of the attached BA.

NSF is requesting concurrence with the determinations presented in the Biological Assessment.

The NSF point-of-contact for ESA Section 7 compliance is Ms. Montona Futrell-Griggs, NEON Program/DBI/BIO, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230; telephone: (703) 292-7162; email: mfutrell@nsf.gov.

We appreciate your assistance in this matter and look forward to your response. If you require any additional information or documentation, please contact Ms. Futrell-Griggs.

Sincerely,



Steven E. Ellis, Ph.D.
Division of Biological Infrastructure
BIO Directorate
National Science Foundation

cc (via email): Jay Nelson (jay_nelson@fws.gov)
Jodi Charrier (jodi_charrier@fws.gov)
John Vetter (john_vetter@fws.gov)

Attachments: Biological Assessment: Domain 20 Field Site for the National Ecological Observatory Network for the National Science Foundation, Pu'u Maka'ala Natural Area Reserve, South Hilo District, Hawai'i Island, Hawai'i

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BIOLOGICAL ASSESSMENT

Domain 20 Field Site for the National Ecological Observatory Network for the National Science Foundation

Puʻu Makaʻala Natural Area Reserve
South Hilo District, Hawaiʻi Island, Hawaiʻi

June 2017

Prepared for
National Science Foundation

ch2m

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SECTION 1

1 Introduction

This document is being submitted in support of compliance efforts under Section 7 of the Endangered Species Act (ESA) for the proposed National Ecological Observatory Network (NEON) field study site at Pu‘u Maka‘ala Natural Area Reserve (NAR). Pu‘u Maka‘ala NAR is located on the eastern side of Hawai‘i Island, and is part of the statewide Natural Area Reserves System (NARS). The purpose of this document is to evaluate the proposed project in sufficient detail to determine its potential effects on federally listed threatened and endangered species (including candidate species and those proposed for listing), and critical habitat.

NEON is a continental-scale ecological observation facility, sponsored by the National Science Foundation (NSF) and operated by Battelle Memorial Institute. It is designed to gather and synthesize data needed to study the impacts of climate change, land use change, and invasive species on natural resources and biodiversity. The Pu‘u Maka‘ala field study site would provide data for NEON’s Pacific Tropical Domain (Domain 20). Similar to other NEON field study sites, the Domain 20 site in Hawai‘i would include a standard set of instruments to collect abiotic, biological, biophysical, biogeochemical, and land use data. The proposed scientific infrastructure and equipment would include one tower, a panelized modular enclosure (referred to as an instrument hut), an array of soil plots with soil sensors, a precipitation gauge, electrical infrastructure, and a suite of distributed terrestrial sampling protocols. The site would be operated for 30 years, with data collection and streaming to the online NEON portal starting in 2018. Such data would be made freely available to the scientific community and general public for use in analyzing ecological conditions in the Hawaiian Islands and would be comparable to data collected across the continental United States, Puerto Rico, and Alaska.

Section 7(a)(1) of the ESA directs federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The proposed project would be federally funded, and NSF is the lead agency for the Section 7 consultation.

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2 Proposed Action

The proposed action consists of constructing and operating the NEON Domain 20 site at Puʻu Makaʻala NAR (also referred to as the proposed project). This section presents an overview and background of NEON and the components of the Domain 20 site.

2.1 Overview of NEON

For nearly two decades, the ecological sciences research community has called for the national research and observation capability needed to promote understanding of the biosphere (Long Term Ecological Research [LTER], 1990; American Institute of Biological Sciences [AIBS], 2003; NEON, 2006). Two reports published by the National Research Council (NRC), *Grand Challenges in Environmental Science* (2001) and *NEON: Addressing the Nation's Environmental Challenges* (2003), identified "Grand Environmental Challenges" and the associated research questions that were deemed critically important to address now, cannot be addressed with existing research infrastructure, and require environmental measurements on a regional to continental scale.

To provide the basis to respond to these critical research questions, NEON was developed as a continental-scale ecological observation facility, comprised of a network of long-term scientific infrastructure deployments to collect high-quality, standardized data. The design divides the continental United States, Alaska, Hawaiʻi, and Puerto Rico into 20 domains, with each domain representing a specific range of eco-climatic conditions, thereby encompassing the full range of environmental variability. Within each domain, infrastructure is deployed to field study sites strategically selected to represent different regions of vegetation, landforms, climate, and ecosystem performance. Data collection methods are standardized across the field study sites and include *in situ* instrument measurements, field sampling, and airborne remote sensing. This network of deployments forms a fully integrated continental-scale research platform. Under this system, measurement of a variable over time in all 20 domains facilitates understanding of the quantity, changes in, and spatial heterogeneity of that variable at a continental scale. Given the time required to observe changes in some ecological parameters, NEON is designed to have a 30-year operational lifespan. Overall, this platform enables scientists to analyze, understand, and forecast the nature and pace of biological change at scales ranging from local to continental.

2.2 Background and History

A thorough process was conducted to identify, evaluate, and select sites for deployment of NEON infrastructure within each of the 20 domains. The NEON project team established site criteria and a detailed selection and review process (involving research community workshops, Blue Ribbon committees, and NRC and NSF merit reviews). Specific site criteria for field study sites include (1) a "wildland" area comprised of undeveloped, natural land representing the dominant vegetation and soil type for that domain, (2) contiguous habitat over an area large enough to implement the sampling protocols, (3) areas subject to minimal disturbance (i.e., not pristine, but still high quality habitat), (4) adequate soil depth to implement sampling protocols, (5) site accessibility, and (6) proximity to an existing power supply.

In October 2006, the NEON project team announced a request for information (RFI) inviting members of the ecological research community to submit ideas about (1) potential field study sites and (2) specific research projects they would conduct using NEON data. The NEON project team then evaluated the potential field study sites identified in the RFI responses. Each potential site was visited to evaluate its overall viability; those found to be viable were further reviewed to assess scientific suitability, practicality, and

environmental conditions. Through this process, both core and relocatable field study sites[1] were selected in each domain. The potential environmental and socioeconomic impacts that would result from implementation of the NEON sites nationwide were assessed, as presented in the *National Ecological Observatory Network (NEON) Environmental Assessment* (NSF, 2009). NSF found that NEON would have no significant impact on the environment, with site-specific agency consultation needs identified and implementation of avoidance and minimization measures.

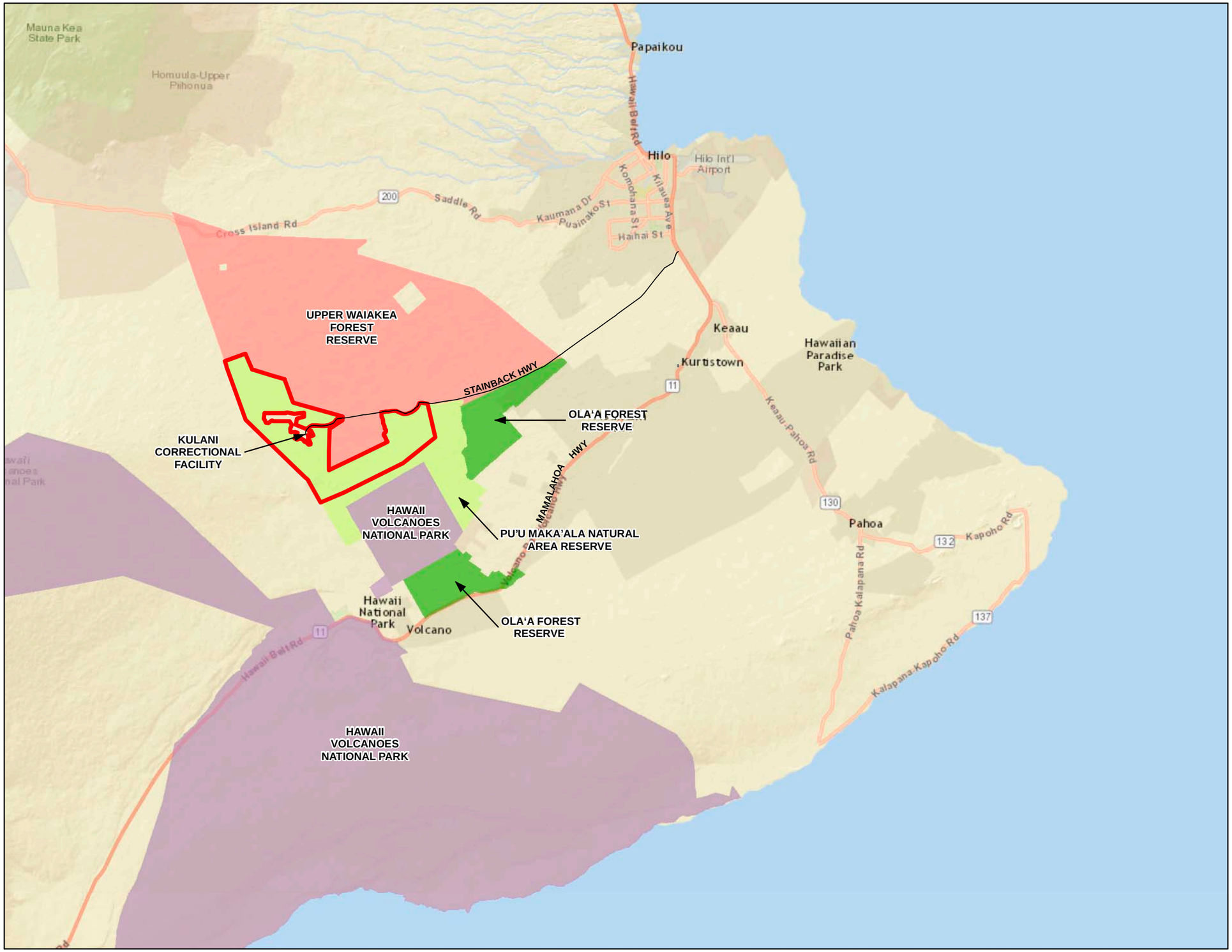
Based on the delineation of the eco-climatic domains for NEON, Domain 20 was defined as "Pacific Tropical," with the Hawaiian Islands comprising the entire domain. Through the site-selection process, as detailed in the 2009 NEON Environmental Assessment, the location of the core field study site identified for Domain 20 was within the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest (which is comprised of Laupāhoehoe NAR and Hilo Forest Reserve lands), located in the North Hilo District on Hawai'i Island. This area is managed by the State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) and the U.S. Forest Service (USFS) for protection of natural resources. Subsequent to issuance of the 2009 NEON Environmental Assessment, the proposed Laupāhoehoe site was determined to be unsuitable because of challenges implementing the design. In addition, the two proposed relocatable field study sites were eliminated from the scope because of (1) a reduction in the overall scope of NEON and (2) changes to the plant community that altered the ability to answer intended scientific questions.

To identify a suitable replacement for the Domain 20 core field study site, the NEON project team worked closely with the ecological research community (i.e., those that responded to the original RFI) and DOFAW and NARS staff to review other similar areas that would meet the site criteria. The first replacement site identified by these entities was located within the Upper Waiakea Forest Reserve. Over the course of more than a year, this site was reviewed in direct coordination with DOFAW and NARS staff and other stakeholders; this process involved multiple site visits, detailed site evaluation, and ongoing stakeholder meetings. Eventually, however, because of concerns about conflicts with existing uses, DOFAW and NARS staff recommended that NSF reject the Upper Waiakea Forest Reserve site and, instead, identified Pu'u Maka'ala NAR as a possible location. Again, an iterative process involving multiple sites visits and site evaluations was conducted in coordination with DOFAW and NARS staff. Eleven possible sites within the NAR were initially considered, one of which was unanimously identified as the most suitable site for project implementation based on the site selection criteria. Additional information regarding the various sites that were considered is provided in the Environmental Assessment.

2.3 Project Location

The proposed Domain 20 core field study site is within the Pu'u Maka'ala NAR, which is located on the northeastern slopes of Mauna Loa, in the South Hilo District, approximately 19 miles (30 kilometers) southwest of the town of Hilo (see Figure 1). Pu'u Maka'ala NAR is approximately 18,730 acres, and is managed by DOFAW for the protection of unique natural resources. It is bordered by the Upper Waiakea Forest Reserve on the north and east, the 'Ōla'a Forest Reserve on the east, the 'Ōla'a Tract of Hawai'i Volcanoes National Park to the south, and private property to the west (Kamehameha Schools), southwest, and southeast (various agricultural parcels). The Kūlani Correctional Facility, which occupies approximately 280 acres, is located within an interior portion of the NAR. Stainback Highway provides access from Mamalahoa Highway (State Route 11) to the eastern edge of Pu'u Maka'ala NAR and the Kūlani Correctional Facility. A series of existing unimproved roads provide limited access within the NAR. The proposed Domain 20 core field study site would be located in the western portion of the NAR, with the proposed

[1] Core sites are designed to collect data from minimally managed wildland areas for the full 30-year lifetime of the NEON project. Relocatable sites are designed to collect data for approximately 10 years and are sited in areas suitable to address land use, invasive species, and urban effects. The infrastructure requirements are generally the same, except the relocatable sites include a secondary precipitation gauge (as opposed to a double-fenced intercomparison reference [DFIR] precipitation gauge).



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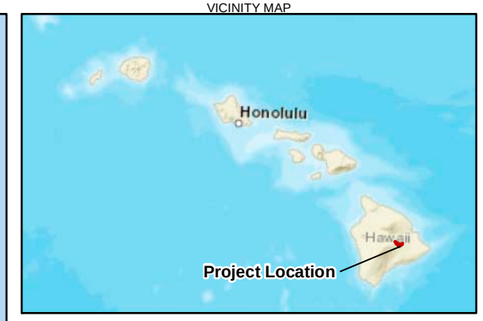

LEGEND

- Project Location (Action Area)
- Hawaii Volcanoes National Park
- Ola'a Forest Reserve
- Pu'u Maka'ala Natural Area Reserve
- Upper Waiakea Forest Reserve

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Miles

Figure 1
Project Location
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

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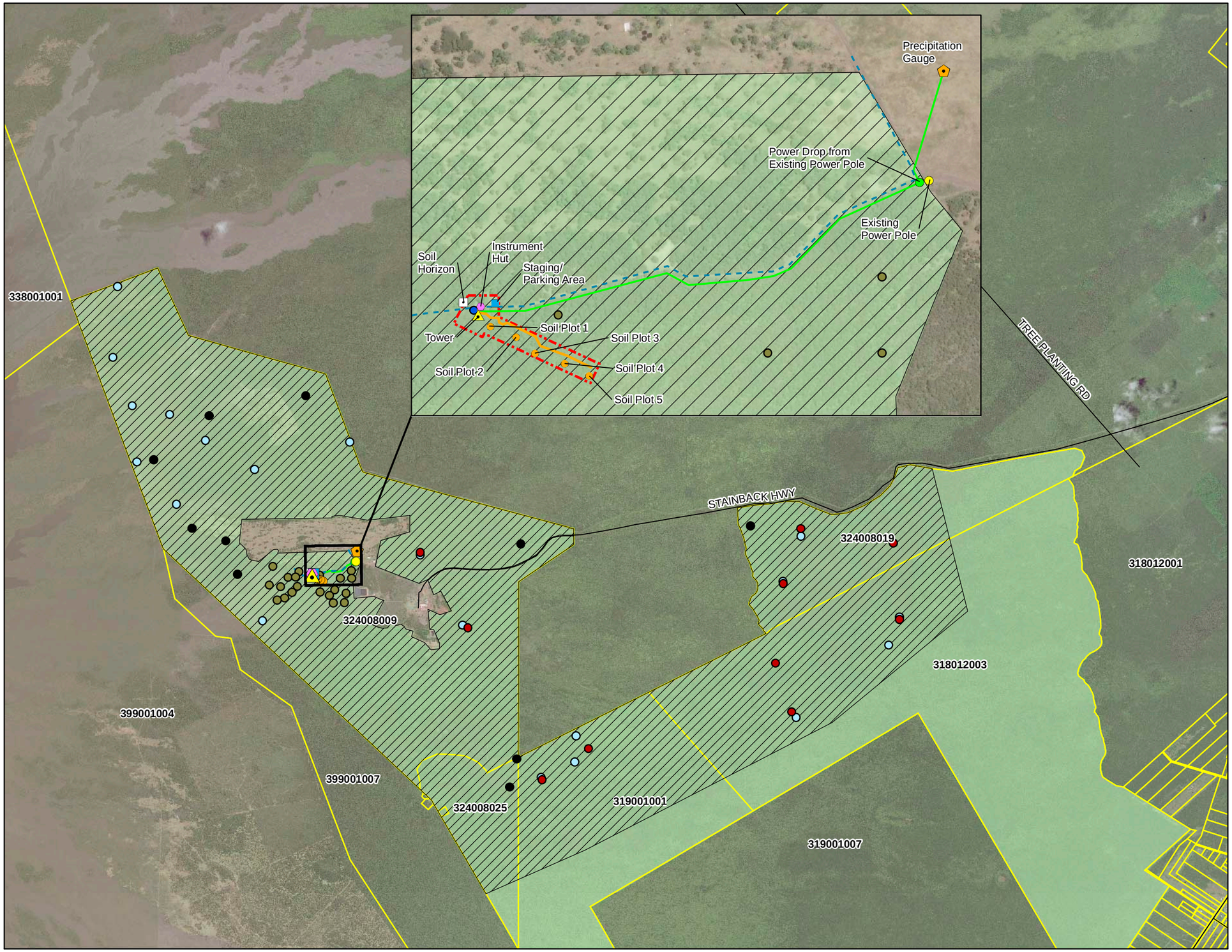
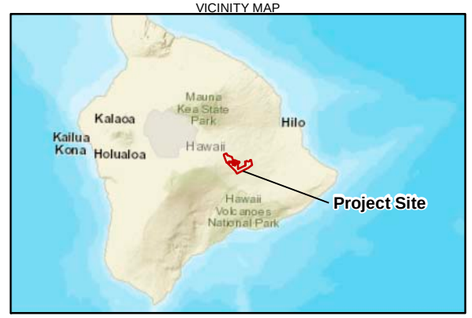


VICINITY MAP



LEGEND

- Precipitation Gauge
- Tower
- Instrument Hut
- Staging/Parking Area
- Soil Horizon
- Soil Array
- Existing Power Pole
- Power Drop from Existing Power Pole
- On-grade Electrical Conduit
- Honeycomb Walkway
- Existing Access Road
- Extent of Potential Construction Activities
- Extent of Potential Terrestrial Sampling
- Tax Map Key (TMK)
- Pu'u Maka'ala Natural Area Reserve

Proposed Sampling Plots and Grids

- Tower Plot (Center Point)
- Distributed Plot (Center Point)
- Bird Grid (Center Point)
- Phenology Transect (Center Point)
- Mosquito Point

NOTE: It is possible that individual plot or grid locations may be adjusted within the limits of the proposed project area. Any adjustment in plot or grid location would be coordinated with DOFAW/NARS.

Aerial Source: NAIP, 2016

N

0 0.5 1
Miles

Figure 2
Pu'u Maka'ala (Domain 20) Core Tower and Sampling Site
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

infrastructure located approximately 1 mile (1.7 kilometers) northwest of the Kūlani Correctional Facility (see Figure 2). Scientific infrastructure would occupy approximately 0.2 acre and would be located entirely within tax map key (TMK) (3)2-4-008:009. Terrestrial sampling plots, with a total footprint of approximately 650 acres, would be distributed throughout approximately 11,660 acres of the surrounding NAR property; this area includes the following TMKs: (3)2-4-008:009, (3)2-4-008:025 (por.), (3)1-9-001:001 (por.), (3)1-8-012:003 (por.), and (3)2-4-008:019 (por.).

2.3.1 Action Area

An action area is defined in the ESA (50 *Code of Federal Regulations* [CFR] 402.02) as the area within which all of the direct and indirect effects of the project would occur. The action area for the Domain 20 core field study site encompasses the full extent of potential terrestrial sampling locations and includes the location of the proposed infrastructure and areas that would be disturbed during construction. The action area is shown in Figure 1 and Figure 2.

2.4 Project Components

As a core site in NEON, the proposed project includes deployment of standardized infrastructure and equipment, as well as terrestrial sampling and data collection consistent with NEON protocols. The following sections detail these project components, including the associated construction and site closure activities.

Based on the analysis contained in the Environmental Assessment for the Proposed Action, a variety of best management practices (BMPs) would be incorporated as part of project implementation. The purpose of these BMPs would be to avoid and minimize potential environmental impacts. These include sanitation procedures to reduce the potential introduction and spread of Rapid *ʻŌhiʻa* Death and invasive plant and animal species, as well as other environmental protection measures specified by DOFAW for work in Puʻu Makaʻala NAR. The BMPs that would be implemented as part of the proposed project are listed in Appendix A.

2.4.1 Project Components

2.4.1.1 Core Site Infrastructure and Equipment

Similar to other NEON core field study sites, the Domain 20 site would be fully instrumented with standardized infrastructure and equipment designed to collect abiotic, biological, biophysical, biogeochemical, and land use data. The following infrastructure and equipment would be deployed to the site; all proposed infrastructure would be located adjacent to existing roads, and no new roads would be required for access to or within the site.

- **Research Tower:** The site would include a single-scaffold lattice tower, which would support an array of equipment and sensors to collect data on atmospheric conditions, climate, canopy microclimate, and solar radiation. A heating, ventilation, and air conditioning (HVAC) unit used to cool the auxiliary equipment would also be mounted on the tower. The tower would extend approximately 33 feet (10 meters) above the forest canopy and would be approximately 105 feet (32 meters) tall. It would be constructed on a concrete foundation pad (approximately 6.5 feet square). Four guy wires would be installed to stabilize the tower. The wires would attach toward the top of the tower (but below the canopy top, to minimize the potential for bird strikes), and would extend approximately 30 meters from the tower base. Minor vegetation trimming would likely be required to maintain proper clearance around the guy wires. The guy wires would be fitted with bird flight diverters to increase the visibility of the guy wires for forest birds. A schematic of the proposed tower is provided in Figure 3.

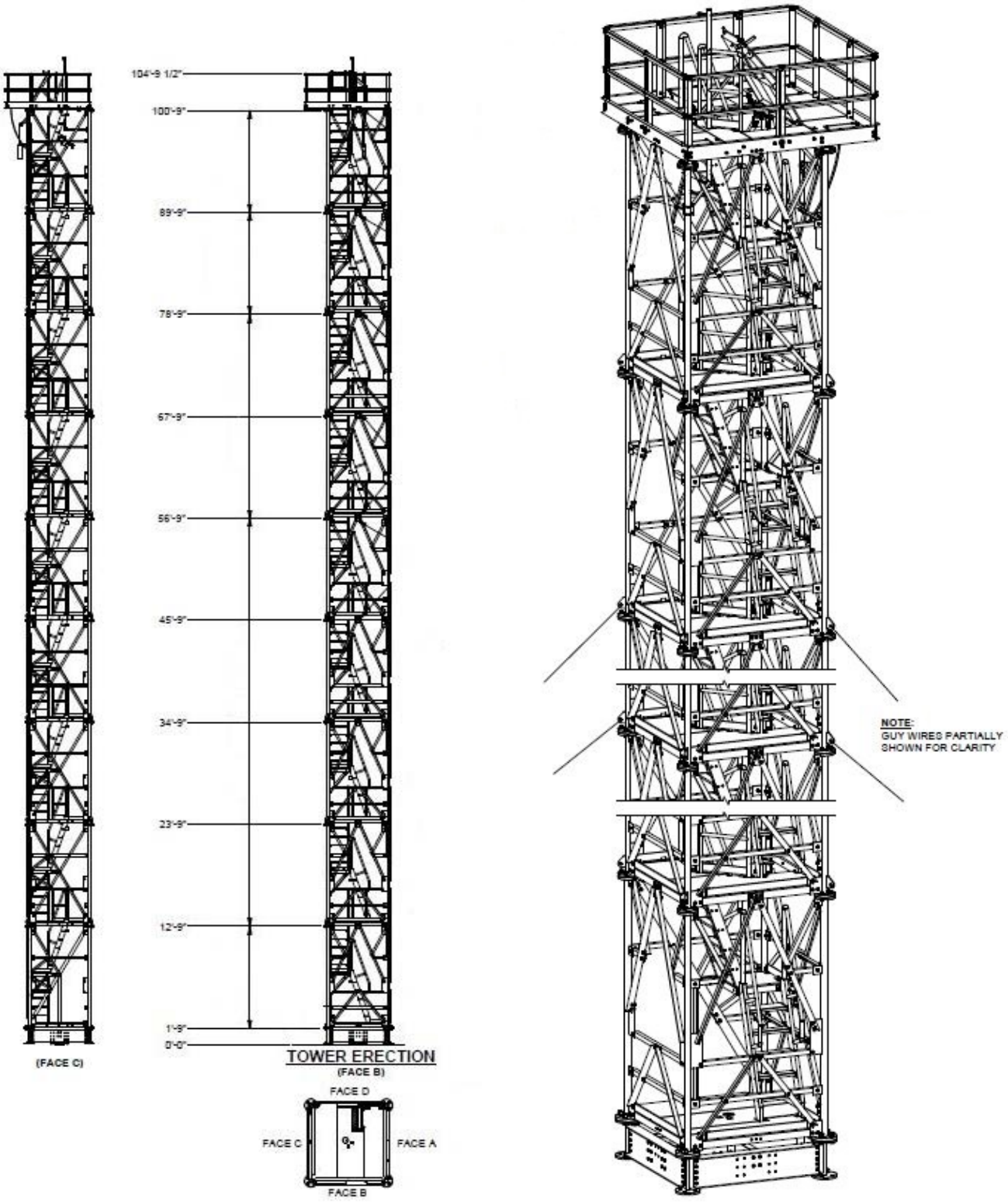


FIGURE 3
Schematic Diagram of Proposed Research Tower

- **Instrument Hut:** The instrument hut would be a prefabricated module that would house gas-analyzers, data recording equipment, and communications and control hardware. It would be mounted on a buried concrete foundation (approximately 9 feet wide by 22 feet long), and would have a raised boardwalk (46 inches wide) installed around the perimeter with a 10-foot-long ramp to facilitate equipment delivery. The instrument hut would include a climate control system with an HVAC unit; a small drainage trench would be installed to collect condensation generated by this system.
- **Soil Horizon Pit:** A 6-foot by 6-foot pit would be temporarily excavated to a depth of 7 feet (or as deep as reasonably possible based on substrate conditions and depth to bedrock) to allow for soil characterization and analysis of soil horizons. The pit would be properly stabilized, covered with plywood and surrounded with construction fencing for safety purposes. The excavated materials would be stockpiled onsite, and once characterization and analysis activities have been completed, the pit would be backfilled. An approximately 3-foot-wide access path to the soil pit would be used during soil pit excavation and evaluation. These activities would all occur during the construction phase.
- **Soil Array:** The soil array would include a series of five sequential soil plots. Each plot would be 5 meters (16.4 feet) square, and would include a network of in-ground soil sensors. The sensors would be installed using minimally intrusive methods, as the goal is to maintain undisturbed native soil for research purposes. Polyvinyl chloride (PVC) conduit with power and communication lines would be routed to each plot (in conjunction with the walkway described immediately below); device posts and metal arbors would be installed at the edge of each plot to support the power and communications equipment needed to operate the soil sensors.
- **Walkways:** Designated walkways would be installed from the access road to the proposed infrastructure within forested habitat to provide a focused point of access and minimize the potential extent of disturbance from repeated visits for maintenance or data collection. The walkways would be approximately 2 feet wide and would consist of flexible honeycomb paver mats designed to reduce soil compaction.
- **Precipitation Gauge:** The precipitation gauge would be a double-fenced intercomparison reference system. The gauge would be mounted to a pipe installed with a 2-foot-diameter concrete foundation. Two concentric octagonal fences (each between 5 and 6 feet high) would be installed around the gauge, with diameters of approximately 13 feet and 26 feet, respectively. Clearing of woody vegetation is typically needed within and surrounding the fenced area to preclude interference with the gauge. However, to minimize impacts to native vegetation, the gauge would be located in a former pastureland dominated by grass species, such that no woody vegetation clearing or trimming is expected to be required.
- **Electrical Equipment:** Power would be obtained from an existing electrical line located at the edge of the Kūlani Correctional Facility property. Secondary power service would extend from an existing pole on this line to a meter socket and transfer switch, which would be owned and used by the local utility to deliver electricity. An auxiliary portal would be installed adjacent to the transfer switch. It would consist of a step-up transformer and communication pedestal, and would serve the research tower and instrument hut. It would also include a plug for a generator, which would only be brought onsite and used in the case of a long-term electrical system outage. The auxiliary portal would be pad-mounted, with the fiberglass pad (approximately 8 feet by 2 feet) installed at existing grade. A second portal (approximately 3 feet by 3 feet) would be installed to serve the precipitation gauge; this portal would include a small HVAC system. From the portals, on-grade electrical and communication lines (contained within PVC conduit) would be laid along an existing fenceline to the instrument hut (approximately 2,520 linear feet), and through former pastureland to the precipitation gauge (approximately 600 linear feet). The conduit would be installed above ground and would be kept in place using fiberglass uni-strut supports, placed at regular intervals and staked into the ground. In a single location, the conduit would be trenched (and capped with concrete) across the existing access road.

- **Staging/Parking Area:** A staging/parking area would be installed near the research tower and instrument hut to provide for parking and staging of equipment during construction, and continued parking through the operations phase. The staging/parking area would be approximately 40 feet by 40 feet, and would consist of approximately 6 inches of base course underlain by geotextile fabric.

The location of the proposed infrastructure is shown in Figure 2. The approximate dimensions of the proposed infrastructure and equipment is listed in Table 1. A schematic diagram of the proposed research tower is provided in Figure 3. Photographs showing similar infrastructure and equipment at other NEON field study sites are provided as part of Figure 4, and photographs showing the proposed locations for the infrastructure and equipment at Pu‘u Maka‘ala NAR are provided as part of Figure 5.

TABLE 1
Summary of Core Site Infrastructure and Equipment

Project Component	Dimension of Infrastructure/Equipment (feet)	Approximate Footprint (ft^2)
Research Tower	6.5 x 6.5; height = 105	42.5
Anchors for Guy Wires	5 x 1 bars anchoring 30-foot-deep 2-inch pipes (for each of 4 anchors)	20
Instrument Hut	9 x 22	198
Boardwalk (Instrument Hut and to Tower)	(26 x 3) + (20 x 4) + (6 x 3)	176
Soil Horizon Pit	6 x 6	36
Soil Array	16.4 x 16.4 (for each of 5 plots)	1,345
Honeycomb Walkway	705 x 2	1,410
Precipitation Gauge	26 x 26	676
Auxiliary Portals	8 x 2; 5 feet tall (for tower and instrument hut) 3 x 3; 4.5 tall (for precipitation gauge)	25
Electrical and Communication Conduit	3,120 x 1 (instrument hut and precipitation gauge); 865 x 1 (soil arrays)	3,985
Staging Area	40 x 40	1,600
Terrestrial Sampling	None	None
TOTAL EXTENT OF DISTURBANCE	---	**9,514**

Note:
ft^2 = square feet

Before installation of any infrastructure or equipment, the limits of the construction area would be delineated to prevent movement into nonconstruction areas. Overall, it is estimated that the construction area would encompass no more than 0.5 acre. Temporary construction fencing would be installed to demarcate active work areas within the construction limits (i.e., areas immediately surrounding the proposed infrastructure or equipment), as appropriate.

All construction activities would be conducted during daylight hours, and no night work would be performed. Workers would travel to and from the project site together to minimize the number of vehicles accessing Pu‘u Maka‘ala NAR. Vehicle use would be strictly limited to the existing access road or proposed staging area, except where essential for installation of infrastructure. No new access roads would be constructed, but the existing access road may be improved to accommodate short-term use by construction vehicles (e.g., laying gravel in localized areas). Equipment and materials would be hand-carried to areas beyond the access road (e.g., the soil plots), as needed.



Figure 4a. Representative Photograph of Tower and Instrument Hut *(Central Plains Experimental Range [CPER], Central Plains Domain)*





Figure 4b. Representative Photographs of Tower *(Delta Junction, Tiaga Domain)* **and Tower Construction Process** *(Smithsonian Conservation Biology Institute [SCBI], Northeast Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 4c. Representative Photographs of Tower, Instrument Hut and Soil Array *(CPER, Central Plains Domain)* **and Tower and Instrument Hut** *(Ordway Swisher Biological Station, Southeast Domain)*



Figure 4d. Representative Photograph of Instrument Hut *(Jones Ecological Research Center, Southeast Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 4e. Representative Photographs of Walkway, Electrical Conduit and Device Post (left) and Arbors Supplying Power to Soil Plots (right) *(Oak Ridge National Laboratory [ORNL], Appalachian & Cumberland Plateau Domain)*



Figure 4f. Representative Photographs of Soil Sensor Equipment *(CPER, Central Plains Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 4g. Representative Photograph of DFIR Precipitation Gauge with On-Grade Conduit and Device Post *(Niwot Ridge, Southern Rockies & Colorado Plateau Domain)*



Figure 4h. Representative Photograph of DFIR Precipitation Gauge and Device Post *(Santa Rita Experimental Range, Desert Southwest Domain)*

FIGURE 4
Representative Photographs of Infrastructure and Equipment at Similar NEON Research Sites



Figure 5a. Photograph of Proposed Tower Location and Adjacent Access Road *(Pu'u Maka'ala NAR)*



Figure 5b. Photograph of Proposed Instrument Hut and Tower Guy Wire Location *(Pu'u Maka'ala NAR)*

FIGURE **5**
Photographs of Proposed Locations for
NEON Infrastructure and Equipment



Figure 5c. Photograph of Proposed Precipitation Gauge Location (left side of frame) and Existing Power Line (right side of frame) *(Pu'u Maka'ala NAR)*



Figure 5d. Photographs of Proposed Power Drop and Auxiliary Portal Location *(Pu'u Maka'ala NAR)*

FIGURE **5**
Photographs of Proposed Locations for
NEON Infrastructure and Equipment

Preparation for construction, installation of infrastructure and construction acceptance is expected to require approximately 5 to 6 months, and installation and calibration of equipment is expected to require approximately 1 to 2 months. Subject to environmental clearance and permitting, it is currently anticipated that construction would start in fall 2017, with operation of the site starting in spring 2018. The proposed construction schedule, with the estimated timeframes for the various construction activities, is presented in Appendix B.

2.4.1.2 Long-term Terrestrial Sampling

Following construction and over the course of the 30-year operational period for NEON, a suite of terrestrial sampling protocols would be implemented on a routine basis. Sampling would occur at designated plots and grids established in locations throughout the surrounding lands of Pu‘u Maka‘ala NAR. Based on stakeholder concerns regarding potential environmental impacts, the density and total footprint of sampling plots and grids was substantially reduced from the levels implemented at other NEON field study sites to the minimum level needed to ensure scientific viability of the project. Up to 62 plots or grids would be distributed over approximately 11,660 acres of the NAR. In total, the plots and grids would cover approximately 630 acres, with the actual sampling occurring in a smaller subset of each plot and grid. The sampling plots and grids would include the following:

- **Tower Base Plots:** Approximately 20 plots: 16 plots, each measuring 20 by 20 meters, and 4 plots, each measuring 40 by 40 meters
- **Distributed Base Plots:** Approximately 20 plots, each measuring 40 by 40 meters
- **Bird Grids:** Approximately 10 grids, each measuring 500 by 500 meters
- **Phenology Plots:** One transect measuring 800 meters
- **Mosquito Plots:** Approximately 10 plots, each measuring 0.5 by 0.5 meter

The potential locations of the sampling plots and grids are shown in Figure 2. The locations as shown were vetted with DOFAW and NARS staff, and reflect the current understanding of existing and future planned research or monitoring activities in Pu‘u Maka‘ala NAR, and an effort to minimize redundancy or excessive activity in any given location. It is possible that the plot and grid locations may be adjusted within the limits of the proposed project area before construction, based on additional stakeholder input. Once the proposed project is operational, the goal would be to keep the plot and grid locations fixed to maximize data integrity. However, there is some degree of flexibility to move individual plots or grids in response to an unanticipated impact or changed conditions within the NAR. Any such decision would be made in direct coordination with the NAR manager. Should there be any changes to the proposed project that could result in a take of federally listed threatened and endangered species (including proposed or candidate species), or adverse modification of designated critical habitat, additional consultation under Section 7 of the ESA would be completed prior to implementing any changes.

The sampling plots and grids would be established at the same time the scientific equipment is installed and calibrated. This effort would include (1) NEON technicians visiting each plot to confirm the scientific validity of the location and (2) permanent markers placed at a fixed sample point or at the ends of a sample transect. Permanent markers would consist of rebar or survey caps (or similar marking device approved by NARS staff) driven into the ground. If the plot or grid were to be relocated during implementation of the project, the original marker(s) would be removed and new permanent marker(s) would be placed.

Over the 30-year operational period, research technicians would visit each sampling plot and grid on a routine basis, as needed to conduct the prescribed sampling activities. The sampling protocols are consistent with the standardized requirements for NEON, but have been tailored as appropriate based on the local ecology and site-specific conditions. The sampling protocols are designed to be passive, with minimal ground disturbance. Certain sampling protocols require placement of sampling equipment (e.g., pitfall traps

and mosquito traps). The list of sampling activities, as well as the associated protocols and required equipment, are listed in Table 2.

Table 2 also lists the sampling frequency, duration, and timing for each of the sampling protocols. The estimated timeframes for the various sampling activities that would be conducted in a typical year are presented in Appendix C. Similar to the determination of plot and grid location, the timing for sampling activities is designed to avoid or minimize impacts, including activities during sensitive periods (e.g., applicable nesting seasons), to the extent possible. In addition, to further minimize disturbance, sampling visits would be combined where possible to minimize the number of times researchers are at the site. It is currently expected that three full-time staff (one domain manager and two research technicians) would be needed to conduct the sampling and other operational requirements. The staff would be supplemented with up to eight temporary technicians during peak sampling periods.

The sampling data collected from the site would be reviewed, synthesized, and packaged by the NEON project team. The resulting data set would be uploaded to an online portal, where it would be made available to the scientific community and general public as part of the continental NEON data set. The Domain 20 data would also be transferred directly to DOFAW and NARS staff to assist with management of the site.

2.4.1.3 Aerial Observations

In addition to the terrestrial sampling effort, an aerial flight would be conducted on an annual basis. The aerial flight would use a small aircraft outfitted with remote sensing equipment (including a hyperspectral imager, Light Detection and Ranging [LiDAR] sensor, and high-resolution camera). The typical flight height would be approximately 3,281 feet (1,000 meters) above ground level (AGL), but would vary based on topography. Data collected from the flight would provide detailed spatial information on the structure and biogeochemical properties of vegetation, and would also facilitate the development of algorithms for scaling up site-specific data.

TABLE 2
Summary of Proposed Terrestrial Sampling Protocols

Type of Sampling	Description of Field Sampling Activity		Equipment Installed	Plot/Grid Location	Sampling Season	Frequency	Duration of Each Event	Number of Visits to Each Plot per Event	Number of Technicians per Visit
Soil sampling	Three composite soil samples (approximately 300 g each) will be collected at each plot. Each sample would be generated from 1-3 soil cores within a 50-cm radius of the target sampling location. Cores range between 3.5 and 11 cm, with typical depth of 30 cm or refusal. Holes will be backfilled at NARS' direction. For baseline characterization, 1 composite soil sample consisting of up to 9 soil cores is collected per plot in a single bout, and remaining bouts are cancelled.	Soil baseline characterization	None	Combination of Tower and Distributed Plots (10)	October-December	1 event only (replaces soil microbe/biogeochemistry sampling in first year)	4-5 days (2-3 plots a day)	1	2-3
		Soil microbes and soil biogeochemistry[1]	None	Tower plots (4); Distributed plots (6)	October, December/ January, April	3 events per year	4-5 days (2-3 plots a day)	1	2
		Soil biogeochemistry: N transformations	Temporary installation of three 35-cm x 5-cm-diameter PVC tubes, buried such that 5 cm remain above the soil; removed after end of 2 week incubation	Tower plots (4); Distributed plots (6)	October, December/ January, April	3 events per year, every 5 years	2 weeks (1 initial sampling day, with a second sampling day 2 weeks after the first)	2	2
Plant diversity	Observations of species presence and cover (at 1 m^2) will be made in 400-m^2, multi-scale plots. Observations within these plots are made at eight 1- and 10-m^2 subplots. Vouchers of a subset of representative plant species (approximately 20 per year) will be collected.		None	Tower plots (20)	November-December	1 event only (initial sampling)	10-20 days (1-2 plots per day)	1	4
				Tower plots (3)	November-December	1 event per year	2-3 days (1-2 plots per day)	1	2
				Distributed plots (20)	November-December	1 event per year	10-20 days (1-2 plots per day)	1	2
Litterfall and fine woody debris	Litter (nonliving plant material) will be collected from basket-like traps and from paired ground traps for woody material <2 cm in diameter, arrayed in 20-m x 20-m plots.		One 0.5-m^2 PVC 'elevated' trap per plot (0.8 m off the ground), and one 1.5-m^2 ground trap per plot	Tower plots (20)	Year-round	Elevated traps: 26 events per year; Ground traps: One event per year	1 day (20 plots per day)	1	2
Belowground fine root biomass	Two soil cores (7.62 cm diameter, 30 cm depth) will be extracted from each plot to measure fine root live and dead biomass; holes to be backfilled at NARS' direction.		None	Tower plots (20)	December	1 event every 5 years	5-10 days (2-4 plots per day)	1	2
Vegetation structure	Measurements such as height and diameter at breast height of woody individuals will be measured. No collection will be made (unless diagnostic plant part is needed to facilitate species identification).		Aluminum tags hung around woody vegetation with loose wire (no nails would be used)	Tower plots (20)	October-December	1 event per year	10-20 days (0.5-1 day per plot)	1	2
				Distributed plots (20)	October-December	1 event every 3 years	20 days (1 plot per plot)	1	2
Coarse downed wood (tally)	Nondestructive tally measurements will be made along three 200-m transects originating from within each plot.		Log tags	Tower plots (20)	October-December	1 event every 3 years	20 days (1 plot per day)	1	2
				Distributed plots (20)	October-December	1 event every 3 years	20 days (1 plot per plot)	1	2
Coarse downed wood (density)	Disks (5-10 cm width) will be cut from downed logs using a chainsaw or hand-powered bucksaw. A total of 100-200 disks will be cut; the final number will depend on the number of taxa and the number of decay classes encountered.		Log tags	Area surrounding tower	October-December	2 events total: one in first 3 years, again 5-6 years later	20 days (1 plot per day)	1	2
				Distributed plots (20)	October-December	2 events total: one in first 3 years, again 5-6 years later	20 days (1 plot per plot)	1	2
Foliar biogeochemistry	Sunlit leaves of dominant species will be harvested using a pruning pole or remote-controlled unmanned aerial vehicle equipped for collecting leaves. If these methods are not feasible, a licensed arborist would be contracted to climb to the canopy to collect the samples.		None	Tower plots (4)	December	1 event every 5 years	2 days (2-3 plots per day)	1	2
				Distributed plots (10)	December	1 event every 5 years	3-5 days (23 plot per day)	1	2
Leaf area index	Digital hemispherical photographs of understory and overstory vegetation will be taken at multiple points within each plot.		None	Tower plots (3)	Year-round	1 event every 2 weeks	1 day (3 plots per day)	1	2
				Distributed plots (20)	December	1 event every 3 years	10 days (2 plots per day)	1	2
Herbaceous biomass	Herbaceous material will be clip harvested from one 0.2-m (0.1-m x 2-m) area.		None	Tower plots (20)	November-December	1 event per year	5-10 days (2-4 plots per day)	1	2
Plant phenology	Phenological status and transitions of plant species will be monitored and recorded. Initially, up to 30 individuals of 3 species will be monitored. Over subsequent years, fewer individuals of 20 species will be monitored.		Aluminum tags wrapped around woody vegetation with loose wire; markers inserted in ground for herbaceous vegetation	Phenology transect (1); along easily accessible road	Year-round	1 event every 2 weeks	1 day (2 plots per day)	1	2
Ground beetles	Four pitfall traps at each plot will be deployed and checked at 2-week intervals to capture and describe the diversity and abundance of ground beetles.		Four pitfall traps per plot; each trap consists of a cup buried flush with the ground, filled with a preservative, and shaded by a flat cover	Distributed plots (10)	October-April	13 events per year	1 day every 2 weeks	1	2
Mosquitoes	CO_2 traps will be deployed for 2 nights (approximately 40 consecutive hours) per sampling event; captured mosquitoes will be retrieved from the trap on three occasions (first morning, second evening, and second morning).		Trap consisting of small insulated cooler (loaded with CO_2 pellets), rain cover, a fan (with 6-volt battery), and catch cup; trap will be hung from a tree or post	Mosquito plots (10), each within 35 m of road	Year-round	1 event per month (12 events per year)	2 days	4	2
Breeding land birds	Bird abundance and diversity data will be collected using binoculars and laser rangefinder; point counts will be conducted for a total of 10 minutes per location		None	Bird grids (10)	February-March	1 event every three years	5-10 days (1-2 grids per day)	1	2

Notes:
[1] Soil biogeochemistry analyses will be conducted on a subset of soil collection every 3 years.
[2] Timing will be determined in consultation with site host.

< = less than
cm = centimeter
CO_2 = carbon dioxide
g = gram
m = meter
m^2 = square meter

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2.4.1.4 Infrastructure and Equipment Maintenance

Long-term operation of the proposed project will require ongoing maintenance to ensure the infrastructure and equipment are in optimal working order and remain properly calibrated. Standard maintenance activities are planned to occur approximately every 2 weeks, with one larger maintenance event conducted annually. In addition, emergency repairs would be conducted as needed. A description of the maintenance activities and their frequency and duration, are summarized in Table 3.

TABLE 3
Summary of Proposed Maintenance Activities

Maintenance Event	Activities to be Conducted	Frequency	Duration of Each Event	Number of Technicians
Standard maintenance of tower sensors	Preventative maintenance including inspecting and cleaning sensors, calibration of nonhazardous CO_2 gas cylinders stored in the hut and troubleshooting/ repairing sensors and systems.	One event every two weeks	2 days	2
Annual maintenance of tower and soil array	Annually, instruments will be removed from the tower and soil array and replaced with recently recalibrated instruments.	One event per year	5 days	2-3
Emergency repairs	Emergency repairs to the tower or soil array sensors and infrastructure in the event damage is caused by weather or other unforeseen factor.	As needed	As needed	To be determined

2.4.2 Standard Operating Procedures

Management of Pu‘u Maka‘ala NAR is focused on preserving natural communities of flora and fauna in as unmodified a state as possible. Similarly, avoidance and minimization of impacts to natural resources is fundamental to the long-term success of the proposed project, as the project is intended to assist in detection of natural changes in native ecosystems. To meet the proposed project needs and to maintain consistency with the NAR management goals, the NEON project team considers natural resource protection and impact avoidance and minimization to be paramount.

Furthermore, the NEON project team understands that there are other research and monitoring efforts that are either ongoing or planned within the NAR. Given that the purpose of the proposed project is to improve and contribute to research capabilities, the NEON project team is equally focused on minimizing the potential for overlap or interference with other research and monitoring efforts.

To this end, implementation of the proposed project within Pu‘u Maka‘ala NAR would be governed by standard operating procedures (SOPs) designed to avoid or minimize impacts and promote collaboration with NARS staff and other researchers, while maximizing the scientific integrity and benefit of the project. The following SOPs are based on NEON’s standardized protocols, as well as input received from DOFAW and NARS staff and other stakeholders to date. These will be developed in more detail as part of a Project Work Plan; this plan will be subject to DOFAW and NARS approval (with a request for review and input from USFWS) before project implementation, and would continue to be refined over the lifetime of the proposed project.

- **Communication Procedures:** All activities within Pu‘u Maka‘ala NAR would be coordinated directly with the NARS Specialist.[2] Frequent and clear communication between the NARS Specialist and the NEON domain manager will be key to successful project implementation, natural resource protection, and coordination with other research and monitoring activities. The NEON domain manager would provide the anticipated schedule for onsite NEON activities in writing to the NARS Specialist (e.g., via email) at a frequency requested by DOFAW and NARS staff, to facilitate coordination in timing or location of NEON activities with other work within the NAR. NEON project management staff would also participate in relevant stakeholder meetings to provide information about NEON activities and gather information about other projects' activities to ensure appropriate coordination and minimize possible conflicts with other stakeholders. In addition, NEON would provide a summary annual report that describes the previous year's activities, as requested by DOFAW.
- **Staff Training:** All onsite staff for the proposed project, including the domain manager and any research technicians or maintenance personnel, would receive adequate training before starting work within the NAR, with refresher training provided as needed. This training would address the specific procedures for decontamination, and would also include information related to identification of sensitive species and their habitat, response protocols if threatened or endangered species are encountered, and other relevant conditions of the project permits.
- **Decontamination Procedures:** Key management objectives for Pu‘u Maka‘ala NAR include control of nonnative species and disease. Issues of particular concern include the potential introduction and spread of invasive species and Rapid *‘Ohi‘a* Death. Decontamination procedures, consistent with those recommended by the resource agencies and used by DOFAW and NARS staff, would be implemented throughout the construction and operation phase of the proposed project; these are listed as part of the BMPs in Attachment A. Any future changes in decontamination procedures, including those adopted by DOFAW or those recommended by the resource agencies, would be incorporated into the proposed project as appropriate.
- **Site Access and Route Planning:** Long-term terrestrial sampling would be conducted in a manner that limits potential disturbance to natural resources to the extent possible. Specifically, all activities would incorporate the following approach:
  - The overall number of visits to the site would be minimized by combining activities to the extent possible.
  - Site visits would be coordinated with NARS staff to reduce impacts during periods when federally listed threatened and endangered species, proposed species, candidate species for listing, and other species of concern are most vulnerable to disturbance.
  - Based on the results of the Section 7 consultation, a detailed plan to avoid, work around, and protect federally listed threatened and endangered species, proposed species, candidate species for listing, and other species of concern would be developed and updated as part of the Project Work Plan, as needed.
  - The routes taken throughout the NAR (including to each sampling location) would be developed in coordination with DOFAW and NARS staff. These routes may be varied over time to disperse impact of foot travel, or may follow the same path to concentrate impacts, depending on the specific locations and based on guidance received from DOFAW and NARS staff.

[2] The NARS Specialist is the person in charge of all natural area reserves and NARS staff affiliated with the Hawaii Island Branch.

  - Observations that require the most frequent visits (e.g., litter, plant phenology, or mosquitoes; see Table 2) would be placed in proximity to roads to reduce foot traffic across the site.

- **Ongoing Impact Assessment and Adaptive Mitigation:** Implementation of the proposed project would incorporate BMPs and other impact avoidance and minimization measures that reflect current best practices and knowledge of site conditions. These BMPs, which are based on the analysis contained in the Environmental Assessment, are summarized in Appendix A. Consistent with the procedures implemented at all NEON project sites, the domain manager would be responsible for continuously tracking project activities to ensure the efficacy of these measures, and to detect and address unanticipated environmental impacts. This effort would include monitoring parking areas, access routes and sampling locations for disturbance to vegetation and wildlife, as well as the introduction and establishment of invasive species. If it is determined, either through this effort or based on input from DOFAW and NARS staff, that project implementation is resulting in unanticipated environmental impact, any associated project activities would be temporarily halted. In coordination with the NARS Specialist, the domain manager would assess the effectiveness of relevant BMPs or other avoidance and minimization measures, and would make any necessary adjustments to adequately address the impact. This effort could also include adjustments to individual sampling plot or grid locations. Additional SOPs would be adopted as needed. Over time, consistent monitoring and evaluation of long-term sampling is expected to result in increased understanding of impacts and subsequent iterations in the approaches to mitigation.
- **Vegetation Trimming**: The proposed project has been designed to minimize the need for any vegetation clearing/trimming, consistent with the overall objective of monitoring natural processes. However, a minimal amount of trimming may be needed to maintain clearance around the project infrastructure (e.g., along the guy wires for the tower). Any vegetation clearing or trimming would first be approved by (1) the NEON science team to make sure it is necessary for scientific purposes, (2) the permitting team to make sure action is acceptable per the permit conditions and complies with seasonal restrictions related to listed species (e.g., bat-pupping and bird-breeding seasons), and (3) the NARS staff to make sure it is consistent with site management objectives. A qualified arborist with specific knowledge of the target species and site conditions would be engaged, as needed.
- **Collection of Listed Plant Species**: The proposed infrastructure and terrestrial sampling plots have been sited to avoid any known occurrences of protected plant species. Terrestrial sampling activities would not include collection or harvest of protected plant species. If it is subsequently determined that collection or harvest of a species that is federally or state listed (or is proposed for listing) is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate permits from the USFWS (Section 10 Scientific Collection Permit) and DOFAW prior to any such collection.
- **Stakeholder and Community Engagement:** Consistent with the overall project objectives, the NEON project team is committed to ongoing engagement with the ecological research community and other project stakeholders, as needed to maximize project success. The purpose of these efforts would be to (1) maintain coordination with other relevant activities, (2) keep project stakeholders apprised of the project status, and (3) contribute to the local community's knowledge of ecological conditions within the project site. Stakeholder and community engagement efforts are expected to include NEON participation in relevant stakeholder meetings, development and maintenance of a project website, and delivery of data to DOFAW, NARS, and other local stakeholders.

These SOPs are summarized in Appendix A, along with the other general BMPs that would be incorporated as part of project implementation to avoid or minimize environmental impacts. Should future adjustments to the SOPs (or other project-related activities) result in conditions that could result in a take of federally listed threatened and endangered species, proposed species, candidate species for listing or adverse modification of designated critical habitat, additional consultation under Section 7 of the ESA would be completed prior to implementing any changes.

2.4.3 Project Duration and Site Closure

NEON is projected to operate for 30 years. The exact nature of site closure at the end of the operational period would be based on the interests of DOFAW, as the site host. If requested, it is possible that some or all of the infrastructure or equipment may be retained onsite. The specific decommissioning and closure plans are undefined at this time. However, for the purposes of this analysis, it is assumed that all sampling infrastructure (including the tower and instrument hut) would be removed, but belowgrade material (such as the tower foundation) would be left in place. All boardwalk materials and electrical equipment (including power lines and conduits) would be removed.

Any materials removed during these processes would be reused, recycled, or properly disposed of at an approved location. All disturbed ground would be stabilized with biodegradable materials and revegetated with species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Compacted soil would be loosened and aerated before revegetation. Revegetation activities would be coordinated with DOFAW and NARS staff, as appropriate.

3 Species Description and Effects Analysis

USFWS provided a letter identifying species that are known to occur or that may occur in the proposed project vicinity through the National Environmental Policy Act (NEPA) scoping process (dated September 12, 2016); a copy of this letter is provided as Appendix D. Additional information regarding listed species and critical habitat within Pu‘u Maka‘ala NAR was obtained from the Pu‘u Maka‘ala NAR Management Plan (DOFAW, 2013). The resulting list of endangered, threatened, and species proposed for listing that are evaluated in this document are listed in Table 4.

Based on information provided in the September 12 USFWS letter and the USFWS Critical Habitat Online Mapper (USFWS, 2016a), there is designated critical habitat within Pu‘u Maka‘ala NAR for 9 species (8 plant species and 1 invertebrate species). Species for which critical habitat has been designated within the action area are identified in Table 4 and the areas of critical habitat are shown in Figure 6.

TABLE 4
Federally Listed Species and Critical Habitat Addressed in Biological Assessment

Vascular Plants and Ferns	
Mauna Loa (*Ka‘u*) silversword (*Argyroxiphium kauense*) *	*Nānū* (*Gardenia remyi*)
‘Ōhā wai (*Clermontia lindseyana*) *	*‘Ohe* (*Joinvillea ascendens* ssp. *ascendens*)
‘Ōhā wai (*Clermontia peleana*)	*Phyllostegia floribunda*
Hāhā (*Cyanea copelandii ssp. copelandii*)	*Kīponapona* (*Phyllostegia racemosa*) *
‘Akū‘akū (*Cyanea platyphylla*)	*Phyllostegia velutina**
Hāhā (*Cyanea shipmanii*) *	*‘Ānunu* (*Sicyos alba) **
Hāhā (*Cyanea stictophylla*) *	Hawaiian vetch (*Vicia menziesii*)
‘Akū (*Cyanea tritomantha*)	*Palai la‘au (Adenophorus periens)*
Ha‘iwale (*Cyrtandra giffardii*) *	*Asplenium peruvianum* var. *insulare*
Ha‘iwale (*Cyrtandra tintinnabula*)	
Birds	
nēnē, Hawaiian goose (*Branta sandvicensis*)	‘*i‘iwi*, scarlet honeycreeper (*Vestiaria coccinea*)
‘*io*, Hawaiian hawk (*Buteo solitarius*)	*‘alalā*, Hawaiian crow (*Corvus hawaiiensis*)
‘*akiapōlā‘au* (*Hemignathus munroi*)	Newell’s shearwater (*Puffinus newelli*)
Hawai‘i ‘*ākepa* (*Loxops coccineus*)	‘*ua‘u* or Hawaiian petrel (*Pterodroma sandwichensis*)
Hawai‘i creeper (*Oreomystis mana*)	‘*akē‘akē*, band-rumped storm petrel (*Oceanodroma castro*)
‘ō‘ū (*Psittirostra psittacea*)	
Mammals	
‘*Ōpe‘ape‘a*, Hawaiian hoary bat (*Lasiurus cinereus semotus*)	
Invertebrates	
Picture-wing fly (*Drosophila mulli*) *	

Note:
* Denotes species for which critical habitat is designated within action area

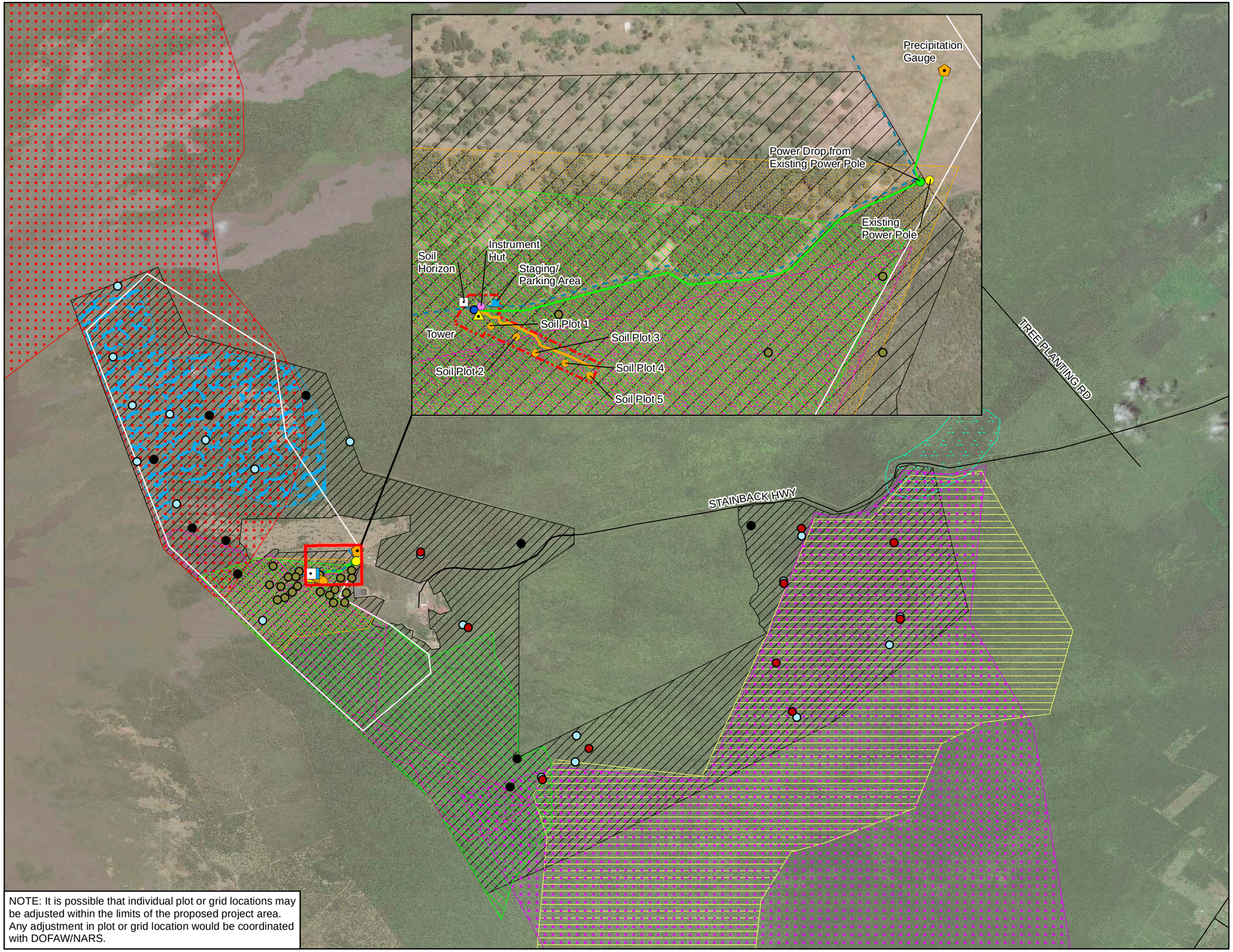
The following sections provide a brief description of each species, along with an assessment of whether the species is known to occur or may occur within the action area, as follows:

- ***Known to occur***: Recent accounts of the species occurrence within Pu‘u Maka‘ala NAR is documented in the Pu‘u Maka‘ala NAR Management Plan (DOFAW, 2013a), has been confirmed by DOFAW and NARS staff, or both.
- ***May occur***: The action area is within the species’ currently known range and includes suitable habitat (based on a qualitative comparison of the species’ habitat requirements with conditions in the action area), or the species was historically known to occur within Pu‘u Maka‘ala NAR but has not been recently confirmed.
- ***Unlikely to occur:*** The action area is either not within the species’ known range, suitable habitat is not present (based on a qualitative comparison of the species’ habitat requirements with conditions in the action area), the species is believed to be extirpated from this location, or a combination thereof.

Species known to occur or that may occur in the action area were further evaluated for possible impacts from the proposed project. Effect determination categories are defined differently based on the legal status of a species and the mandates and responsibilities of the agency tasked to manage or protect that species. Threatened or endangered species were assigned to one of three categories of possible effect, following USFWS guidelines:

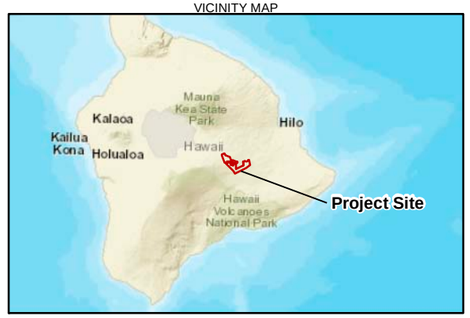
- ***No effect*****:** A determination of no effect means there are absolutely no effects to the species and its critical habitat, either positive or negative. It does not include small effects or effects that are unlikely to occur.
- ***May affect, is not likely to adversely affect***: Under this effect determination, all effects to the species and its critical habitat are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without adverse effects to the species. Insignificant effects relate to the magnitude of the impact and should not reach the scale where take occurs. Discountable effects are considered 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. Determinations of “not likely to adversely affect, due to beneficial, insignificant, or discountable effects” require written concurrence from the USFWS.
- ***May affect, is likely to adversely affect***: This effect determination means that the proposed project would have an adverse effect on the species or its critical habitat. Any action that would result in “take” of an endangered or threatened species is considered an adverse effect. A combination of beneficial and adverse effects is still considered “likely to adversely affect,” even if the net effect is neutral or positive. The effect on the species or critical habitat must be extremely small to qualify as a discountable effect. Likewise, an effect that can be detected in any way or that can be meaningfully articulated in a discussion of the results of the analysis is not discountable; it is an adverse effect.

Species that are proposed for listing were evaluated using the following effect determination categories: ***No effect***, ***Not likely to jeopardize the continued existence of the species***, or ***Likely to jeopardize the continued existence of the species***. Jeopardy is defined under the ESA as occurring when “an action is reasonably expected, directly or indirectly, to diminish a species’ numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced.”



NOTE: It is possible that individual plot or grid locations may be adjusted within the limits of the proposed project area. Any adjustment in plot or grid location would be coordinated with DOFAW/NARS.

VICINITY MAP



LEGEND

- Precipitation Gauge
- Tower
- Instrument Hut
- Staging/Parking Area
- Soil Horizon
- Soil Array
- Existing Power Pole
- Power Drop from Existing Power Pole
- On-grade Electrical Conduit
- Honeycomb Walkway
- Existing Access Road
- Extent of Potential Construction Activities
- Extent of Potential Terrestrial Sampling

Critical Habitat

- Argyroxiphium kauense
- Clermontia lindseyana
- Cyanea shipmanii
- Cyanea stictophylla
- Cyrtandra giffardii
- Drosophila mulli
- Phyllostegia racemosa
- Phyllostegia velutina
- Sicyos albus

Proposed Sampling Plots and Grids

- Tower Plot (Center Point)
- Distributed Plot (Center Point)
- Bird Grid (Center Point)
- Phenology Transect (Center Point)
- Mosquito Point

Aerial Source: NAIP, 2016

N

0 0.5 1
Miles

Figure 6
Critical Habitat
National Ecological Observatory Network (NEON) Project
Hawaii Island, Hawaii

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For those species for which critical habitat has been designated within the action area, potential impacts to critical habitat were assessed based on the extent to which the physical or biological features that support that species would be affected. Impacts to critical habitat were evaluated using the following effect determination categories: ***No effect***, ***Not likely to result in destruction or adverse modification of critical habitat***, or ***Likely to result in destruction or adverse modification of critical habitat***. The potential for adverse modification of critical habitat is based on an analysis of the infrastructure and terrestrial sampling activities that would occur within areas of designated critical habitat. Table 5 summarizes the infrastructure and terrestrial sampling activities that would occur in each unit of critical habitat within Pu‘u Maka‘ala NAR (denoted with an “X”). As described in the preceding section, it is possible that the plot and grid locations may be adjusted within the limits of the proposed project area before construction, based on additional stakeholder input. There is also some potential that individual plots may be relocated over time in response to unanticipated impacts or changed conditions within the NAR. It is expected that any such refinements would involve relatively minor shifts in location (within the project area) and the range of sampling activities would not change. As such, it is anticipated that the potential impacts to listed species and critical habitat would be commensurate with the analysis contained herein. Should there be any changes that could result in a take of federally listed threatened or endangered species (including proposed or candidate species), or adverse modification of designated critical habitat, additional consultation under Section 7 of the ESA would be completed prior to implementing any changes.

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TABLE 5
Proposed Infrastructure and Terrestrial Sampling Located Within Critical Habitat at Pu‘u Maka‘ala NAR

	Critical Habitat Units within NEON Domain 20 Field Site								
	Mauna Loa silversword (*Argyroxiphium kauense*)	*‘Ōhā wai* (*Clermontia lindseyana*)	*Hāhā* (*Cyanea shipmanii*)	*Hāhā* (*Cyanea stictophylla*)	*Ha‘iwale* (*Cyrtandra giffardii*)	*Kīponapona* (*Phyllostegia racemosa*)	*Phyllostegia velutina*	*‘Ānunu* (*Sicyos alba)*	Picture-wing fly (*Drosophila mulli*)
Infrastructure and Equipment									
Research Tower		X				X	X		
Anchors for Guy Wires		X				X	X		
Instrument Hut		X				X	X		
Boardwalk		X				X	X		
Soil Horizon Pit		X				X	X		
Soil Array		X		X (3 plots and walkway)		X	X		
Honeycomb Walkway		X				X	X		
Precipitation Gauge		X							
Auxiliary Portals		X				X	X		
Electrical and Communication Conduit		X				X	X		
Staging Area		X				X	X		
Terrestrial Sampling[1,2]	Distributed Plots (8) Mosquito Point (5)	Tower Plots (18) Distributed Plots (8) Phenology Transect (1) Mosquito Point (5)	Distributed Plots (6) Mosquito Point (3)	Tower Plots (15) Distributed Plots (1) Mosquito Point (1)	Distributed Plots (4) Bird Grid (5)	Tower Plots (18) Distributed Plots (1) Phenology Transect (1) Mosquito Point (1)	Tower Plots (18) Distributed Plots (2) Bird Grid (1) Phenology Transect (1) Mosquito Point (3)	Distributed Plots (4) Bird Grid (5) Mosquito Point (1)	None
Plot establishment (ND)	X	X	X	X	X	X	X	X	
Soil characterization (S)	X	X	X	X	X	X	X	X	
Soil microbes (S)	X	X	X	X	X	X	X	X	
Soil biogeochemistry (S)	X	X	X	X	X	X	X	X	
Plant diversity (U)	X	X	X	X	X	X	X	X	
Litterfall and fine woody debris (U)		X		X		X	X		
Belowground fine root biomass (S)		X		X		X	X		
Vegetation structure (ND)	X	X	X	X	X	X	X	X	
Coarse downed wood (U)	X	X	X	X	X	X	X	X	
Foliar biogeochemistry (C)	X	X	X	X	X	X	X	X	
Leaf area index (ND)	X	X	X	X	X	X	X	X	
Herbaceous biomass (U)		X		X		X	X		
Plant phenology (ND)		X				X	X		
Ground beetles (S)	X	X	X	X	X	X	X	X	
Mosquitoes (ND)	X	X	X	X		X	X	X	
Breeding land birds (ND)					X		X	X	

NOTES:
“X” denotes that the infrastructure or terrestrial sampling activities would occur in critical habitat for the listed species at Pu‘u Maka‘ala NAR.
[1] Type of impact associated with each sampling activity: S = Soil disturbance; U = Understory vegetation disturbance; C = Canopy vegetation disturbance; ND = Non-destructive to soil and vegetation, but technicians present in each plot during sampling.
[2] The plot and grid locations may be adjusted within the limits of the proposed project area before construction (based on additional stakeholder input) and/or relocated over time in response to unanticipated impacts or changed conditions within the NAR, such that the total number of plots and grids within each unit of critical habitat may be modified. However, the type of activities and potential impacts in each unit of critical habitat are expected to be commensurate with the analysis contained herein.

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3.1 Mauna Loa (*Ka‘u*) Silversword (*Argyroxiphium kauense*)

3.1.1 Description

The *Ka‘u* silversword is a giant rosette plant endemic to Mauna Loa on the island of Hawai‘i. It was federally listed as endangered in 1993.

Historically, *Ka‘u* silversword historically occurred at elevations from 5,200 to 8,000 feet (1,585 to 2,500 meters), in a band from the southwest rift to the northeast slope of Mauna Loa and on Hualālai on Hawai‘i Island (USFWS, 1995). There are three known populations of this species in the wild, occurring in Hawai‘i Volcanoes National Park (Kahuku Unit), Waiakea, and Kapapala. As of 2015, approximately 626 individuals were known to occur in the wild. Approximately 35,000 individuals have been outplanted, including those within Pu‘u Maka‘ala NAR (USFWS, 2015a; DOFAW, 2013). The *Ka‘u* silversword occurs in moist open forest, subalpine mesic shrubland, bogs, and weathered, old *pahoehoe* or *a‘a* lava with well-developed pockets of soil in subalpine mountain vegetation between 3,330 and 9,100 feet (1,635 and 2,774 meters). Associated native plant species include *pilo* (*Coprosma montana*), *laukahi kuahiwi* (*Plantago hawaiensis*), *Silene hawaiiensis*, *Asplenium fragile* var. *insulare*, *‘ōhi‘a*, *pukiawe* (*Styphelia tameiameiae*), *nēnē* (*Coprosma ernodeoides*), *‘ōhelo ai* (*Vaccinium reticulatum*), *naenae* (*Dubautia ciliolata*), *nohoanu* (*Geranium cuneatum*), *Carex montis-eeka*, *Carex alligata*, *kuolohia* (*Rhynchospora chinensis*), *aalii* (*Dodonaea viscosa*), *Gahnia gahniiformis*, or hair grass (*Deschampsia nubigena*) (USFWS, 2002).

The primary threat to this species is from trampling, rooting, and browsing by feral and domesticated ungulates. This threat has been partially addressed through fencing of wild and outplanted populations. Small population size and possible inbreeding, drought, human disturbance, insects which prey on seeds, and invasive species are lesser threats. Recently, an increasing threat is destruction or degradation of habitat as a result of climate change (USFWS, 2015a).

Critical habitat was designated in 2003. It includes four units (approximately 35,657 acres) on Hawai‘i Island. The northwest portion of Pu‘u Maka‘ala NAR is within critical habitat. The physical or biological features that support *Ka‘u* silversword were defined on the basis of the habitat features of the areas in which the species was reported from at the time critical habitat was designated, as described by the type of plant community, associated native plant species, locale information (e.g., steep rocky cliffs, talus slopes, or stream banks), and elevation. As such, the descriptions of the physical elements of the locations of the species, including habitat type, plant communities associated with the species, location, and elevation described above constitute the physical and biological features for this species (USFWS, 2002).

3.1.2 Effects Analysis

3.1.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of the *Ka‘u* silversword within the footprint of the proposed

infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Ka'u* silversword, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Ka'u* silversword. The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including *Ka'u* silversword. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Ka'u* silversword is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Ka'u* silversword as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the proposed project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Ka'u* silversword. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Ka'u* silversword.

3.1.2.2 Effects to Critical Habitat

No infrastructure would be constructed within designated critical habitat for the *Ka'u* silversword. As listed in Table 5, sampling within critical habitat for this species would be limited to mosquito points and distributed plots. Mosquito point sampling would not modify the physical or biological features that contribute to critical habitat for the *Ka'u* silversword, as there would be no consumptive sampling of vegetation or disturbance of soils. Distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, coarse downed wood, foliar biogeochemistry, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb

to the canopy and collect the samples. The harvest of leaves from canopy dominants would not alter the physical and biological elements that support the *Ka'u* silversword, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support the *Ka'u* silversword. Therefore, the proposed NEON site is ***not likely to result in destruction or adverse modification of critical habitat*** for the *Ka'u* silversword***.***

3.2 *ʻŌhā wai* (*Clermontia lindseyana*)

3.2.1 Description

Clermontia lindseyana is a small, branched tree that grows to approximately 20 feet (6 meters) tall. It was federally listed as endangered in 1994.

Historically, *Clermontia lindseyana* was known from the southern slopes of Haleakalā and eastern portions of Maui, as well as the eastern slope of Mauna Kea and the eastern, southeastern, and southwestern slopes of Mauna Loa on Hawai'i Island (USFWS, 1996). There is believed to be one population remaining on Maui and four populations remaining on Hawai'i Island, which include individuals within or near Pu'u Maka'ala NAR (USFWS, 2010a; DOFAW, 2010). Outplantings include those in the Kūlani portion of Pu'u Maka'ala NAR (DOFAW, 2013a). The extant populations of *Clermontia lindseyana* grow in slightly open forest cover in wet and mesic *ʻōhiʻa* (*Metrosideros polymorpha*) and *koa* (*Acacia koa*) forest, *ʻōhiʻa* forest, and mixed montane mesic *ʻōhiʻa-koa* forest at elevations between 4,310 and 7,400 feet (1,314 and 2,256 meters). Associated species include *pukiawe*, '*ōlapa* (*Cheirodendron trigynum*), *Rubus hawaiiensis*, *pilo*, *Athyrium* sp., or *ʼala'ala wai nui* (*Peperomima* sp.) (USFWS, 2002).

The primary threat to this species is trampling, rooting, and grazing by feral and domesticated ungulates, which destroys individuals plants and provides disturbed areas for invasive by nonnative plant species. Other threats include invasion by nonnative plant species (USFWS, 1996).

Critical habitat designated for *Clermontia lindseyana* includes areas on Hawai'i Island and Maui, designated in 2003 and 2016 (respectively). On Hawai'i Island, there are three units of critical habitat (totaling approximately 10,459 acres), including areas within Pu'u Maka'ala NAR (50 CFR Part 17). The physical or biological features were defined on the basis of the habitat features of the areas in which the species was reported from at the time critical habitat was designated, as described above (USFWS, 2002).

3.2.2 Effects Analysis

3.2.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort,

there are no known occurrences of *Clermontia lindseyana* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. *Clermontia lindseyana* is known from near where infrastructure would be installed, but outside the limits of construction. To further protect *Clermontia lindseyana*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Clermontia lindseyana*. The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including any seedlings of *Clermontia lindseyana*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Clermontia lindseyana* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect *Clermontia lindseyana*, as this species is not a canopy component, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the proposed project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of *Clermontia lindseyana*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Clermontia lindseyana*.

3.2.2.2 Effects to Critical Habitat

The proposed infrastructure would be constructed within critical habitat for *Clermontia lindseyana*, as listed in Table 5. As noted above, the proposed infrastructure locations were micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed. As such, these areas lack the physical and biological features to support *Clermontia lindseyana* at this time. Although the proposed infrastructure is not expected to reduce the ability of the critical habitat to support populations of *Clermontia lindseyana*, it would displace approximately

0.2 acre of habitat for the lifetime of the proposed project, which is ***likely to result in destruction or adverse modification of critical habitat***.

As shown in Table 5, sampling within critical habitat for *Clermontia lindseyana* would include the phenology transect, tower plots, mosquito points, and distributed plots. The phenology transect and mosquito point sampling would not modify the physical or biological features that contribute to critical habitat for *Clermontia lindseyana*, as there would be no consumptive sampling of vegetation or disturbance of soils. The tower plot and distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, litterfall and fine woody debris, fine root biomass, coarse downed wood, foliar biogeochemistry, herbaceous biomass, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves form canopy dominants would not alter the physical and biological elements that support *Clermontia lindseyana*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The tower plots and distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, litterfall traps, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support *Clermontia lindseyana*. Therefore, the proposed sampling is ***not likely to result in destruction or adverse modification of critical habitat*** for *Clermontia lindseyana.*

3.3 *ʻŌhā wai* (*Clermontia peleana*)

3.3.1 Description

Clermontia peleana is an epiphytic shrub or tree that grows to approximately 20 feet (6 meters) tall. It was federally listed as endangered in 1994.

There are two subspecies of *Clermontia peleana*, one known from Maui and the other from Hawaiʻi Island. The subspecies known from Hawaiʻi Island historically occurred on the northeastern and southeastern slopes of Mauna Kea and from the eastern slopes of Mauna Loa (USFWS, 1996). As of 2015, only 5 individuals were known in the wild and there were approximately 5 outplanted populations, including approximately 34 individuals in the Kūlani portion of Puʻu Makaʻala NAR (USFWS, 2015b). The species occurs in rain forests dominated by *koa*, *ʻōhiʻa*, *hāpuʻu* (*Cibotium* sp.) *and* ʻ*ōlapa*.

The primary threat to this species is trampling, rooting, and grazing by feral and domesticated ungulates. Other threats include the small population size, and herbivory by slugs and rats. Recently, an increasing threat is destruction or degradation of habitat as a result of climate change (USFWS, 2015b).

Critical habitat was designated for this species in 2003. It includes three units (approximately 38,664 acres) on Hawaiʻi Island (50 CFR Part 17). No critical habitat occurs within Puʻu Makaʻala NAR.

3.3.2 Effects Analysis

3.3.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Clermontia peleana* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Clermontia peleana*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Clermontia peleana*. The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would not affect *Clermontia peleana*, as this species would not occur on the ground. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Clermontia peleana* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species would be sited to avoid any trees with *Clermontia peleana* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction. Because *Clermontia peleana* is an epiphyte, neither the soil sampling nor the beetle traps would result in removal of or damage to individuals of *Clermontia peleana*.

As discussed in Section 2.4.2, SOPs would be incorporated into project implementation and would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Clermontia peleana*.

3.3.2.2 Effects to Critical Habitat

Because there is no designated critical habitat for *Clermontia peleana* within Pu'u Maka'ala NAR, there would be no potential for destruction or adverse modification of critical habitat for this species. As such, there would be ***no effect*** on critical habitat for *Clermontia peleana*.

3.4 *Hāhā* (*Cyanea copelandii* ssp. *copelandii*)

3.4.1 Description

Cyanea copelandii ssp. copelandii is a small, epiphytic shrub that grows to approximately 6 feet (2 meters) tall. It was federally listed as endangered in 1994.

This species historically occurred at two locations on the southeastern slope of Mauna Loa in montane wet forest dominated by *hāpu'u*. As of 2010, there are no extant individuals or population occurrences (with no observations since the 1950s). Although there is a possibility that it could occur in suitable habitat that has not been surveyed (USFWS, 2012a), this species is believed to be extinct.

Primary threats to this species are feral ungulates, as well as by rats which consume the fruits and seeds (thereby reducing reproduction and establishment). If still extant, the species is also threatened by the small population size (USFWS, 1996).

Critical habitat has not been designated for this species.

3.4.2 Effects Analysis

3.4.2.1 Effects to Species

As described in Section 3.4.1, this species is believed to be extinct. However, in the event that it is present, direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyanea copelandii ssp. copelandii* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyanea copelandii ssp. copelandii*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyanea copelandii ssp. copelandii.* The clip

harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would not affect *Cyanea copelandii ssp. copelandii*, as this species would not occur on the ground. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyanea copelandii ssp. copelandii* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be sited to avoid any trees with *Cyanea copelandii ssp. copelandii* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction. Because *Cyanea copelandii ssp. copelandii* is an epiphyte, neither the soil sampling nor the beetle traps would result in removal of or damage to individuals of *Cyanea copelandii ssp. copelandii*.

As discussed in Section 2.4.2, SOPs would be incorporated into project implementation and would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Cyanea copelandii ssp. copelandii*.

3.4.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be ***no effect*** on critical habitat.

3.5 *ʻAkūʻakū* (*Cyanea platyphylla*)

3.5.1 Description

Cyanea platyphylla is an unbranched palm-like shrub that grows to approximately 10 feet (3 meters) tall. It was federally listed as endangered in 1996.

Cyanea platyphylla typically occurs in lowland and montane wet forests dominated by ʻōhiʻa and *koa*, at elevations between 390 and 3,000 feet (120 and 915 meters). It is often associated with *hāpuʻu*, *hoʻiʻo* (*Athyrium sandwichianum*), *hame* (*Antidesma* sp.), *oha wai* (*Clermontia* spp.), *pilo*, and *haʻiwale* (*Cyrtandra* spp.). Historically, *Cyanea platyphylla* occurred in the Kohala Mountains, Laupāhoehoe in the Hamakua District, the mountains above Hilo, Pahoa, Glenwood, Honaunau in South Kona, and an unidentified location referred to as "Kalanilehua" (USFWS, 1998a). When the species was listed in 1996, there were 3 known populations (one of which was outplanted), with approximately 57 to 107 individuals. As of 2012, there are an estimated 12 individuals in the wild and 15 outplanted individuals (USFWS, 2012b).

Known threats to the species include habitat modification by feral ungulates, competition by introduced plant species, herbivory by rats, and volcanic activity (USFWS, 1998a).

Critical habitat was designated for *Cyanea platyphylla* in 2003. It includes two units totaling 7,234 acres on Hawaiʻi Island. No critical habitat for this species occurs within Puʻu Makaʻala NAR.

3.5.2 Effects Analysis

3.5.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyanea platyphylla* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyanea platyphylla*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyanea platyphylla.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including *Cyanea platyphylla*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyanea platyphylla* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Cyanea platyphylla*,as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Cyanea platyphylla*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Cyanea platyphylla*.

3.5.2.2 Effects to Critical Habitat

Because there is no designated critical habitat for *Cyanea platyphylla* within Pu‘u Maka‘ala NAR, there would be no potential for destruction or adverse modification of critical habitat for this species. As such, there would be ***no effect*** on critical habitat for *Cyanea platyphylla*.

3.6 *Hāhā* (*Cyanea shipmanii*)

3.6.1 Description

Cyanea shipmanii is a small, unbranched (or sparsely branched) shrub that grows to approximately 13 feet (4 meters) tall. It was federally listed as endangered in 1994.

This species historically occurred only the eastern slopes of Mauna Kea on Hawai‘i Island, with only about 50 individuals occurring as of the 1840s. As of 2014, there are approximately 8 individuals known in the wild and approximately 763 outplanted individuals, including those in the Kūlani portion of Pu‘u Maka‘ala NAR. *Cyanea shipmanii* occurs in montane mesic forest dominated by *koa* and *‘ōhi‘a* on the windward slopes of the island, at elevations between 5,310 and 6,650 feet (1,619 and 2,027 meters). Associated native plants include *kāwa‘u* (*Ilex anomala*), *kōlea* (*Myrsine lessertiana*), or *‘ōlapa* (USFWS, 2002).

Primary threats to this species are feral ungulates, as well as invasive introduced plants and herbivory by rates and slugs. Recently, an increasing threat is destruction or degradation of habitat as a result of climate change (USFWS, 2015c).

Critical habitat for *Cyanea shipmanii* was designated in 2003. It includes three units (approximately 6,088 acres), including the northwestern portion of Pu‘u Maka‘ala NAR (50 CFR Part 17). The physical or biological features were defined on the basis of the habitat features of the areas in which the species was reported from at the time critical habitat was designated, as described above (USFWS, 2002).

3.6.2 Effects Analysis

3.6.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyanea shipmanii* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyanea shipmanii*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.

- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyanea shipmanii.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including any seedlings of *Cyanea shipmanii*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyanea shipmanii* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Cyanea shipmanii* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Cyanea shipmanii*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Cyanea shipmanii*.

3.6.2.2 Effects to Critical Habitat

No infrastructure would be constructed within designated critical habitat for *Cyanea shipmanii*. As listed in Table 5, sampling within critical habitat for this species would be limited to mosquito points and distributed plots. Mosquito plot sampling would not modify the physical or biological features that contribute to critical habitat for *Cyanea shipmanii*, as there would be no consumptive sampling of vegetation or disturbance of soils. Distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, coarse downed wood, foliar biogeochemistry, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves from canopy dominants would not alter the physical and biological elements that support *Cyanea shipmanii*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to

support *Cyanea shipmanii*. Therefore, the proposed NEON site is ***not likely to result in destruction or adverse modification of critical habitat*** for *Cyanea shipmanii.*

3.7 *Hāhā* (*Cyanea stictophylla*)

3.7.1 Description

Cyanea stictophylla is a short-lived perennial species that grows epiphytically or in moss. It was federally listed as endangered in 1994.

This species historically occurred on the western, southern, southeastern and eastern slopes of Mauna Loa on Hawai'i Island. At the time it was listed, *Cyanea stictophylla* was known from three populations comprising approximately 15 individuals. As of 2012, there were an estimated 16 wild individuals and 449 outplanted individuals, including those in the Kūlani portion of Pu'u Maka'ala NAR. *Cyanea stictophylla* occurs in lowland to montane, mesic to wet forest dominated by *ōhi'a* and *koa*, at elevations between 3,500 and 6,400 feet (1,070 and 1,950 meters). Associated species include *ālani* (*Melicope* spp.) and *opuhe (Urera glabra*) (USFWS, 1996).

Threats to this species include predation and herbivory by feral ungulates and rodents, as well as degradation of habitat and competition by invasive species. Climate change also poses an increasing threat (USFWS, 2012c).

Critical habitat for *Cyanea stictophylla* was designated in 2003. It includes four units (approximately 95,484 acres), including the northwestern portion of Pu'u Maka'ala NAR (50 CFR Part 17).

3.7.2 Effects Analysis

3.7.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyanea stictophylla* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyanea stictophylla*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyanea stictophylla.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Cyanea stictophylla*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyanea stictophylla* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Cyanea stictophylla* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Cyanea stictophylla*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Cyanea stictophylla*.

3.7.2.2 Effects to Critical Habitat

The only infrastructure that would be constructed within critical habitat for *Cyanea stictophylla* is a portion of the soil array and associated walkway. Each of the 3 soil plots within the critical habitat would be 5 meters square. However, the soil array sensors would be installed using minimally intrusive methods, as the goal is to maintain undisturbed native soil for research purposes. Given the minimal extent of disturbance, installation of the soil array would not be expected to alter the long-term ability of the area to support *Cyanea stictophylla*.

As shown in Table 5, sampling within critical habitat for *Cyanea stictophylla* would include tower plots, mosquito points, and distributed plots. Mosquito point sampling would not modify the physical or biological features that contribute to critical habitat for *Cyanea stictophylla*, as there would be no consumptive sampling of vegetation or disturbance of soils. The tower plot and distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, litterfall and fine woody debris, fine root biomass, coarse downed wood, foliar biogeochemistry, herbaceous biomass, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves form canopy dominants would not alter the physical and biological elements that support *Cyanea stictophylla*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The tower plots and distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, litterfall traps, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support *Cyanea stictophylla*.

Therefore, the proposed NEON site is ***not likely to result in destruction or adverse modification of critical habitat*** for *Cyanea stictophylla.*

3.8 *Akū* (*Cyanea tritomantha*)

3.8.1 Description

Cyanea tritomantha is a palm-like shrub known only from Hawai'i Island. It was federally listed as endangered in 2013.

Historically, this species was known from lowland wet, montane wet and wet cliff ecosystems on the windward slopes of Mauna Kea, Mauna Loa, Kīlauea, and the Kohala Mountains (Pratt and Abbott, 1997).

In 2013, at the time of listing, there were 16 known occurrences with less than 400 individuals of *Cyanea tritomantha*. Most of these are in the Kohala Mountains. One occurrence, with approximately 50 individuals, is in Pu'u Maka'ala NAR (USFWS, 2013); there are also occurrences in Upper Waiakea Forest Reserve and the Ola'a Tract of Hawai'i Volcanoes National Park. The species has also been outplanted in select locations, including Pu'u Maka'ala NAR (USFWS, 2013). In Pu'u Maka'ala NAR, *Cyanea tritomantha* occurs in *'ōhi'a-hāpu'u* forest (Kumu Pono Associates, 2004).

Known threats to *Cyanea tritomantha* include habitat destruction by feral and domesticated ungulates, herbivory by slugs and rats, invasion of nonnative species (particularly strawberry guava [*Psidium cattleianum*]), and habitat modification as a result of heavy rains and landslides. Other threats include low rates of viability and regeneration. Climate change may also pose a threat (USFWS, 2013).

No critical habitat has been designated for this species.

3.8.2 Effects Analysis

3.8.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyanea tritomantha* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyanea tritomantha*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyanea tritomantha.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Cyanea tritomantha*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyanea tritomantha* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Cyanea tritomantha* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Cyanea tritomantha*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Cyanea tritomantha*.

3.8.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be **no effect** on critical habitat.

3.9 *Ha'iwale* (*Cyrtandra giffardii*)

3.9.1 Description

Cyrtandra giffardii is a small, shrubby tree that grows to approximately 20 feet (6 meters) tall. It was federally listed as endangered in 1994.

Cyrtandra giffardii occurs in shady, wet montane forest dominated by *hāpu'u* at elevations between 2,400 and 4,900 feet (720 and 1,500 meters). It is historically known from the northeastern slope of Mauna Kea south to the eastern slope of Mauna Loa. In 1994, at the time of listing, there were fewer than 100 individuals known in the wild, including occurrences in Pu'u Maka'ala NAR (USFWS, 1994). As of 2012, there are two known populations with approximately 112 individuals in the wild (Laupāhoehoe NAR and Hawai'i Volcanoes National Park), and approximately 77 outplanted individuals (USFWS, 2012d).

The primary threat contributing to the species' decline is habitat destruction from rooting and trampling by feral pigs and resulting invasions by nonnative plant species. The limited population size also limits the species' reproductive potential and increases vulnerability to extinction (USFWS, 1994 and 2012d).

Critical habitat designated for *Cyrtandra giffardii* in 2003. It includes three units totally 15,617 acres on Hawai‘i Island. The southern portion of Pu‘u Maka‘ala NAR is included in this critical habitat.

3.9.2 Effects Analysis

3.9.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyrtandra giffardii* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyrtandra giffardii*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyrtandra giffardii.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Cyrtandra giffardii*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyrtandra giffardii* is necessary to achieve the project’s scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Cyrtandra giffardii* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Cyrtandra giffardii*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Cyrtandra giffardii*.

3.9.2.2 Effects to Critical Habitat

No infrastructure would be constructed within designated critical habitat for *Cyrtandra giffardii*. As listed in Table 5, sampling within critical habitat for this spcies would be limited to bird grids and distributed plots. Bird grids would not modify the physical or biological features that contribute to critical habitat for *Cyrtandra giffardii*, as there would be no consumptive sampling of vegetation or disturbance of soils. Distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, coarse downed wood, foliar biogeochemistry, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves from canopy dominants would not alter the physical and biological elements that support *Cyrtandra giffardii*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support *Cyrtandra giffardii*. Therefore, the proposed NEON site is ***not likely to result in destruction or adverse modification of critical habitat*** for *Cyrtandra giffardii.*

3.10 *Haʻiwale* (*Cyrtandra tintinnabula*)

3.10.1 Description

Cyrtandra tintinnabula is a small, shrubby tree that grows to approximately 6.6 feet (2 meters) tall. It was federally listed as endangered in 1994.

This species grows in dense lowland wet forests dominated by *koa*, *ʻōhiʻa, hāpuʻu*, or a combination thereof, at elevations between 1,280 and 4,690 feet (390 and 1,443 meters). It historically was known only from three locations on the northeastern slopes of Mauna Kea (USFWS, 1996). In 1994, at the time of listing, a total of 18 individuals were known to occur in the wild, all located in the Laupāhoehoe area. As of 2012, more than 150 individuals are known to occur in the wild at Laupāhoehoe and Hakalau National Wildlife Refuge (USFWS, 2012e).

The primary threat contributing to the decline of this species is rooting and browsing by feral pigs, which damages individual plants and also causes habitat degradation and invasion of nonnative species. The small population size and limited distribution also limits reproductive potential and restricts the gene pool (USFWS, 1996).

Critical habitat was designated for *Cyrtandra tintinnabula* in 2003. It includes two units totaling 6,672 acres on Hawaiʻi Island. No critical habitat occurs within Puʻu Makaʻala NAR.

3.10.2Effects Analysis

3.10.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Cyrtandra tintinnabula* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Cyrtandra tintinnabula*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Cyrtandra tintinnabula.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically site to avoid protected species, including seedlings of *Cyrtandra tintinnabula*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Cyrtandra tintinnabula* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Cyrtandra tintinnabula* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Cyrtandra tintinnabula*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Cyrtandra tintinnabula*.

3.10.2.2 Effects to Critical Habitat

Because there is no designated critical habitat for *Cyrtandra tintinnabula* within Pu‘u Maka‘ala NAR, there would be no potential for destruction or adverse modification of critical habitat for this species. As such, there would be ***no effect*** on critical habitat for *Cyrtandra tintinnabula*.

3.11 *Nānū* (*Gardenia remyi*)

3.11.1Description

Gardenia remyi is a tree that grows to approximately 43 feet (13 meters) tall. This species was listed as endangered in 2016.

This species typically occurs in mesic forest and occasionally in wet forest at elevations between 197 and 2,493 feet (60 to 760 meters). Historically, it occurred on Kaua‘i, Maui, Moloka‘i, and Hawai‘i Island. Occurrences on Hawai‘i Island include Wao Kele O Puna NAR, Waiākea Forest Reserve, Pahoa, and Hakalau Nui. As of 2014, there are 19 populations with a total of 85 to 87 individuals known from Kaua‘i, Maui, Moloka‘i and Hawai‘i Island. Known occurrences on Hawai‘i Island include 1 individual in Waiākea Forest Reserve, 3 individuals in Wao Kele O Puna, 6 to 12 individuals in Pu’u O Umi NAR, and 1 individual in Kohala NAR (USFWS, 2014a).

Threats to this species include feral ungulates, which browse on *Gardenia remyi*, destroy suitable habitat and increase opportunities for invasion and competition by nonnative plant species. Climate change may also pose a threat to this species (USFWS, 2014a).

Critical habitat has not been designated for this species.

3.11.2Effects Analysis

3.11.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Gardenia remyi* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Gardenia remyi*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Gardenia remyi.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Gardenia remyi*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Gardenia remyi* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvestof sunlit canopy dominant species, would not affect the *Gardenia remyi* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Gardenia remyi*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Gardenia remyi*.

3.11.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be ***no effect*** on critical habitat.

3.12 *ʻOhe* (*Joinvillea ascendens* ssp. *ascendens*)

3.12.1Description

Joinvillea ascendens ssp. *ascendens* is an erect herb that grows to approximately 16 feet (5 meters) tall. It was listed as endangered in 2016.

This species occurs in wet to mesic lowland and montane forest dominated by *ʻōhiʻa* and *koa*, and along intermittent streams at elevations between 1,000 and 4,360 feet (305 and 1,299 meters). Historically, *Joinvillea ascendens* ssp. *ascendens* occurred on Kauaʻi, Oʻahu, Maui, Molokaʻi and Hawaiʻi Island. Known occurrences on Hawaiʻi Island were on the northeastern side of the island from the Kohala Mountains to Volcanoes National Park. As of 2014, the species is known to occur across all five islands, with generally the same range on Hawaiʻi Island. There are 45 known populations with a total of 200 individuals. There are 8 known populations (with 13 individuals) on Hawaiʻi Island (USFWS, 2014b).

This species is primarily threatened by feral ungulates that degrade suitable habitat and increase opportunities for invasion and competition by nonnative plant species (USFWS, 2014b).

Critical habitat has not been designated for this species.

3.12.2Effects Analysis

3.12.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Joinvillea ascendens* ssp. *ascendens* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Joinvillea ascendens* ssp. *ascendens*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Joinvillea ascendens* ssp. *ascendens.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including *Joinvillea ascendens* ssp. *ascendens*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Joinvillea ascendens* ssp. *ascendens* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Joinvillea ascendens* ssp. *ascendens* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Joinvillea ascendens* ssp. *ascendens*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Joinvillea ascendens* ssp. *ascendens*.

3.12.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be ***no effect*** on critical habitat.

3.13 *Phyllostegia floribunda*

3.13.1 Description

Phyllostegia floribunda is a perennial herb that is only found on Hawai‘i Island. It was federally listed as endangered in 2013.

Phyllostegia floribunda occurs in lowland wet, montane mesic, and montane wet ecosystems. It was historically found in the Kohala Mountains, Hamakua, Laupāhoehoe NAR, Waiakea and Upper Waiakea Forest Reserves, Hawai‘i Volcanoes National Park, and Puna. As of 2013, there were 12 known occurrences of this species, with fewer than 100 individuals. There is one occurrence with a few individuals in the wild, plus additional outplanted individuals in Pu‘u Maka‘ala NAR (USFWS, 2013)

Primary threats to this species are feral ungulates, as well as invasive introduced plants and herbivory by rates and slugs. Climate change may also be a potential threat (USFWS, 2013).

Critical habitat has not been designated for this species.

3.13.2 Effects Analysis

3.13.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Phyllostegia floribunda* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Phyllostegia floribunda*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to

be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Phyllostegia floribunda.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including *Phyllostegia floribunda*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Phyllostegia floribunda* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would not affect the *Phyllostegia floribunda* as it is not a canopy species, nor would it alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of the *Phyllostegia floribunda*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the *Phyllostegia floribunda*.

3.13.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be ***no effect*** on critical habitat.

3.14 *Kīponapona* (*Phyllostegia racemosa*)

3.14.1Description

Phyllostegia racemosa is a climbing vine that is only found on Hawai‘i Island. It was federally listed as endangered in 1996.

Phyllostegia racemosa typically occurs in disturbed montane mesic or wet forests dominated by *koa*, *‘ōhi‘a* and *hāpu’u*, at elevations between 2,300 and 6,350 feet (700 and 1,935 meters). Associated species include ‘*ōhelo* (*Vaccinium calycinum*), *akala* (*Rubus hawaiiensis*), and *Dryopteris wallichiana*. Historically, this species occurred in the Hakalau and Saddle Road areas of Mauna Kea and the Kūlani/Keauhou and Kipuka Ahiu areas of Mauna Loa. Reports suggest that this species has always been relatively rare (USFWS, 2012f). In 1996, at the time of listing, four populations were known from the Kūlani/Keauhou area, Hakalau Forest National Wildlife Refuge, and Hawai‘i Volcanoes National Park. As of 2007, no extant occurrences were known and the species is believed to be extinct in the wild. However, there are multiple outplanting sites for this species, including those in Pu‘u Maka‘ala NAR (USFWS, 2012f).

Primary threats that contributed to decline of this species are feral ungulates, which cause habitat disturbance and provide opportunities for invasion and establishment of nonnative plant species. The limited population size also limits the species' reproductive potential and increases vulnerability to extinction (USFWS, 1998a).

Critical habitat was designated for *Phyllostegia racemosa* in 2003. It includes three units totaling 7,134 acres on Hawai‘i Island. The northwestern portion of Pu‘u Maka‘ala NAR is included in this critical habitat.

3.14.2Effects Analysis

3.14.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The proposed project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Phyllostegia racemosa* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. *Phyllostegia racemosa* is known from near where infrastructure would be installed, but outside the limits of construction. To further protect *Phyllostegia racemosa*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Phyllostegia racemosa.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Phyllostegia racemosa*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Phyllostegia racemosa* is necessary to achieve the project’s scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be selected to avoid any trees with *Phyllostegia racemosa* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the proposed project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of *Phyllostegia racemosa*. Other SOPs that would be incorporated into project implementation would

include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Phyllostegia racemosa*.

3.14.2.2 Effects to Critical Habitat

The proposed infrastructure (excluding the precipitation gauge) would be constructed within critical habitat for *Phyllostegia racemosa*. As noted above, the proposed infrastructure locations were micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed. As such, these areas lack the physical and biological features to support *Phyllostegia racemosa* at this time. Although the proposed infrastructure is not expected to reduce the ability of the critical habitat to support populations of *Phyllostegia racemosa*, it would displace approximately 0.2 acre of habitat for the lifetime of the proposed project, which is ***likely to result in destruction or adverse modification of critical habitat***.

As shown in Table 5, sampling within critical habitat for *Phyllostegia racemosa* would include the the phenology transect, tower plots, mosquito plots, and distributed plots. The phenology transect and mosquito point sampling would not modify the physical or biological features that contribute to critical habitat for *Phyllostegia racemosa*, as there would be no consumptive sampling of vegetation or disturbance of soils. Tower plot and distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, litterfall and fine woody debris, fine root biomass, coarse downed wood, foliar biogeochemistry, herbaceous biomass, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves form canopy dominants would not alter the physical and biological elements that support *Phyllostegia racemosa*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The tower plots and distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, litterfall traps, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support *Phyllostegia racemosa*. Therefore, the proposed sampling is ***not likely to result in destruction or adverse modification of critical habitat*** for *Phyllostegia racemosa.*

3.15 *Phyllostegia velutina*

3.15.1Description

Phyllostegia velutina is a climbing vine that only occurs on Hawai‘i Island. It was federally listed as endangered in 1996.

Phyllostegia velutina occurs in montane mesic and dry forests to montane wet forests. In *‘ōhi‘a* and *koa* dominated montane mesic and montane wet forests, it typically occurs with species including *‘ōlapa*, *laukahi* (*Plantago major*), *kōlea*, *pilo*, *‘ōhelo* (*Vaccinium* spp.), *māmaki* (*Pipturus albidus*), *kāwa‘u*, and *hāpu‘u* (*Cibotium* spp.). Historically, this species was known to occur on the southern slopes of Hualālai and the eastern, western and southern slopes of Mauna Loa. In 1996, at the time of listing, 30 to 55 individuals were known from three populations (Pu’u Wa’awa’a, Honua’ula Forest Reserve, and

Kūlani/Kauhou). As of 2012, these three populations were extant, with a total 116 individuals. This species has also been outplanted in multiple locations including Pu‘u Maka‘ala NAR (USFWS, 2012g; DOFAW, 2013).

Primary threats that contributed to decline of this species are feral ungulates, which cause habitat degradation and provide opportunities for invasion and establishment of nonnative plant species. The species is also vulnerable to loss of habitat associated with human disturbance and volcanic activity (USFWS, 2012g).

Critical habitat was designated for *Phyllostegia velutina* in 2003. It includes three units totaling 9,009 acres on Hawai‘i Island. The northwestern portion of Pu‘u Maka‘ala NAR is included in this critical habitat.

3.15.2Effects Analysis

3.15.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The proposed project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Phyllostegia velutina* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. *Phyllostegia velutina* is known from near where infrastructure would be installed, but outside the limits of construction. To further protect *Phyllostegia velutina*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Phyllostegia velutina.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Phyllostegia velutina*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Phyllostegia velutina* is necessary to achieve the project’s scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be selected to avoid any trees with *Phyllostegia velutina* growing into the

canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the proposed project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of *Phyllostegia velutina*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Phyllostegia velutina*.

3.15.2.2 Effects to Critical Habitat

The proposed infrastructure (excluding the precipitation gauge) would be constructed within critical habitat for *Phyllostegia velutina*. As noted above, the proposed infrastructure locations were micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed. As such, these areas lack the physical and biological features to support *Phyllostegia velutina* at this time. Although the proposed infrastructure is not expected to reduce the ability of the critical habitat to support populations of *Phyllostegia velutina*, it would displace approximately 0.2 acre of habitat for the lifetime of the proposed project, which is ***likely to result in destruction or adverse modification of critical habitat***.

As shown in Table 5, sampling within critical habitat for *Phyllostegia velutina* would include the phenology transect, mosquito points, bird grids, tower plots and distributed plots. The phenology transect, bird grid and mosquito point sampling would not modify the physical or biological features that contribute to critical habitat for *Phyllostegia velutina*, as there would be no consumptive sampling of vegetation or disturbance of soils. Tower plot and distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, litterfall and fine woody debris, fine root biomass, coarse downed wood, foliar biogeochemistry, herbaceous biomass, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves form canopy dominants would not alter the physical and biological elements that support *Phyllostegia velutina*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The tower plots and distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, litterfall traps, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support *Phyllostegia velutina*. Therefore, the proposed sampling is ***not likely to result in destruction or adverse modification of critical habitat*** for *Phyllostegia velutina**.***

3.16 *ʻĀnunu* (*Sicyos alba*)

3.16.1Description

Sicyos alba is an annual vine that only occurs on Hawaiʻi Island. It was federally listed as endangered in 1996.

Sicyos alba typically occurs in montane wet forests dominated by *ʻōhiʻa* and *hāpuʻu*, at elevations between 3,270 and 5,072 feet (966 and 1,546 meters). It is often associated with *hāpuʻu*, *kāwaʻu*, *kanawao* (*Broussaisia arguta*), *haʻiwale*, *kōpiko* (*Psychotria mariniana*), *olomea* (*Perrottetia sandwicensis*), *ʻōlapa*, and *Cyanea tritomantha*. Historically, this species occurred in the Kīlauea area. In 1998, when the recovery plan was published, there were only two known populations, one in Puʻu Makaʻala NAR (one individual) and one in Olaʼa Forest Reserve (20 individuals). As of 2012, the only known occurrences were 5 wild individuals and 16 outplanted individuals.

Primary threats that contributed to decline of this species are feral ungulates, which cause habitat degradation and provide opportunities for invasion and establishment of nonnative plant species. The species is also vulnerable to loss of habitat associated with human disturbance and volcanic activity (USFWS, 2012h).

Critical habitat was designated for *Sicyos alba* in 2003. It includes one unit totaling 15,483 acres on Hawaiʻi Island. The southern portion of Puʻu Makaʻala NAR is included in this critical habitat.

3.16.2Effects Analysis

3.16.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Sicyos alba* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Sicyos alba*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Sicyos alba.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Sicyos alba*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Sicyos alba* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be selected to avoid any trees with *Sicyos alba* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plotes (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of *Sicyos alba*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Sicyos alba*.

3.16.2.2 Effects to Critical Habitat

No infrastructure would be constructed within designated critical habitat for *Sicyos alba*. As listed in Table 5, sampling within critical habitat for this species would be limited to mosquito points, bird grids and distributed plots. Mosquito point and bird grid sampling would not modify the physical or biological features that contribute to critical habitat for *Sicyos alba*, as there would be no consumptive sampling of vegetation or disturbance of soils. Distributed plot sampling would include intrusive activities with potential to alter critical habitat, including sampling related to soil parameters, plant diversity, coarse downed wood, foliar biogeochemistry, and beetle pitfall traps. Harvest of canopy leaves would be conducted using a pruning pole or a remote-controlled unmanned aerial vehicle equipped for collecting leaves. Should either of these methods not be feasible, a licensed arborist would be contracted to climb to the canopy and collect the samples. The harvest of leaves from canopy dominants would not alter the physical and biological elements that support *Sicyos alba*, as the amount of leaves harvested would not alter the sunlight regime of the forest floor or alter the microclimate. The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff. As such, the proposed project is not expected to modify the physical or biological features that contribute to critical habitat or otherwise reduce the ability of the habitat to support *Sicyos alba*. Therefore, the proposed NEON site is ***not likely to result in destruction or adverse modification of critical habitat*** for *Sicyos alba****.***

3.17 Hawaiian Vetch (*Vicia menziesii*)

3.17.1Description

Vicia menziesii is a perennial liana that is only found on Hawai‘i Island. It was federally listed as endangered in 1978, and was the first plant species in Hawai‘i to be listed.

Vicia menziesii occurs in wet to mesic forests dominated by *‘ōhi‘a* and *koa* at elevations between 50 and 5,640 feet (1,570 to 1,720 meters). The species was collected from both Mauna Loa and Mauna Kea in the late 18th century. It was subsequently believed to be extinct, but was rediscovered in 1974 and now is known only from the northeastern slope of Mauna Kea. As of 2010, there were a total of 37 individuals known from 6 populations. This species has been outplanted in Pu‘u Maka‘ala NAR (USFWS, 2012i; DOFAW, 2010).

The primary threat contributing to the decline of this species are feral ungulates, which cause habitat degradation and provide opportunities for invasion and establishment of nonnative plant species. The

small population size and limited distribution also limits reproductive potential and restricts the gene pool (USFWS, 2012i).

No critical habitat has been designated for *Vicia menziesii*.

3.17.2Effects Analysis

3.17.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Vicia menziesii* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Vicia menziesii*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Vicia menziesii.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would be specifically sited to avoid protected species, including seedlings of *Vicia menziesii*. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Vicia menziesii* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be selected to avoid any trees with *Vicia menziesii* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction.

As part of the SOPs for the project, as described in Section 2.4.2, researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to individuals of *Vicia menziesii*. Other SOPs that would be incorporated into project implementation would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Vicia menziesii*.

3.17.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be ***no effect*** on critical habitat.

3.18 *Palai laʻaū* (*Adenophorus periens*)

3.18.1 Description

Palai laʻaū is a short-lived epiphytic fern species. It was federally listed as endangered in 1994.

Palai laʻaū occurs in *ʻōhiʻa-hāpuʻu* lowland wet forests, where it grows epiphytically (most often on *ʻōhiʻa* trees). This species historically occurred on Kauaʻi, Oʻahu, Maui, Lānaʻi, Molokaʻi and Hawaiʻi Island. In 1994, at the time of listing, approximately 1,280 individuals were known to occur in the wild on Kauaʻi, Molokaʻi and Hawaiʻi Island. It is currently only found on Kauaʻi and Hawaiʻi Island, and as of 2015, the number of known occurrences of this species in the wild has decreased to 31 individuals. On Hawaiʻi Island, this species occurs in the Kahalaleʼa NAR on the slopes of Kīlauea (USFWS, 2010b and 2015d).

Although the specific threats that are contributing to the decline of this species are not well understood, they are believed to include feral ungulates, which cause habitat degradation and provide opportunities for invasion and establishment of nonnative plant species, as well as volcanic activity. Climate change may also pose a threat to this species (USFWS, 2010b).

Critical habitat was designated for this species on Maui and Molokaʻi. No critical has been designated on Hawaiʻi Island.

3.18.2 Effects Analysis

3.18.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *palai laʻaū* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *palai laʻaū*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.

- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *palai laʻaū.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would not affect *palai laʻaū*, as this species would not occur on the ground. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *palai laʻaū* is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be sited to avoid any trees with *palai laʻaū* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction. Because *Palai laʻaū* is an epiphyte, neither soil sampling nor the beetle traps would result in removal of or damage to individuals of *palai laʻaū*.

As discussed in Section 2.4.2, SOPs would be incorporated into project implementation and would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations ofp*Palai laʻaū*.

3.18.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for this species, there would be ***no effect*** on critical habitat.

3.19 *Asplenium fragile* var. *insulare*

3.19.1Description

Asplenium fragile var*. insulare* is a short-lived epiphytic fern species. It was federally listed as endangered in 1994.

This species has been reported from montane wet, mesic and dry forest habitats, as well as subalpine dry forest and shrubland habitat. It grows in dark and moist areas, particularly lava tubes, pits, deep cracks, and lava tree molds. It historically occurred in east Maui and on Hawaiʻi Island; locations on Hawaiʻi Island include Mauna Kea, Hualālai, Mauna Loa, and near Hilo. In 1998, at the time the recovery plan was written, there was 1 population of *Asplenium fragile* var*. insulare* known in East Maui and 8 populations known on Hawaiʻi Island, with approximately 278 individuals. As of 2012, there were 14 populations (4 on Maui and 10 on Hawaiʻi Island) containing 603 to 948 individuals. Species occurrences on Hawaiʻi Island are within Hawaiʻi Volcanoes National Park and Pohakuloa Training Area (USFWS, 1998b and 2012j).

The primary threat contributing to the decline of this species are feral ungulates, which browse on individuals plants and also causes habitat degradation and invasion of nonnative species. This species is also vulnerable to human disturbance, particularly military operations at Pohakuloa Training Area (USFWS, 2012j).

Critical habitat was designated for *Asplenium fragile* var*. insulare* in 2003 on Maui and Hawai'i Island, with the two units totaling 3,135 acres. There is no critical habitat within Pu'u Maka'ala NAR

3.19.2 Effects Analysis

3.19.2.1 Effects to Species

Direct impacts to this species could include damage to or destruction of individual plants as a result of project-related activities. Indirect impacts could result from loss or degradation of suitable habitat.

DOFAW and NARS staff actively monitor and inventory the occurrence and location of all protected plant species (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). The proposed project infrastructure was sited in close coordination with DOFAW and NARS staff, including multiple field inspections, specifically intended to avoid protected plant species occurrences. Based on this effort, there are no known occurrences of *Asplenium fragile* var*. insulare* within the footprint of the proposed infrastructure, in areas where vegetation trimming may be required (e.g., along the tower guy wires), or in proximity to construction areas or access routes. To further protect *Asplenium fragile* var*. insulare*, the following measures would be implemented prior to and during construction to avoid and minimize potential impacts:

- Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts.
- Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits.

The proposed infrastructure was micro-sited to be in areas that are within or in proximity to representative native forest habitat, but that have been previously disturbed, such that project-related impacts to these areas are not expected to degrade potential habitat for listed species.

During the operational phase of the proposed project, terrestrial sampling activities would primarily involve passive observation and data collection tasks, as summarized in Table 2. These are expected to be similar in nature to other ongoing monitoring and research activities in the NAR. None of the sampling activities would involve harvest or collection of *Asplenium fragile* var*. insulare.* The clip harvesting of herbaceous plant material (from a 0.2-m^2 area within the tower plots) would not affect *Asplenium fragile* var*. insulare*, as this species would not occur on the ground. As stated in Section 2.4.2, if it is subsequently determined that collection or harvest of *Asplenium fragile* var*. insulare* is necessary to achieve the proposed project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection.

The foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species, would be sited to avoid any trees with *Asplenium fragile* var*. insulare* growing into the canopy and would not alter habitat conditions such that this species would experience reduced growth or reproduction. Because *Asplenium fragile* var*. insulare* is an epiphyte, neither soil sampling nor the beetle traps would result in removal of or damage to individuals of *Asplenium fragile* var*. insulare*.

As discussed in Section 2.4.2, SOPs would be incorporated into project implementation and would include provisions for staff training, site access and route planning, and ongoing impact assessment and adaptive mitigation.

With implementation of these measures, impacts on listed plant species would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of *Asplenium fragile* var*. insulare*.

3.19.2.2 Effects to Critical Habitat

Because there is no designated critical habitat for *Asplenium fragile* var*. insulare* within Puʻu Makaʻala NAR, there would be no potential for destruction or adverse modification of critical habitat for this species. As such, there would be ***no effect*** on critical habitat for *Asplenium fragile* var*. insulare*.

3.20 *Nēnē*, Hawaiian goose (*Branta sandvicensis*)

3.20.1Description

Nēnē is the only endemic goose species (of five) still extant in Hawaiʻi. It was listed as endangered in 1967.

This species is adapted to a terrestrial and largely nonmigratory lifestyle in the Hawaiian Islands, with negligible dependence on freshwater habitat. The *nēnē* is capable of both inter-island and high-altitude flight. *Nēnē* occupy various habitat types ranging from beach strand, shrubland, and grassland to lava rock at elevations ranging from coastal lowlands to alpine areas (Banko et al., 1999). The geese eat plant material, and the composition of their diet depends largely on the vegetative composition of their surrounding habitats.

After nearly becoming extinct in the 1940s and 1950s, the *nēnē* population has been rebuilt through captive-breeding programs. In 2011, the *nēnē* population was estimated to be 2,465-2,555 birds, including 416 on Maui, 83 on Moloka'i, 1,424-1,514 on Kaua'i, and 542 on Hawaiʻi. In 2012, approximately 300 nēnē were relocated from areas near the Lihue Airport on Kaua'i to reduce the risk of bird-aircraft strikes, of which 239 were moved to Hawaiʻi and the remainder were moved to Maui (DOFAW, 2012).

The nēnē has an extended breeding season, with eggs reported from all months except May, June, and July. However, most birds in the wild nest during the rainy (winter) season between October and March (Banko et al., 1999). *Nēnē* nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. During molt, adults are flightless for a period of 4 to 6 weeks. Molt occurs after hatching of eggs, such that the adults generally attain their flight feathers at about the same time as their offspring. When flightless, goslings and adults are vulnerable to predators such as cats and mongoose. From June to September, family groups join others in post-breeding aggregations (flocks), often far from nesting areas.

The main factor limiting the recovery of *nēnē* populations is predation by introduced mammals, most notably cats, rats, and mongoose. Additional threats may include limited access or availability of nutritional resources during breeding and anthropomorphic disturbances, including car strikes, disturbance of nesting and feeding, and fatalities at golf courses. Breeding habitat, particularly at low elevations, may be limited (USFWS, 2004).

No critical habitat has been designated for the *nēnē*.

3.20.2Effects Analysis

3.20.2.1 Effects to Species

Nēnē do not use closed forest habitat, but are known to occur in the open areas in the Kūlani portion of Pu'u Maka'ala NAR. Although they prefer the mowed baseball field at the Kūlani Correctional Facility, *nēnē* have also been observed within and surrounding the former pastureland in the NAR (personal communication, N. Agorastos, NARS Specialist, September 20, 2016). This portion of the project area provides suitable nesting and foraging habitat for *nēnē*.

Direct impacts to *nēnē* could occur if a nest is damaged, goslings are separated from adults, or if an adult permanently leaves an area as a result of project-related activities. Short-term indirect impacts could occur if *nēnē* are temporarily displaced from their habitat as a result of noise or other disturbance associated with construction activities. Displacement could alter an individual's typical foraging and roosting patterns, forcing it to search for new foraging and roosting locations. Displacement from roosting or foraging habitat could also lead to increased predation if a *nēnē* is forced to change its behavior and search for suitable habitat. Permanent removal of suitable nesting habitat would constitute a long-term indirect impact; however, this impact is considered discountable because only approximately 676 ft^2 of suitable habitat would be removed (for the precipitation gauge) and there is ample habitat available in the project vicinity.

During the operational phase of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. The only activities that are expected to occur in areas with suitable habitat for *nēnē* relate to maintenance of the precipitation gauge.

The following measures would be implemented to avoid and minimize potential impacts to *nēnē* during construction and operation of the proposed project:

- A biologist familiar with the nesting behavior of the *nēnē* would survey suitable habitat within the construction area before the initiation of any construction activities, or after any subsequent delay in work of 3 or more days (during which time the birds could attempt nesting). If a nest is discovered, USFWS would be contacted.
- All NEON staff would be trained to identify *nēnē* and know the appropriate steps to take if *nēnē* are present within the project area or encountered in transit to sampling locations.
- If a *nēnē* is encountered within the project area, the bird would not be approached, and all activities within 100 feet of the bird would cease until the bird leaves the area of its own volition.
- If a *nēnē* is encountered while in transit to a sampling location, the researcher(s) would stop and remain in place until the bird moved more than 100 feet from the travel route of its own volition or slowly retreat and return for sampling at a later time.
- A maximum speed limit of 15 miles per hour would be enforced for all project vehicles traveling within the project site to minimize potential collisions with *nēnē*.

With implementation of these measures, impacts on the *nēnē* would be discountable. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the species.

3.20.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for *nēnē*, there would be ***no effect*** on critical habitat.

3.21 *ʻIo*, Hawaiian hawk (*Buteo solitarius*)

3.21.1Description

ʻ*Io*, or the Hawaiian Hawk, is a bird of prey endemic to Hawaiʻi. It was listed as an endangered species in 1967.

This species breeds only on Hawaiʻi Island. Though they have been occasionally seen on Maui, Oʻahu, and Kauaʻi, they were extirpated from these three islands after the arrivals of humans in Hawaii. They depend on native forest for nesting, but use a broad range of habitats for foraging. Native-exotic forest, mature native forest, mature native forest with grass understory, and orchards generally support greater densities of hawks than do shrubland, pioneer native forest, or urban habitats. However, densities in certain habitats also showed considerable difference among regions, with forests in both Hāmākua and Kona supporting greater densities than those found in Puna. This species generally remains in and defends its territory year-round. It nests from March through September. The majority of nests occur in native trees (particularly *ʻōhiʻa*), although nonnative trees may also be used (including eucalyptus [*Eucalyptus* spp.], ironwood [*Casuarina equisetifolia*], mango [*Mangifera indica*], coconut palm [*Cocos nucifera*], and macadamia [*Macadamia integrifolia*]). Nests can be used for several years, with nesting material added each breeding season (Griffin et al., 1998).

Loss of native forest to residential, large-scale agriculture, exotic forestry, and to business and industrial areas have had the greatest negative impact on the Hawaiian hawk. The Hawaiian hawk can be seen soaring over or foraging in these changed areas, but they typically do not nest in them. These areas may also be a source of high mortality, especially for young birds. Shooting, vehicle collision, poisoning, starvation, and predation by introduced mammalian predators are documented sources of mortality (USFWS, 1984; USFWS, 2012k).

No critical habitat has been designated for this species.

3.21.2Effects Analysis

3.21.2.1 Effects to Species

The Hawaiian hawk is known to occur in the Kūlani portion of Puʻu Makaʻala NAR (DOFAW, 2010). The native forest (particularly areas with large, mature *ʻōhiʻa*) provides suitable nesting habitat, and the former pastureland may be used for foraging.

The Hawaiian hawk could be directly impacted by project construction in the event a nest is damaged or destroyed. Operation of construction equipment and other loud or unpredictable construction activities could also indirectly affect this species through nest failure. Harassment of nesting sites could result in altered feeding and breeding patterns or nest or chick abandonment. Nest disturbance could also increase exposure of chicks and juveniles to inclement weather or predators (USFWS, 2016b). As shown in the construction timeline contained in Appendix B, nearly all of the construction activities have been scheduled to occur outside of the Hawaiian hawk nesting season. The only activity that would occur during the nesting season is installation of the sensors on the research tower and in the soil array. This activity would not involve any work that could directly impact a Hawaiian hawk nest (e.g., vegetation trimming), and noise levels would be limited to those associated with motorized hand tools (e.g., an electric winch and hand drills). The noise levels would not be continuous and would attenuate as sound travels from the construction area, as a function of distance, terrain and the dense forest vegetation. Furthermore, construction activities would be ongoing in the localized construction area for several

months prior to the nesting season, such that nesting hawks would be expected to exhibit avoidance behavior and selectively use other high-quality habitat in the surrounding areas.

During the operation period of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. As shown in the sampling timeline contained in Appendix C, sampling activities during the hawk nesting season would generally be limited to litterfall and fine woody debris, leaf area index, plant phenology, mosquito points, beetle pitfall traps, bird surveys, and soil sampling. These are non-destructive activities and would involve only minimal disturbance of soil and understory vegetation. Maintenance activities would involve periodic inspection and replacement of equipment and instruments, and may include infrequent vegetation trimming. Overall, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Pu‘u Maka‘ala NAR. Operation of the tower and instrument hut would generate a humming sound, but it is expected that the sound would attenuate such that the impacts would be localized and Hawaiian hawks would acclimate or relocate from the affected area, as needed.

The following measures would be implemented to avoid and minimize potential impacts to the Hawaiian hawk:

- Vegetation clearing and construction would be avoided during the Hawaiian hawk breeding season (March through September) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS.
- If determined to be needed, nesting deterrents would be placed on the tower. Any deterrent used would first be approved by USFWS and DOFAW.
- Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed.
- NEON staff would be trained to recognize the Hawaiian hawk and their nests. In the event that a Hawaiian hawk nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were identified along the pedestrian route to a sampling plot, an alternate route would be used until the nest is no longer occupied.

With implementation of these measures, impacts on the Hawaiian hawk would be discountable. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the species.

3.21.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for *nēnē*, there would be ***no effect*** on critical habitat.

3.22 Honeycreepers (*ʻAkiapōlāʻau*, Hawaiʻi *ʻĀkepa*, Hawaiʻi Creeper; *ʻŌʻū*, and *ʻIʻiwi*)

3.22.1Description

Hawaiian honeycreepers are small, passerine birds that are endemic to Hawaiʻi. Five of these species are listed or are proposed for listing: the endangered *ʻakiapōlāʻau* (*Hemignathus munroi*), the endangered Hawaiʻi *ʻākepa* (*Loxops coccineus*), the endangered Hawaiʻi creeper (*Oreomystis mana*), the endangered *ʻōʻū* (*Psittirostra psittacea*), and the proposed threatened *ʻiʻiwi*, scarlet honeycreeper (*Vestiaria coccinea*). Because these species share similar habitat needs and biological characteristics, they are discussed as a single group.

The *ʻakiapōlāʻau* was listed as endangered in 1967. It is endemic to Hawaiʻi Island, and has evolved to fill the niche occupied by woodpeckers in many other parts of the world. It is recognizable by its long, sharply curving upper mandible. *ʻAkiapōlāʻau* are found in montane mesic and wet forest dominated by *koa* and *ʻōhiʻa*, or in subalpine dry forest dominated by *mamane* (*Sophora chrysophylla*) and *naio* (*Myoporum sandwicense*), at elevations above 4,000 feet (1,300 meters). It creeps along trunks and branches searching for grubs and various arthropods within the bark, with lichen-covered and dead branches preferred as foraging substrate. As of 2015, there were an estimated 1,900 individuals, primarily in Hakalau Forest National Wildlife Refuge and upper Kau (USFWS, 2015e; USFWS, 2006a).

The Hawaiʻi *ʻākepa* was listed as endangered in 1970 (USFWS, 2006a). Hawaiʻi *ʻākepa* occur in old-growth *ʻōhiʻa* or *ʻōhiʻa*/*koa* forests, and exclusively nest in the cavities of large, old-growth *ʻōhiʻa* and *koa* trees. Foraging occurs mainly on the terminal leaf clusters of *ʻōhiʻa*, as well as *koa* leaves and seedpods. As of 2015, there were an estimated 12,000 Hawaiʻi *ʻākepa*, with disjunct populations in the Hakalau, Kau, Kona, and Hualālai regions on Hawaiʻi Island. The species is believed to be nearly extirpated from Hualālai and central Kona (USFWS, 2015g).

The Hawaiʻi creeper was listed as endangered in 1975. It is endemic to Hawaiʻi Island, and most commonly occurs in mesic and wet forests above 5,000 feet (1,500 meters) in elevation. The species prefers relatively undisturbed *ʻōhiʻa/koa* forests and primarily forages on the branches, trunks, and foliage of live trees, with some foraging activity in ʻōlapa and other subdominant species. It typically nests at mid-canopy, approximately 43 feet (13 meters) in height. As of 2015, approximately 14,000 individuals were known to occur, with disjunct populations in the windward Hawaiʻi, Kau, Kona, and Hualālai regions of Hawaiʻi Island (USFWS, 2015f; USFWS, 2006a).

The *ʻōʻū* was listed as endangered in 1967. Although this species was once relatively common, very little has been reported on its life history, and little is known of its breeding and nesting habits (USFWS, 2006a). It was historically found on Kauaʻi, Oʻahu, Maui, Lānaʻi, Molokaʻi, and Hawaiʻi Island in a wide range of forest habitat from sea level to alpine areas, with dense *ʻōhiʻa* forest with ieʻie considered to be preferred habitat. Recent data show *ʻōʻū* was subsequently confined to mid-elevation (3,000 to 5,000 feet) mesic and wet *ʻōhiʻa* forests, which is well within the range of mosquito-borne diseases. The species is now believed to be extinct, with the last reliable observations made on Hawaiʻi Island in 1987 and on Kauaʻi in 1989 (USFWS, 2015h; USFWS, 2006a).

The *ʻiʻiwi* was proposed for listing as threatened in 2016. The species primarily occurs in closed canopy, montane wet or montane mesic forests composed of tall stature *ʻōhiʻa*, or mixed *ʻōhiʻa*/*koa* forest. It creates cup-shaped nests typically within the upper canopy of *ʻōhiʻa* trees. These birds are strong fliers that move long distances to locate nectar sources. Movement to lower elevation areas is an important

factor in the species' exposure to avian diseases, particularly malaria. Once considered one of the most common native forests birds in Hawai'i, *'i'iwi* was historically across all the major islands and occurred from sea level to the tree line. It is no longer known to occur on Lāna'i, and only a few individuals are known from O'ahu, Moloka'i and west Maui. The species is largely restricted to forests above 3,937 feet (1,200 meters) on Hawai'i Island, east Maui, and Kaua'i. The vast majority of individuals occur on Hawai'i Island, with declining populations on Kaua'i and Maui (USFWS, 2016).

The main factors contributing to population decline of Hawaiian honeycreepers are habitat degradation and herbivory by ungulates; predation by rats, cats and mongoose; mosquito-borne diseases; invasive introduced plants; small population size; and climate change (USFWS, 2015e; USFWS, 2006a; USFWS, 2016b).

No critical habitat has been designated for the listed species of Hawaiian honeycreepers.

3.22.2Effects Analysis

3.22.2.1 Effects to Species

'*Akiapōlā*'*au*, Hawai'i *'ākepa*, Hawai'i creeper, and *'i'iwi* (collectively referred to as honeycreepers breeding season) are known to occur within Pu'u Maka'ala NAR, particularly in the Kūlani area. High quality nesting and foraging habitat is present throughout the native *'ōhi'a* forest. This section addresses potential impacts to these four species of Hawaiian honeycreepers. *'Ō'ū* are not expected to occur, as the species is believed to be extinct. Potential for impacts to this species are not assessed.

Construction of the proposed project could directly impact honeycreepers if a nest is damaged or destroyed. Operation of construction equipment and other loud or unpredictable construction activities could also indirectly affect honeycreepers through nest failure. Harassment of nesting sites could result in altered feeding and breeding patterns or nest or chick abandonment. Nest disturbance could also increase exposure of chicks and juveniles to inclement weather or predators (USFWS, 2016b). As shown in the construction timeline contained in Appendix B, nearly all of the construction activities have been scheduled to occur outside of the honeycreeper nesting season, which is understood to be from February through July (although nesting has been known to start as early as January in some locations). All activities that require vehicular motorized construction equipment, which would result in the most noise and disturbance, have been scheduled to occur prior to February. The activities that would occur between February and July include the final stages of erecting the research tower (and guy wires), assembly of the instrument hut and installation of the sensors. Equipment to be used during these activities includes a gin pole with a motorized spool (to pull material up the tower), a motorized spool to pull the guy wires, and motorized hand tools (e.g., an electric winch and hand drills) for installation of the tower and instrument hut components. These activities would not involve any work that could directly impact a honeycreeper nest (e.g., vegetation trimming), and noise levels would be limited to those associated with motorized hand tools. The noise levels would not be continuous and would attenuate as sound travels from the construction area, as a function of distance, terrain and the dense forest vegetation. Furthermore, construction activities would be ongoing in the localized construction area for several months prior to the nesting season, such that nesting honeycreepers would be expected to exhibit avoidance behavior and selectively use other high-quality habitat in the surrounding areas.

During the operation period of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. As shown in the sampling timeline contained in Appendix C, sampling activities during the honeycreeper nesting season would generally be limited to litterfall and fine woody debris, leaf area index, plant phenology, mosquito points, beetle pitfall traps, bird surveys, and soil sampling.

These are non-destructive activities and would involve only minimal disturbance of soil and understory vegetation. Maintenance activities would involve periodic inspection and replacement of equipment and instruments, and may include infrequent vegetation trimming. Overall, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Puʻu Makaʻala NAR. Operation of the tower and instrument hut would generate a humming sound, but it is expected that the sound would attenuate such that the impacts would be localized and honeycreepers would acclimate or relocate from the affected area, as needed.

The following measures would be implemented to further avoid and minimize potential impacts to honeycreepers:

- Vegetation clearing and construction activies would be avoided during the honeycreeper nesting season (February through July) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 500 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS.
- The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds.
- Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed.

With implementation of these measures, impacts on listed forest bird species would be discountable. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of these species

3.22.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for ʻa*kiapōlāʻau*, Hawaiʻi *ʻākepa*, Hawaiʻi creeper, and *ʻiʻiwi*, there would be ***no effect*** on critical habitat for these species.

3.23 *ʻAlalā*, Hawaiian Crow (*Corvus hawaiiensis*)

3.23.1Description

ʻAlalā, or the Hawaiian crow, is a medium-sized crow endemic to the island of Hawaiʻi. It was listed as an endangered species in 1967.

Historically, the species was restricted to the dry and mesic forests in the western and southern portions of the island, from Puʻuanahulu in the North Kona District to the vicinity of Kīlauea Crater in the Kaʼū District. The species is associated with ʻ*ōhiʻa* and ʻ*ōhiʻa-koa* forests with an understory of native fruit-bearing trees, vines, and shrubs. A significant amount of protective understory cover appears to also be important to avoid predation by the Hawaiian hawk (USFWS, 2009). Nesting occurs predominantly in *ʻōhiʻa*, although other trees may also be used. Nest construction usually starts in March, with the first clutch laid in April. Additional clutches are often laid upon loss or removal of the first clutch. Incubation lasts approximately 19 to 22 days. Juveniles fledge approximately 40 days after hatching, but are initially poor fliers and remain near the ground for long periods (USFWS, 2009).

Once abundant on Hawaiʻi Island, the total number of ʻ*alalā* declined rapidly through the 20th century and by 1992, there were only 11 birds known to be in the wild. Between 1993 and 1998, 27 captively

bred juvenile *ʻalalā* were released in the wild. Of the 27 released birds, 21 died or disappeared; the remaining 6 were returned to captivity. The species was extirpated from the wild by 2013, although a population of more than 100 captively raised birds has been maintained.

A new effort to reintroduce captively raised *ʻalalā* to the wild was recently initiated by DOFAW, USFWS, and San Diego Zoo Global. Puʻu Makaʻala NAR was selected as the primary site for release of the captively raised birds. Although the species did not historically occur in this location, it was known from nearby areas, including Hawaiʻi Volcanoes National Park. Puʻu Makaʻala was selected as the release site because the high quality forest habitat and the protection provided by ungulate fencing. The first release (5 birds total) occurred in December 2016. In January 2016, 3 of the birds were found dead; the remaining 2 birds were taken back into captivity. A second release is planned in late summer or early fall 2017. Future releases of approximately 12 birds are anticipated to occur annually for the next 5 years, depending on the success and survival of the released birds. Following each release, there will be a team of onsite biologists providing supplemental feeding, conducting ongoing predator control, monitoring life history, and conducting nest searches for approximately 5 years.

Threats to the *ʻalalā* include habitat degradation by ungulates, predation by nonnative mammals (e.g., rats, cats, and mongoose) and the Hawaiian hawk, introduced disease, and habitat loss and fragmentation. As the remaining population is small and confined to captivity, the species may also be subject to reduced reproductive success because of inbreeding, reduced survivorship because of loss of wild behaviors, and susceptibility to stochastic events (USFWS, 2015i).

No critical habitat has been designated for this species.

3.23.2Effects Analysis

3.23.2.1 Effects to Species

ʻAlalā have been extinct in the wild for approximately 15 years, but captively bred birds are in the process of being released to areas of suitable habitat. The current plans call for release of approximately 12 birds within Puʻu Makaʻala NAR annually for the next 5 years, depending on the success and survival of the released birds.

Given the anticipated timing of the proposed project relative to the planned release of *ʻalalā*, it is expected that construction will be complete well before any *ʻalalā* are nesting within Puʻu Makaʻala NAR.

During the operation period of the proposed project, terrestrial sampling activities would generally involve passive observation and data collection tasks, similar to other ongoing monitoring and research activities in the NAR. As shown in the sampling timeline contained in Appendix C, sampling activities during the *ʻalalā* nesting season would generally be limited to litterfall and fine woody debris, leaf area index, plant phenology, mosquito points, beetle pitfall traps, bird surveys, and soil sampling. These are non-destructive activities and would involve only minimal disturbance of soil and understory vegetation. Maintenance activities would involve periodic inspection and replacement of equipment and instruments, and may include infrequent vegetation trimming. Overall, these activities would be minimally intrusive and are expected to be generally commensurate with other ongoing research and management activities in Puʻu Makaʻala NAR. Operation of the tower and instrument hut would generate a humming sound, but it is expected that the sound would attenuate such that the impacts would be localized and *ʻalalā* would acclimate or relocate from the affected area, as needed.

Ongoing coordination has been conducted with the *ʻalalā* release team to better understand the potential for the impacts described above and to identify measures to avoid and minimize potential

impact. As a result of this coordination, the proposed project has been sited such that none of the infrastructure or terrestrial sampling plots would be located within 1,600 feet of the initial release site. The following additional measures would be implemented to avoid and minimize potential impacts to *ʻalalā*:

- Vegetation clearing and construction would be avoided during the *ʻalalā* breeding season (February through July) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS.
- The use of shiny materials would be minimized and shiny surfaces would be masked to decrease their attractiveness to *ʻalalā*. Specifically, the tower would be constructed of materials that are a dull, galvanized gray. An exterior treatment involving dark or dull colors would be added to any shiny surfaces, such as power boxes and communication equipment.
- All trash would be placed into appropriate containers and promptly removed from the project site, to avoid inadvertent discarding of shiny materials or other items that may be of interest to *ʻalalā*.
- The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds.
- The beetle traps would be fitted or retrofitted, depending on timing of *ʻalalā* releases, with chicken wire to limit the extent to which *ʻalalā* could access the traps. Any preservatives used in the beetle traps would be verified to be nontoxic to birds.
- Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed.
- NEON staff would be trained to recognize *ʻalalā* and their nests. In the event that an *ʻalalā* nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were to be identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest is no longer occupied.

With implementation of these measures, impacts on *ʻalalā* would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the species.

3.23.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for *ʻalalā*, there would be ***no effect*** on critical habitat for this species.

3.24 Seabirds (Hawaiian Petrel, Newell's Shearwater, and Band-rumped Storm Petrel)

3.24.1 Description

The endangered Hawaiian petrel or *ʻuaʻu* (*Pterodroma sandwichensis)*, threatened Newell's shearwater (*Puffinus newelli*), and endangered band-rumped storm-petrel or *ʻakēʻakē* (*Oceanodroma castro*) constitute the seabirds group. Because these species share similar habitat needs and biological characteristics, they are discussed as a single group.

The Hawaiian petrel was listed as endangered in 1967. It was once abundant on all main Hawaiian Islands except Niʻihau (Mitchell et al., 2005). The largest known colony is located on Haleakalā, Maui, but the species also occurs on Kauaʻi, Lānaʻi, and Hawaiʻi Island. The majority of known nests on Hawaiʻi Island are within Hawaiʻi Volcanoes National Park on the lower alpine and subalpine slopes of Mauna Loa, with an estimated 50 to 60 breeding pairs remaining (NPS, 2016).

Newell's shearwater was listed as a threatened species by the USFWS in 1975. It was once abundant on all the main Hawaiian Islands, but has suffered significant decline in population size and range. The largest breeding population of Newell's shearwater occurs on Kauaʻi. There is little data regarding shearwaters on other islands, but the species has been documented on Molokaʻi, Oʻahu and Hawaiʻi Island (USFWS, 2011b).

Band-rumped storm petrels are considered the rarest breeding seabird in Hawaiʻi (Banko et al., 1991; Slotterback, 2002). The species was listed as endangered in 2016. Historically, band-rumped storm petrels were numerous on all of the main Hawaiian Islands. There are three separated breeding populations, with one in Japan, one in Hawaiʻi and the other in the Galapagos Islands. The majority of the breeding colonies in Hawaiʻi are located on Kauaʻi. Other smaller colonies occur on Maui, Lānaʻi, Kahoʻolawe, and Hawaiʻi Island. On Hawaiʻi Island, Hawaiian band-rumped storm-petrels are known to nest in high-elevation lava fields (USFWS, 2014c).

The types of habitat used for seabird nesting are diverse and range from xeric habitats with little or no vegetation, such as at Haleakalā National Park on Maui to wet forests dominated by *ʻōhiʻa* with *uluhe* (*Dicranopteris linearis*) understory, such as those found on Kauaʻi (Mitchell et al., 2005). Nests are typically located in various naturally occurring features such as lava tubes, cracks in tumuli (fractured hills on the surface of *pāhoehoe* flows), spaces created by uplift of *pāhoehoe* slabs, and other miscellaneous natural features (Hu et al., 2001; Mitchell et al., 2005; Pyle and Pyle, 2009).

The main factors contributing to population declines of ground-nesting seabirds are habitat degradation; the loss of nesting habitat; predation of eggs, hatchlings, and adults at nesting sites by introduced mammals (e.g., dogs, mongooses, cats, rats, and pigs); and urban lighting associated with disorientation and fall-out of juvenile birds (Ainley et al., 1997; Mitchell et al., 2005; Hays and Conant, 2007).

No critical habitat has been designated for these species.

3.24.2 Effects Analysis

3.24.2.1 Effects to Species

Hawaiian petrels, Newell's shearwaters, and band-rumped storm-petrels (collectively referred to as seabirds) may fly over the project area in transit between the ocean and upland breeding sites. Seabirds are vulnerable to striking objects that protrude above the vegetation canopy, such as antennas or guy

wires. In addition, they are attracted to lights, which can cause disorientation (Banko et al., 1991; Ainley et al., 1997; Mitchell et al., 2005). Fledging seabirds are especially affected by artificial lighting and can become exhausted from circling the light sources, resulting in grounding. Once grounded, the birds are vulnerable to predation by small mammals (e.g., cats and mongoose).

To avoid and minimize any such impacts to seabirds, the following measures would be implemented:

- Construction activities would be restricted to daylight hours to avoid the use of nighttime lighting that could attract seabirds.
- Installation of outside lighting would be avoided, to the extent possible. If outside lights are required for safety or security purposes, directional lighting or shielded lighting would be used to prevent upward radiation. The shields would be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below. Outside lights that are not needed for security and safety would be turned off from dusk through dawn during the seabird fledging season (September 15 to December 15).
- The guy wires for the research tower would not extend above the top of the tree canopy to minimize the potential for bird strikes.

With implementation of these measures, impacts on seabirds would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of these species.

3.24.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for these seabird species, there would be ***no effect*** on critical habitat for these species.

3.25 *ʻŌpeʻapeʻa*, Hawaiian Hoary Bat (*Lasiurus cinereus semotus*)

3.25.1Description

The Hawaiian hoary bat was listed as endangered in 1970. It is the only native terrestrial mammal that is extant within the Hawaiian Islands (USFWS, 1998c).

The Hawaiian hoary bat occurs throughout the Hawaiian Islands and has been observed from sea level to approximately 13,000 feet (3,963 meters) (USFWS, 2012l). The population size is unknown because of the difficulty in detecting the species. However, there are substantial populations on Kauaʻi, Maui and Hawaiʻi Island, with less frequent sightings on Oʻahu, Molokaʻi, Lānaʻi, and Kahoʻolawe (Bonaccorso, 2010; Pacific Rim Conservation, 2013).

Prime habitat for this species includes native moist and rain forests up to 6,000 feet (1,830 meters), but Hawaiian hoary bats have also been documented in xeric and nonnative habitats, as well as urban areas (Bonaccorso, 2010). Hawaiian hoary bats are insectivores and are regularly observed foraging over streams, reservoirs, and wetlands up to 300 feet (100 meters) offshore (U.S. Department of Agriculture [USDA, 2009). Hawaiian hoary bats forage in open, wooded, and linear habitats with a wide range of vegetation types (USFWS, 2012l). The bat typically roosts in dense canopy foliage or in the subcanopy when canopy is sparse, with open access for launching into flight (USDA, 2009). The Hawaiian hoary bat roosts in native and nonnative trees, but has no strong preference for any single species.

Hawaiian hoary bats are believed to be threatened by habitat loss, pesticides, predation, and roost disturbance. Reduction of tree cover and indirect impacts from the use of pesticides may be the primary causes of recent declines (USFWS, 2012l). Hawaiian hoary bats are also injured and killed from collisions with man-made structures, including barbed wire fences, wind turbines, and communication towers.

No critical habitat has been designated for this species.

3.25.2Effects Analysis

3.25.2.1 Effects to Species

The Hawaiian hoary bat is known to occur within Pu‘u Maka‘ala NAR, particularly in the Kūlani area. Roosting typically occurs in dense canopy foliage or in the subcanopy when canopy is sparse, with open access for launching into flight (USDA, 2009). It forages in open, wooded, and linear habitats with a wide range of vegetation types, and while foraging, leaves young unattended in "nursery" trees and shrubs.

If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June I to September 15), there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. To avoid and minimize any such impacts to Hawaiian hoary bats, the following measures would be implemented. With implementation of these measures, the project is not likely to adversely affect this species.

- No trees taller than 15 feet are planned to be trimmed or removed as a result of the proposed project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees. However, if it is subsequently determined that a limited number of trees need to be trimmed or removed during that time period, a qualified biologist would conduct observations following standard protocols to determine whether any of the trees that would be removed are being used by bats and could harbor juveniles. If any trees are determined to be used by bats, they would not be trimmed or removed until after September 15.
- No fences are proposed to be installed as part of the project. In the event a fence is needed, it would have barbless top-strand wire to prevent entanglement of Hawaiian hoary bats on barbed wire.

With implementation of these measures, impacts on the Hawaiian hoary bat would be discountable or insignificant. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the species.

3.25.2.2 Effects to Critical Habitat

Because no critical habitat has been designated for the Hawaiian hoary bat, there would be ***no effect*** on critical habitat for this species.

3.26 Picture-wing Fly (*Drosophila mulli*)

3.26.1Description

Drosophila mulli is a picture-wing fly that is only found on Hawai‘i Island. It was federally listed as threatened in 2006.

Drosophila mulli occurs in wet montane *‘ōhi‘a* forests at elevations between 2,150 and 3,250 feet (655 and 990 meters), and is restricted to the natural distribution of its host plant, *loulu* (*Pritchardia beccariana*). Adult flies are found only on the underside of leaves on this endemic fan palm, which has

been heavily impacted by feral ungulates and rats. The larval feeding site on the plant is still unknown (USFWS, 2006b and 2012m). There are only three locations that this species has been recorded: Ola'a Forest Reserve, Upper Waiakea Forest Reserve, and along Stainback Highway. The last observation of this species was recorded in 2001 (USFWS, 2012m).

The factors contributing to the decline of this species include habitat alteration and loss of host plants caused by feral ungulates, rats, and human disturbance. Climate change is also an increasing threat (USFWS, 2012m).

Critical habitat for *Drosophila mulli* was designated in 2008. There are three units of critical habitat, totaling 693 acres on Hawai'i Island. The far eastern tip of Pu'u Maka'ala NAR (along Stainback Highway) is within *Drosophila mulli* Critical Habitat. Designation of critical habitat for *Drosophila mulli* was based on the following physical and biological features: (1) wet, montane *'ōhi'a* forest between the elevations of 1,955 and 3,585 feet (596 to 1,093 meters) and (2) the larval stage host plant *Pritchardia beccariana*, which exhibits one or more life stages (from seedlings to senescent individuals) (USFWS, 2008).

3.26.2Effects Analysis

3.26.2.1 Effects to Species

Drosophila mulli is restricted to the distribution of its host plant, *loulu* (*Pritchardia beccariana*). It was previously documented in the far eastern tip of Pu'u Maka'ala NAR, along Stainback Highway, but was last observed in this area in 2000. If still present in this location, this species could be affected by project-related activities. Specifically, if any *loulu* that are being used by *Drosophila mulli* are cleared/trimmed or otherwise damaged, *Drosophila mulli* that are occupying the plant could inadvertently be harmed or killed. Because *loulu* is a primary feature of critical habitat for *Drosophila mulli*, any damage or destruction of *loulu* in this area would also result in an adverse modification of designated critical habitat.

To avoid and minimize any such impacts to *Drosophila mulli*, the following measures would be implemented:

- No *loulu* or wet montane forest habitat would be cleared or trimmed, nor would vegetation biomass be harvested as part of sampling within areas that are designated critical habitat for *Drosophila mulli*. If *loulu* is to be cleared, trimmed or harvested in portions of the project area that are not within designated critical habitat, they would first be inspected for *Drosophila mulli* by a qualified biologist. If *Drosophila mulli* are found, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid impacts to the occupied *loulu*. Temporary protective fencing would be installed around the occupied *loulu*, as appropriate.
- Mosquito traps would not be installed within 1,000 feet of critical habitat for *Drosophila mulli* or any location where the species was previously documented within Pu'u Maka'ala NAR.

With implementation of these measures, impacts on the picture-wing fly would be discountable. As such, the proposed project ***may affect, but is not likely to adversely affect*** individuals or populations of the species.

3.26.2.2 Effects to Critical Habitat

No infrastructure would be constructed and no sampling is proposed within the area of designated critical habitat for *Drosophila mulli*. NEON will avoid any subsequent sampling within this area and will

not use this area for access to interior sampling point locations. Because this area would not be sampled or disturbed, there would be ***no effect*** on critical habitat for *Drosophila mulli*.

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4 Summary and Conclusions

A total of 32 listed species (including those proposed for listing) are known to occur (or may occur) in the action area, as listed in Table 4. These include a variety of vascular plant and ferns, birds, mammals and invertebrate species. Critical habitat has been designated within the action area for 9 of these species, including 8 plant species and 1 invertebrate species. Two listed species (*hāhā* [*Cyanea copelandii*] *and ʻōʻū* [*Psittirostra psittacea*]) previously occurred in the action area, but are believed to be extirpated (or extinct).

Potential impacts of the proposed project to listed species are expected to be temporary, discountable, and insignificant. As detailed above, implementation of seasonal restrictions on construction activities and other conservation measures and best management practices would likely preclude any major or long-term effects to these federally protected species. Similarly, project implementation would not significantly affect any physical or biological features within designated critical habitat. Based on this evaluation, and as summarized in Table 6, the proposed project ***may affect, but is not likely to adversely affect*** the federally listed (or proposed listed) vascular plant and fern, bird, mammal, and invertebrate species that are known to occur (or may occur) in the action area. The proposed project is ***not likely to jeopardize the continued existence*** of species proposed for listing. The proposed project is ***not likely to result in destruction or adverse modification*** of critical habitat for 6 species. As the proposed infrastructure would displace a small amount of critical habitat for 3 species over the lifetime of the project, the proposed project is **Likely to result in destruction or adverse modification of critical habitat** for those three species. The determination of effect for each species and designated critical habitat is summarized in Table 6.

TABLE 6
Effects Determination for Federally Listed or Proposed Species Potentially Occurring at Pu‘u Maka‘ala NAR

Species Name	Status	Critical Habitat in Project Area	Potential to Occur in Project Area	Determination of Effect (Species)	Determination of Effect (Critical Habitat)
Vascular Plants and Ferns					
Mauna Loa (*Ka‘u*) silversword *Argyroxiphium kauense*	Endangered	Yes (northwestern portion of NAR)	Known to occur (outplanted); some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Not likely to result in destruction or adverse modification of critical habitat***
‘ōhā wai *Clermontia lindseyana*	Endangered	Yes (northwestern portion of NAR)	Known to occur (outplanted); tower and some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Likely to result in destruction or adverse modification of critical habitat*** (Infrastructure) ***Not likely to result in destruction or adverse modification of critical habitat*** (Sampling)
‘ōhā wai *Clermontia peleana*	Endangered	No	Known to occur (outplanted)	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
hāhā *Cyanea copelandii* ssp. *copelandii*	Endangered, Possibly Extinct	No	Unlikely; believed to be extinct	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
‘akū‘akū *Cyanea platyphylla*	Endangered	No	May occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
hāhā *Cyanea shipmanii*	Endangered	Yes (northwestern portion of NAR)	Known to occur (outplanted); some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Not likely to result in destruction or adverse modification of critical habitat***
hāhā *Cyanea stictophylla*	Endangered	Yes (western portion of NAR)	Known to occur (outplanted); tower and some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Not likely to result in destruction or adverse modification of critical habitat***
‘akū *Cyanea tritomantha*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
ha‘iwale *Cyrtandra giffardii*	Endangered	Yes (southern portion of NAR)	May occur; some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Not likely to result in destruction or adverse modification of critical habitat***
ha‘iwale *Cyrtandra tintinnabula*	Endangered	No	May occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
nānū *Gardenia remyi*	Endangered	No	May occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***

TABLE 6
Effects Determination for Federally Listed or Proposed Species Potentially Occurring at Pu‘u Maka‘ala NAR

Species Name	Status	Critical Habitat in Project Area	Potential to Occur in Project Area	Determination of Effect (Species)	Determination of Effect (Critical Habitat)
‘ohe *Joinvillea ascendens* ssp. *ascendens*	Endangered	No	May occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
No common name *Phyllostegia floribunda*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
kīponapona *Phyllostegia racemosa*	Endangered	Yes (northwestern portion of NAR)	Known to occur; tower and some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Likely to result in destruction or adverse modification of critical habitat*** (Infrastructure) ***Not likely to result in destruction or adverse modification of critical habitat*** (Sampling)
No common name *Phyllostegia velutina*	Endangered	Yes (northwestern portion of NAR)	Known to occur; tower and some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Likely to result in destruction or adverse modification of critical habitat*** (Infrastructure) ***Not likely to result in destruction or adverse modification of critical habitat*** (Sampling)
‘ānunu *Sicyos alba*	Endangered	Yes (southern portion of NAR)	Known to occur; some sampling plots would be in critical habitat	***May affect, not likely to adversely affect***	***Not likely to result in destruction or adverse modification of critical habitat***
Hawaiian vetch *Vicia menziesii*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
palai la‘aū *Adenophorus periens*	Endangered	No	May occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
No common name *Asplenium fragile* var. *insulare*	Endangered	No	May occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
Birds					
nēnē, Hawaiian goose *Branta sandvicensis*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
‘io, Hawaiian hawk *Buteo solitarius*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
‘akiapōlā‘au *Hemignathus munroi*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***

TABLE 6
Effects Determination for Federally Listed or Proposed Species Potentially Occurring at Pu‘u Maka‘ala NAR

Species Name	Status	Critical Habitat in Project Area	Potential to Occur in Project Area	Determination of Effect (Species)	Determination of Effect (Critical Habitat)
Hawai‘i *‘ākepa* *Loxops coccineus*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
Hawai‘i creeper *Oreomystis mana*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
‘ō‘ū *Psittirostra psittacea*	Endangered	No	Species is believed to be extinct	***No effect (species would not occur)***	***No effect (no critical habitat)***
‘i‘iwi, scarlet honeycreeper *Vestiaria coccinea*	Proposed Threatened	No	Known to occur	***Not likely to jeopardize the species’ continued existence***	***No effect (no critical habitat)***
‘alalā, Hawaiian crow *Corvus hawaiiensis*	Endangered	No	Known to occur (pending release of captively bred birds)	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
‘akē‘akē, band-rumped storm petrel *Oceanodroma castro*	Endangered	No	Species may fly over site while travelling between upland nest sites and the ocean	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
‘ua‘u or Hawaiian petrel *Pterodroma sandwichensis*	Endangered	No	Species may fly over site while travelling between upland nest sites and the ocean	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
Newell’s shearwater *Puffinus newelli*	Threatened	No	Species may fly over site while travelling between upland nest sites and the ocean	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
Mammals					
‘ōpe‘ape‘a, Hawaiian hoary bat *Lasiurus cinereus semotus*	Endangered	No	Known to occur	***May affect, not likely to adversely affect***	***No effect (no critical habitat)***
Invertebrates					
Pomace fly *Drosophila mulli*	Threatened	Yes (far eastern tip of NAR)	Known to occur (but not recorded in this area since 2000)	***May affect, not likely to adversely affect***	***No effect***

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6 Acronyms, Abbreviations and Terminology Index

Acronym	Definition
AGL	above ground level
AIBS	American Institute of Biological Sciences
BMP	best management practice
CFR	*Code of Federal Regulations*
cm	centimeter(s)
CO_2	carbon dioxide
DOFAW	Division of Forestry and Wildlife
ESA	Endangered Species Act
ft^2	square feet
g	gram(s)
HVAC	heating, ventilation, and air conditioning
LiDAR	Light Detection and Ranging
LTER	Long Term Ecological Research
m	meter(s)
m^2	square meter(s)
NAR	natural area reserve
NARS	Natural Area Reserves System
NEON	National Ecological Observatory Network
NEPA	National Environmental Policy Act
NPS	National Parks Service
NRC	National Research Council
NSF	National Science Foundation
PVC	polyvinyl chloride
RFI	request for information
SOP	standard operating procedure
TMK	tax map key
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

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Appendix A
Best Management Practices to be Implemented as part of NEON Domain 20 Field Site

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Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
General	N/A	A Project Work Plan detailing the SOPs would be developed and executed. The Plan would be subject to DOFAW/NARS approval (with a request for review and input from USFWS) before project implementation, and would continue to be refined over the lifetime of the project. SOPs would address (but not be limited to) the following (which are further detailed in Section 2.4.2): • Communication Procedures • Staff Training • Decontamination Procedures • Site Access and Route Planning • Ongoing Impact Assessment and Adaptive Mitigation • Vegetation Trimming • Collection of Listed Plant Species • Stakeholder and Community Engagement
Climate	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact relative to climate; no avoidance or minimization measures are proposed.
Land Use and Recreation	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact relative to land use and recreation; no avoidance or minimization measures are proposed.
Geology and Soils	Construction: Minor, short-term impact Operation: Minor, short-term impact (decommissioning)	Measures to avoid and minimize potential impacts related to soil erosion include the following: • The extent of ground disturbance would be minimized to the extent practicable. • Temporarily disturbed areas would be stabilized and revegetated as quickly as possible.
Water Resources	Construction: Negligible, short-term impact Operation: Negligible, short-term impact (decommissioning)	Measures to minimize the potential for water quality impacts to receiving waters would be implemented during construction and operation (particularly decommissioning), and are expected to include the following: • Erosion and sediment control measures (such as silt fences) would be installed before earth-moving activities are initiated, and would be inspected and properly maintained throughout the construction period. • Disturbance of soil would be minimized during periods of heavy rain. • Vehicles and equipment would be inspected for leaks or contamination on a daily basis. • In the event of a spill/leak of fuel or lubricants from onsite equipment, the materials would be cleaned in a timely manner and disposed at an approved site.

Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Biological Resources (Vegetation)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on vegetation include: • Any vegetation removal required during construction or operation would be conducted in accordance with the SOPs for the project (see Section 2.4.2), including prior approval by the NEON science team, permitting team and site host. A qualified arborist with specific knowledge of the target species and site conditions would be engaged, as needed. • Terrestrial sampling activities would be conducted in accordance with the SOPs for the proposed project, particularly those related to site access, route planning, and ongoing impact assessment and mitigation. • In sampling plots where tree tagging is needed, coiled wire would be wrapped around the tree (instead of using standard tree tags) to avoid physical impact to the tree. • Areas temporarily disturbed during construction or decommissioning would be revegetated. Revegetation efforts would utilize species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Revegetation efforts would be coordinated with DOFAW/NAR.
Biological Resources (Wildlife)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on wildlife include those listed as part of the SOPs (see Section 2.4.2), including site access and route planning efforts designed to limit potential disturbance, and ongoing impact assessment and mitigation.
Biological Resources (Critical Habitat)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on wildlife include: • The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff.
Biological Resources (Threatened and Endangered Species)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts to threatened and endangered species include: **Plant Species** • Preconstruction surveys would be conducted throughout the construction limits. In the event that a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts. • Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits. • Consumptive vegetation sampling (biomass and canopy sunlit leaf collection) would be sited to avoid occurrences of protected plant species. • Should harvest of a listed or proposed species be determined to be necessary for scientific goals, then the researcher would have to obtain appropriate permits from USFWS (Section 10 Scientific Collection Permit) and the State of Hawai'i prior to any such collection. ***Nēnē*** • A biologist familiar with the nesting behavior of the *nēnē* would survey suitable habitat within the construction area before the initiation of any construction activities, or after any subsequent delay in work of 3 or more days (during which time, the birds could attempt nesting). If a nest were discovered, USFWS would be contacted.

Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• All NEON staff would be trained to identify *nēnē* and know the appropriate steps to take if *nēnē* are present within the project area or encountered in transit to sampling locations. • If a *nēnē* is encountered within the project area, the bird would not be approached, and all activities within 100 feet of the bird would cease until the bird leaves the area of its own volition. • If a *nēnē* is encountered while in transit to a sampling location, the researcher(s) would stop and remain in place until the bird moved more than 100 feet from the travel route of its own volition or slowly retreat and return for sampling at a later time. • A maximum speed limit of 15 miles per hour would be enforced for all project vehicles traveling within the project site to minimize potential collisions with *nēnē*. ***Hawaiian Hawk*** • Vegetation clearing and construction would be avoided during the Hawaiian hawk breeding season (March through September) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest is found) would be coordinated with USFWS. • If determined to be needed, nesting deterrents would be placed on the tower. Any deterrent used would first be approved by USFWS and DOFAW. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. • NEON staff would be trained to recognize the Hawaiian hawk and their nests. In the event that a Hawaiian hawk nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied. **Honeycreepers (*ʻakiapōlāʻau*, Hawaiʻi ʻ*ākepa*, *alawi*, and *ʻiʻiwi*)** • Vegetation clearing and construction occurs would be avoided during the honeycreepers breeding season (February through July) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 500 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. ***ʻAlalā*** • Vegetation clearing and construction would be avoided during the *ʻalalā* breeding season (February through July) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS. • The use of shiny materials would be minimized and shiny surfaces would be masked to decrease their attractiveness to ʻalalā. Specifically, the tower would be constructed of materials that are a dull, galvanized gray. An exterior treatment involving dark or dull colors would be added to any shiny surfaces, such as power boxes and communication equipment.

Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• All trash would be placed into appropriate containers and promptly removed from the project site, to avoid inadvertent discarding of shiny materials or other items that may be of interest to *ʻalalā*. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. • The beetle traps would be fitted or retrofitted, depending on timing of *ʻalalā* releases, with chicken wire to limit the extent to which *ʻalalā* could access the traps. Any preservatives used in the beetle traps would be verified to be non-toxic to birds. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. • NEON staff would be trained to recognize *ʻalalā* and their nests. In the event that an *ʻalalā* nest were to be identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were to be identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied. **Seabirds** • Construction activities would be restricted to daylight hours to avoid the use of nighttime lighting that could attract seabirds. • Installation of outside lighting would be avoided, to the extent possible. If outside lights were required for safety or security purposes, directional lighting or shielded lighting would be used to prevent upward radiation. The shields would be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below. Outside lights that are not needed for security and safety would be turned off from dusk through dawn during the seabird fledging season (September 15 to December 15). • The guy wires for the research tower would not extend above the top of the tree canopy to minimize the potential for bird strikes. **Hawaiian Hoary Bat** • No trees taller than 15 feet are planned to be trimmed or removed as a result of the proposed project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees. However, if it is subsequently determined that a limited number of trees need to be trimmed or removed during that time period, a qualified biologist would conduct observations following standard protocols to determine whether any of the trees that would be removed are being used by bats and could harbor juveniles. If any trees are determined to be used by bats, they would not be trimmed or removed until after September 15. • No fences are proposed to be installed as part of the proposed project. In the event a fence is needed, it would have barbless top-strand wire to prevent entanglement of Hawaiian hoary bats on barbed wire. **Picture-Wing Fly** • No *loulu* or wet montane forest habitat would be cleared or trimmed, nor would vegetation biomass be harvested as part of sampling within areas that are designated critical habitat for *Drosophila mulli*. If *loulu* is to be cleared, trimmed or harvested in portions of the project area that are not within designated critical habitat, they would first be inspected for *Drosophila mulli* by a qualified biologist. If *Drosophila mulli* are found, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid impacts to the occupied *loulu*. Temporary protective fencing would be installed around the occupied *loulu*, as appropriate. • Mosquito traps would not be installed within 1,000 feet of critical habitat for *Drosophila mulli* or any location where the species was previously documented within Puʻu Makaʻala NAR.
Biological Resources	Construction: Minor, short-term impact	To avoid and minimize the potential for introduction and spread of invasive species, the sanitation procedures utilized by DOFAW/NARS staff will be implemented over the lifetime of the project. The current procedures are listed below; any future modifications or additions made by DOFAW/NARS will be incorporated, as appropriate.

Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
(Invasive Species)	Operation: Minor, long-term impact	• All vehicles, tools, equipment and building materials, and packaging and shipping containers will be cleaned and fumigated before being shipped to Hawai'i and again once they arrive. The same protocol will be followed before leaving the local port. • All vehicles, equipment, and materials will be stored offsite at a clean staging area and will be subject to sanitation protocols daily before they are returned to the site. This measure will be randomly inspected for compliance and enforced. • All other materials (including personal equipment and boots) will be inspected for foreign matter (including dirt, seeds, eggs, larvae, or other propagules) and cleaned before entering the site. • All workers would be instructed on specific procedures to prevent the introduction and spread of invasive species in the project area. • All trash, including food waste, would be placed into appropriate containers, removed from the project site, and properly disposed of. • NEON domain staff would conduct regular monitoring for invasive species within the project area throughout the operational period. If invasive species were detected, removal and control would be coordinated with the NAR manager. To avoid and minimize the potential for Rapid *'Ōhi'a* Death to spread to the proposed project area, the sanitation procedures set forth by the Rapid *'Ōhi'a* Death multi-agency working group would be implemented throughout construction and operations of the NEON site. The current procedures are listed below; any future modifications or additions to these procedures will be adopted for the proposed project, as appropriate. • A survey of the proposed project site would be conducted no more than two weeks before any tree cutting to determine if there are any infected *'ōhi'a* trees. If infected *'ōhi'a* are suspected at the site, the appropriate agencies would be contacted for further guidance (including USFWS, University of Hawai'i Cooperative Extension Service, USDA Forest Service and USDA Agriculture Research Service). • Tools used to cut *'ōhi'a* would be cleaned with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. If a bleach solution is used, tools would be oiled afterwards to prevent corrosion. Chainsaw blades would be brushed clean, sprayed with the cleaning solution, and run briefly to lubricate the chain. • Personal gear, including shoes and clothes, would be cleaned before and after entering the forest. Shoes would be brushed to remove soil, then sprayed with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. Other personal gear would also be sprayed with the cleaning solution. Clothing would be washed with hot water and detergent. • Vehicles used off-road or in infected forest areas would be thoroughly cleaned using a pressure-washer and detergent. All soil would be removed from the tires and vehicle undercarriage. • If clearing or trimming of *'ōhi'a* is required for the proposed project, the cut wood would be left onsite and would not be transported.
Archaeological, Architectural, and Cultural Resources	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The following measures would be implemented to avoid and minimize potential impacts to archaeological resources, should they be discovered: • If previously unidentified archaeological resources were discovered during project activities, ground disturbing activities would be halted in the vicinity of the find and NSF would consult with the State Historic Preservation Division and other consulting parties, as appropriate, regarding eligibility for listing in the National Register of Historic Places, project effects, necessary mitigation, or other treatment measures. • An unanticipated discovery plan would be developed before construction activities to address archaeological and cultural resources that might be discovered. Measures to avoid and minimize impacts to culturally important species, including *'alalā* and Hawaiian hawk are addressed as part of Biological Resources.

Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Visual Resources	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize the potential for impacts to visual resources include the following: • To minimize the potential obtrusiveness of the proposed infrastructure, the tower and ancillary components would be designed to blend into the surrounding environment to the degree possible. The tower would be constructed of galvanized steel, which blends well with forest vegetation. Cloaking methodologies would be applied to decrease the visibility of specific objects, including the auxiliary portal and electrical lines.
Hazardous Materials	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize the potential for impacts related to hazardous materials include the following: • Use of proper handling and storage procedures for construction equipment fuel and lubricants • Routine inspection of vehicles and equipment for leaks
Air Quality	Construction: Minor, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize potential impacts on air quality include the following: • All construction vehicles and equipment would be maintained in proper tune according to manufacturer's specifications. • The number of vehicles accessing and moving within the project area would be limited to the extent possible. Vehicles speed on unpaved roads within the project area would be limited to 15 miles per hour or less. • Vehicles and equipment would not be allowed to idle for extended periods of time (i.e., greater than 20 minutes). • The extent of ground disturbance would be minimized where possible. Temporarily disturbed areas would be stabilized and revegetated as quickly as possible. • All trucks hauling soil or other loose materials would be covered. • The entrance to the project site would be stabilized to avoid offsite tracking of sediment.
Noise	Construction: Minor, short-term impact Operation: Minor, long-term impact	Pursuant to Hawaii Administrative Rules 11-46-7, a permit would be obtained from the State of Hawaii Department of Health to allow the operation of construction-related equipment, as needed. It is expected that the permit would restrict the times of day when construction activities may emit noise in excess of the maximum permissible sound levels. The Department of Health may also require the incorporation of noise mitigation into the construction plan. BMPs that would be implemented to reduce noise levels during construction are expected to include the following: • Proper tuning and balancing of construction equipment, and maintenance in accordance with the manufacturer's specifications • Use of noise barriers or mufflers on diesel and gasoline engines • Restriction of construction activities to typical working days/hours • Keeping unnecessary noise to a minimum Measures to avoid and minimize potential impacts during project operations include the following: • If needed, engineered mufflers may be added to the pumps to reduce noise levels during operations.
Transportation and Traffic	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential traffic-related impacts include the following: • Large vehicle deliveries along Stainback Highway would be timed to avoid typical commute hours to minimize the potential impacts to other motorists, particularly residents traveling to and from Mountain View via North Kūlani Road, to the extent possible. • The timing of large vehicle deliveries would also be coordinated with Kūlani Correctional Facility, as appropriate. • Traffic controls (including signage, flagging, or other similar methods) would be implemented as needed, to further minimize impacts to other vehicles travelling on Stainback Highway.

Summary of Potential Impacts and Proposed Mitigation Measures for NEON Domain 20 Field Site

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• Vehicular traffic within Pu'u Maka'ala NAR would be minimized to the extent practicable, so as to decrease potential roadway impacts. This effort will include (1) coordination of deliveries to minimize the total number of trips needed and (2) carpooling requirements for construction and operations staff.
Human Health and Safety	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize potential human health and safety impacts include the following: • All personnel and contractors working at the site would comply with applicable Occupational Safety and Health Administration (OSHA) regulations. • The construction contractor would develop and implement a Health and Safety Plan to minimize risks associated with potential hazards.
Public Services and Utilities	Construction: Negligible, short-term impact Operation: No impact	The proposed project would be expected to have a negligible impact relative to public services and utilities; no avoidance or minimization measures are proposed.
Socioeconomics	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact on socioeconomics; no avoidance or minimization measures are proposed.

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Appendix B
Estimated Timeframes for Construction Activities

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Estimated Timeframes for Construction Activities, Domain 20 Field Site

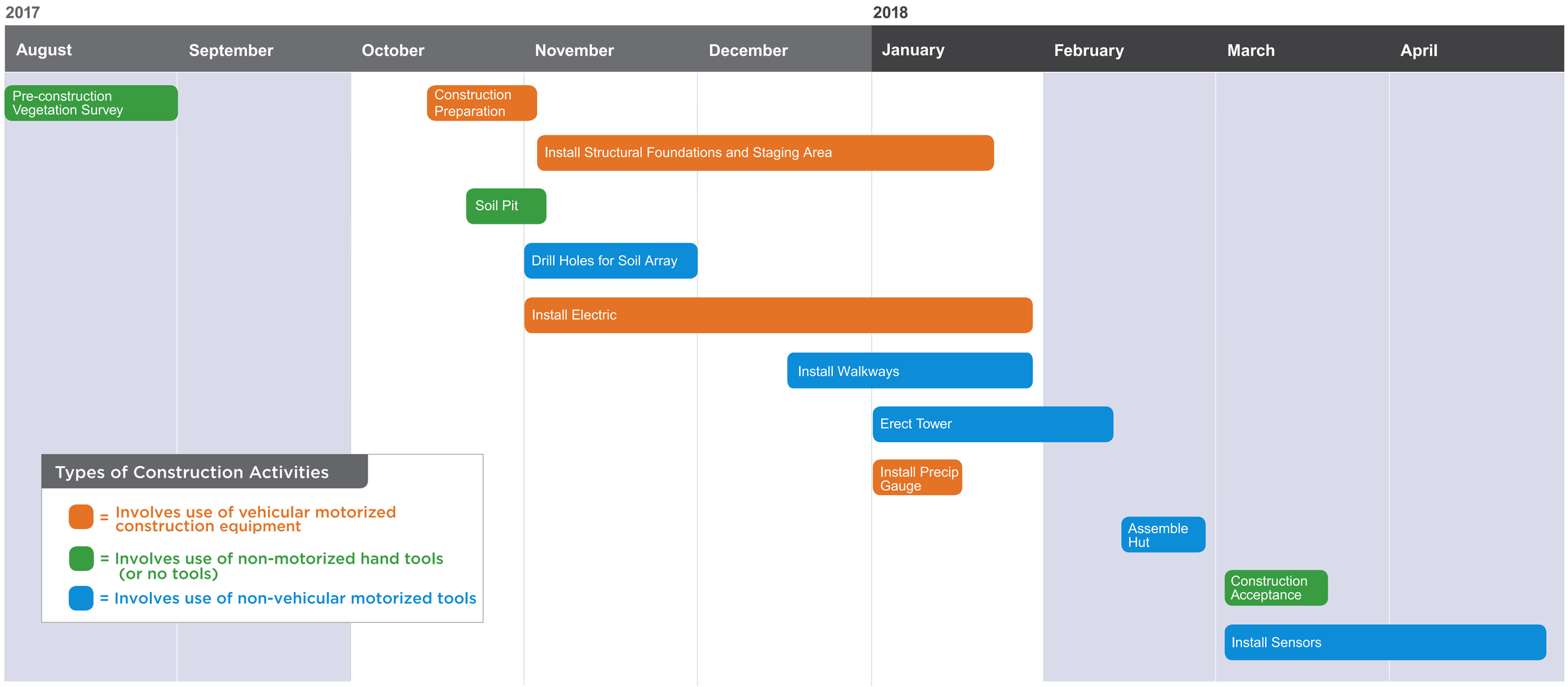
Nesting Seasons

Hawaiian Hoary bat breeding/pup season

Hawaiian Hawk breeding season

Honeycreeper & ‘Alala breeding season

Hawaiian Hawk breeding season



Types of Construction Activities

- = Involves use of vehicular motorized construction equipment
- = Involves use of non-motorized hand tools (or no tools)
- = Involves use of non-vehicular motorized tools

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Summary of Tasks to be Conducted During Construction Activities

Task	Activities
Pre-construction Surveys	Conduct pre-construction surveys in construction area by foot (place flags and stakes)
Install Structural Foundations and Staging Area	Transport concrete to site via existing access road (likely by motorized wheelbarrow, front-loading bobcat, or pump from concrete truck)
	Deliver pallets of grout to site for guy anchor holes via existing access road (transported with trailer or front-loading bobcat)
	Drill guy anchor foundation holes (water used to cool drill, water will be contained in a water truck)
	Use mini-excavator to break up subsurface rock for tower, hut and DFIR foundations (as needed)
	Clear staging area and bring in gravel with dump truck
	Use a front-loading bobcat to remove excavated rock
	Pour concrete (likely by motorized wheelbarrow, front-loading bobcat, or pump from concrete truck), mixed offsite
Soil Pit	Excavate soil pit using hand tools
Drill Holes for Soil Array	Drill holes for soil array (with hand-held motorized hammer drill and generator or by hand)
Install Electric Equipment	Install on-grade conduit (and underground at road crossings)
	Clear vegetation along path for electrical equipment (and honeycomb walkway)
	Use mini-excavator to install buried electric conduit across roadways
	Use small hand-held motorized hammer drill and generator to install anchors around conduit
	Use chainsaw to clear deadfall
	Install soil arbors using small hand-held motorized hammer drill and generator
	Install concrete cap over the in-ground conduit (likely by motorized wheelbarrow, front-loading bobcat, or pump from concrete truck)
Install Walkways	Roll out honeycomb walkway along path cleared during installation of electrical equipment
	Anchor honeycomb walkway using a hammer or hand-held motorized hammer drill and generator
	Install boardwalk piers using a hand-held motorized hammer drill and generator
	Clear deadfall with chainsaw
Erect Tower	Transport tower pieces to site on a trailer and assemble by hand
	Use "gin pole" (pully system with motorized spool/generator at the base of the tower) to pull materials up the tower
	Install guy lines (using electric motor and generator to pull wire, front-loading bobcat to carry the spool of wire)
Install Precipitation Gauge	Use mini excavator or auger to drill holes for DFIR fence posts
	Hand mix quickcrete for installation of posts
	hand drill/bolt the wooden slats for the fence
Assemble Hut	Transport hut components on a trailer or front-loading bobcat to the site (transported in 3' x 8' sections)
	Assemble the hut by hand with hand tools
	Bolt the hut to the foundation
	Install HVAC inside instrument hut
Construction Acceptance	Turn on HVAC and tower equipment to verify power is working
Install Tower and Soil Sensors	Install sensors on tower and in soil array (with hand drills and electric winch)

LEGEND

Use of non-motorized hand tools
Use of non-vehicular motorized tools
Use of vehicular construction equipment

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Appendix C
Estimated Timeframes for Sampling Activities during Typical Sampling Year

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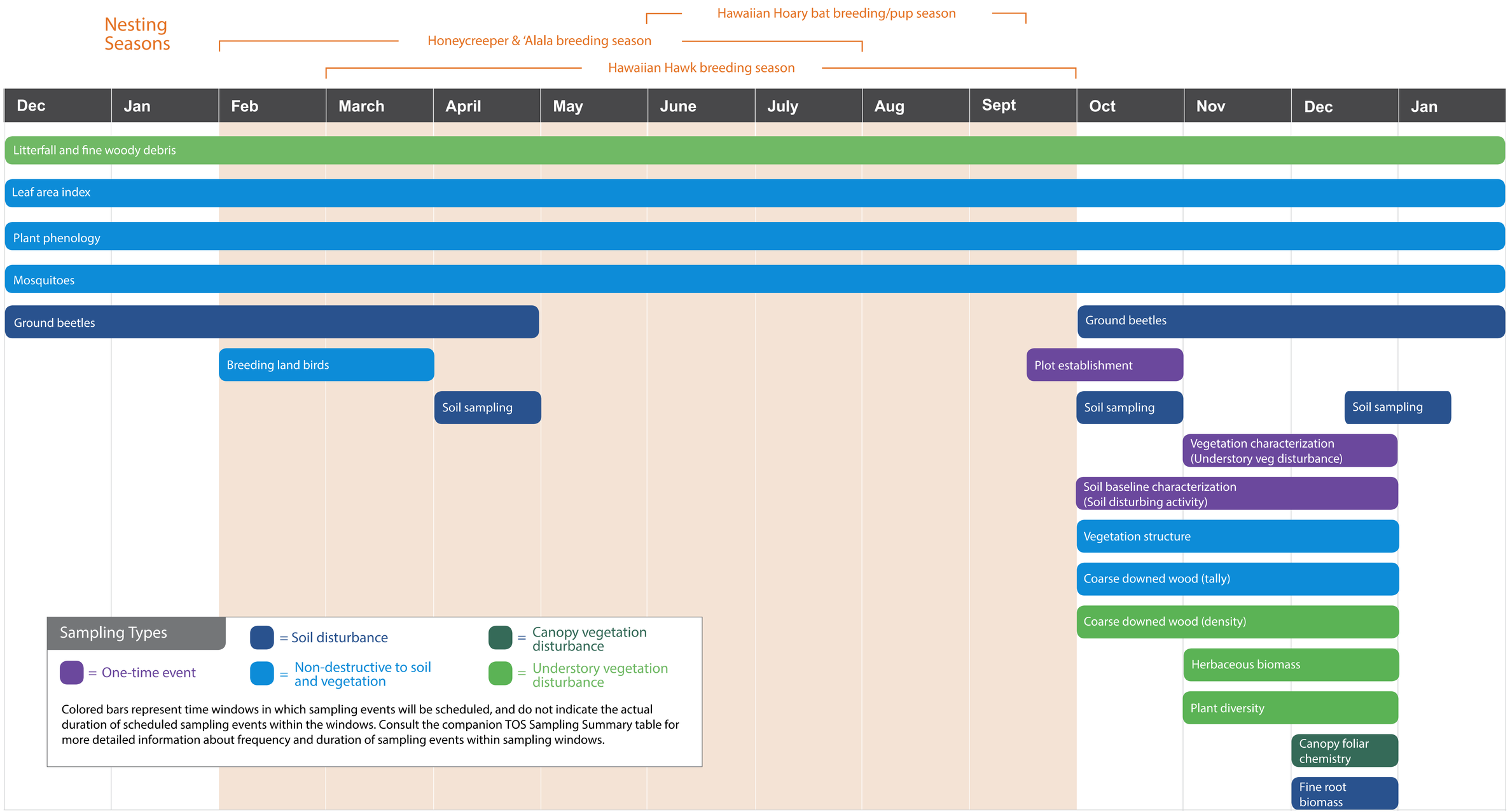
Estimated Timeframes for Sampling Activities During Typical Sampling Year, Domain 20 Field Site



Sampling Types

- = One-time event
- = Soil disturbance
- = Non-destructive to soil and vegetation
- = Canopy vegetation disturbance
- = Understory vegetation disturbance

Colored bars represent time windows in which sampling events will be scheduled, and do not indicate the actual duration of scheduled sampling events within the windows. Consult the companion TOS Sampling Summary table for more detailed information about frequency and duration of sampling events within sampling windows.

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Appendix D
Correspondence from U.S. Fish and Wildlife Service
(dated September 12, 2016)

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
01EPIF00-2016-TA-0479

Mr. Steven Ellis, Program Director
Division of Biological Infrastructure
Biological Sciences Directorate
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

SEP 12 2016

Subject: Technical Assistance for Proposed National Ecological Observatory Network Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve, Hawaii Island

Dear Mr. Ellis:

The U.S. Fish and Wildlife Service (Service) received your letter on August 11, 2016, requesting technical assistance for the National Science Foundation-funded proposed National Ecological Observatory Network (NEON) Domain 20 Core Tower and Sampling Site at Puu Makaala Natural Area Reserve (Puu Makaala NAR), Hawaii Island. The proposed site is to provide ecological data on NEON's Domain 20, "Pacific Neotropical in Hawaii," and would be the only site representing this domain in the United States. Site components would include an ecological research tower proposed to be approximately 30.5 meters tall, instrument hut, soil array, Double Fence Intercomparison Reference (DFIR) precipitation gauge (with required vegetation clearance area), and associated electrical infrastructure with power run. A suite of terrestrial sampling protocols and an annual aerial flight would occur within the greater permitted area in the Puu Makaala NAR. Terrestrial plot sampling and associated plot size would include the following: 20 Tower Plots-40x40 m; 6 Tick Plots-40x40 m; 30 Base Plots-40x40 m; 6-8 Mammal Grids-90x90 m; 5-15 Bird Grids-500x500 m; 2 Phenology Plots-200x200 m; and 10 Mosquito Points-5x5 m. The proposed project area including plots encompasses TMK (3) 2-4-008:009, TMK (3) 2-4-008:025, TMK (3) 1-9-001:001, TMK (3) 1-8-012:003 and TMK(3) 2-4-008:019, and would be permitted by the State of Hawaii via a Natural Area Reserve System (NARS) Special Use Permit and OCCL Use Permit.

Based on information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Project, there is one federally listed mammal in the vicinity of the project area, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*); eight federally listed birds, including the Hawaiian crow or alala (*Corvus hawaiiensis*), nene (*Branta sandvicensis*), Hawaiian hawk or io (*Buteo solitarius*), akiapolaau (*Hemignathus munroi*), Hawaii creeper, (*Oreomystis mana*), Hawaii akepa (*Loxops coccineus*), Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus newelli*); one

bird species proposed for listing, the band-rumped storm-petrel (*Oceanodroma castro*); and one bird species petitioned for listing, the iiwi (*Vestiaria coccinea*). There are fifteen federally listed plants in the vicinity of the project area: palai laau (*Adenophoros periens*), Mauna Loa silversword (*Argyroxiphum kauense*), *Asplenium peruvianum var. insulare*, oha wai (*Clermontia lindseyana*), oha wai (*Clermontia peleana*), haha (*Cyanea coplanadii*), akuaku (*Cyanea platyphylla*), haha (*Cyanea shipmanii*), haha (*Cyanea stictophylla*), haiwale (*Cyrtandra giffardii*), haiwale (*Cyrtandra tintinnabula*), kiponapona (*Pyllostegia racemosa*), *Phyllostegia velutina*, anunu (*Sicyos alba*), and Hawaiian vetch (*Vicia menziesii*). There is no proposed or final critical habitat within the vicinity of the project area. The Service recommends the following measures to avoid and minimize project impacts to listed species:

Hawaiian hoary bat

The Hawaiian hoary bat is known to occur across a broad range of habitats throughout the State of Hawaii. This bat roosts in both exotic and native woody vegetation and, while foraging, leaves young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the Hawaiian hoary bat breeding season (June 1 to September 15), there is a risk that young bats that cannot yet fly on their own could inadvertently be harmed or killed. The Service recommends that woody plants greater than 15 feet tall should not be removed or trimmed during the Hawaiian hoary bat breeding season. Additionally, Hawaiian hoary bats forage for insects from as low as three feet to higher than 500 feet above the ground. When barbed wire is used in fencing, Hawaiian hoary bats can become entangled. The Service therefore recommends that barbed wire not be used for fencing as part of this proposed action.

Hawaiian hawk

The Hawaiian hawk is known to occur across a broad range of forest habitats throughout the Island of Hawaii. Loud, irregular and unpredictable activities, such as using heavy equipment or building a structure, near an endangered Hawaiian hawk nest may cause nest failure. Harassment of Hawaiian hawk nesting sites can alter feeding and breeding patterns or result in nest or chick abandonment. Nest disturbance can also increase exposure of chicks and juveniles to inclement weather or predators. If any ground clearing or construction will occur during the Hawaiian hawk breeding season (March through September), we recommend a nest search of the project footprint and surrounding areas be conducted by a qualified ornithologist immediately prior to the start of construction activities. Pre-disturbance surveys for Hawaiian hawks are only valid for 14 days. If disturbance for the specific location does not occur within 14 days of the survey, another survey will be required. Surveys should ensure that construction activity will not occur within 1,600 feet of any Hawaiian hawk nest. If nesting Hawaiian hawks are present in the action area or within 1,600 feet of the action area, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Nene

The nene is currently found on all the main islands except Lanai and Kahoolawe. Nene are known to occupy various habitat and vegetation community types ranging from coastal dune vegetation and non-native grasslands (such as golf courses, pastures, and rural areas) to sparsely vegetated low- and high-elevation lava flows, mid-elevation native and non-native shrubland, cinder deserts, native alpine grasslands and shrublands, and open and nonnative alpine shrubland-woodland community interfaces. Nene do not occur in closed forest areas. Nene have an extended breeding season with eggs reported from all months except May, June, and July, although the majority of birds in the wild nest during the rainy (winter) season between October

and March. Nesting peaks in December and most goslings hatch from December to January. Nene nest on the ground, in a shallow scrape in the dense shade of a shrub or other vegetation. To avoid adverse impacts to nene, we recommend a qualified individual conduct surveys at the proposed project site for presence of nene prior to project(s) initiation. We further recommend if a nene is observed, or flies into the site while activities are occurring, all activities be halted within 100-ft (30-m) of the individual(s), and work should not resume until the nene leave the area on their own accord.

Forest Birds

Akiapolaau, Hawaii creeper, and Hawaii akepa, and iiwi (collectively known as forest birds) occur in forest habitats throughout the Island of Hawaii. The Hawaiian crow is planned to be introduced to Puu Makaala NAR in fall 2016. Loud, irregular and unpredictable activities, such as using heavy equipment or building a structure, near a nest of these species may cause nest failure. Harassment of nesting sites can alter feeding and breeding patterns or result in nest or chick abandonment. Nest disturbance can also increase exposure of chicks and juveniles to inclement weather or predators. If any ground clearing or construction will occur during the breeding season for these species (February through July), we recommend a nest search of the project footprint and surrounding areas be conducted by a qualified ornithologist immediately prior to the start of construction activities. Pre-disturbance surveys are only valid for 14 days. If disturbance for the specific location does not occur within 14 days of the survey, another survey will be required. Surveys should ensure that construction activity will not occur within 500 feet of any nest of Akiapolaau, Hawaii creeper, and Hawaii akepa, and 1,600 feet of any nest of Hawaiian crow. If listed forest birds are present in the action area or within 500 feet of the action area for Akiapolaau, Hawaii creeper, and Hawaii akepa and 1,600 feet of the action area for Hawaiian crow, we recommend you coordinate with the Service to develop appropriate avoidance and minimization measures dependent upon the site specific information.

Seabirds

Hawaiian petrels, Newell's shearwaters and band-rumped storm-petrels (collectively known as seabirds) are known to transit over the project area when flying between the ocean and upland breeding colonies. Many bird species are known to strike objects, such as antennas or guywires, protruding above surrounding vegetation. In Hawaii, seabirds are attracted to lights and are known to collide with buildings, light poles, wires, and other tall objects. Any lights associated with the projects should be cut-off, equipped with a motion sensor, or shielded so that the light cannot be seen from above. Fledging seabirds are especially affected by artificial lighting and have a tendency to exhaust themselves while circling the light sources and become grounded. Too weak to fly, these birds become vulnerable to depredation by feral predators such as small Indian mongoose (*Herpestres auropunctatus*), cats (*Felis catus*), and dogs (*Canis familiaris*). We therefore recommend avoiding or minimizing use of artificial lighting and avoiding night work if possible. If artificial lighting must be used we recommend this be shielded so the bulb is not visible at or above bulb-height. If night work must be conducted this should take place outside the sea bird fledging season (September 15 through December 15) and should utilize shielded lighting.

Plants

Listed plants are distributed throughout the Puu Makaala NAR. We recommend close coordination with Hawaii NARS to fully avoid any adverse impacts to listed plants during installation of proposed sampling grids.

Technical Assistance Regarding Rapid Ohia Death

Rapid Ohia Death (ROD), a newly identified disease, has killed large numbers of mature ohia trees (*Metrosideros polymorpha*) in forests and residential areas of Hawaii Island. The disease is caused by a vascular wilt fungus (*Ceratocystis fimbriata*). Crowns of affected trees turn yellowish or brown within days to weeks and dead leaves typically remain on branches for some time. All ages of ohia trees can be affected and can have symptoms of browning of branches or leaves. As of early 2015 the disease was confined to Hilo and the Puna district on Hawaii Island, but has since been confirmed in Volcano, South Kona, and Hamakua districts. Additional information on ROD can be found at http://www2.ctahr.hawaii.edu/forestry/downloads/ROD-trifold-03.2016.pdf and http://www2.ctahr.hawaii.edu/forestry/disease/ohia_wilt.html.

Many of our listed species are reliant on native ohia forest. The following avoidance and minimization measures should be followed for projects working in ohia forests or at sites with ohia trees on Hawaii Island:

- A survey of the proposed project site should be conducted within two weeks prior to any tree cutting to determine if there are any infected ohia trees. If infected ohia are suspected at the site, the following agencies should be contacted for further guidance.
    - USFWS – please contact the name at the bottom of this letter
    - Dr. J.B. Friday, University of Hawaii Cooperative Extension Service, 808-969-8254 or jbfriday@hawaii.edu
    - Dr. Flint Hughes, USDA Forest Service, 808-854-2617, fhughes@fs.fed.us
    - Dr. Lisa Keith, USDA Agriculture Research Service, 808-959-4357, Lisa.Keith@ars.usda.gov

- Both prior to cutting ohia and after the project is complete:
    - Tools used for cutting infected ohia trees should be cleaned with a 70 percent rubbing alcohol solution. A freshly prepared 10 percent solution of chlorine bleach and water can be used as long as tools are oiled afterwards, as chlorine bleach will corrode metal tools. Chainsaw blades should be brushed clean, sprayed with cleaning solution, and run briefly to lubricate the chain.
    - Vehicles used off-road in infected forest areas should be thoroughly cleaned. The tires and undercarriage of the vehicle should be cleaned with detergent if they have travelled from an area with ROD or travelled off-road.
    - Shoes and clothing used in infected forests should also be cleaned. Shoes should be decontaminated by dipping the soles in 10 percent bleach or 70 percent rubbing alcohol to kill the ROD Fungus. Other gear can be sprayed with the same cleaning solutions. Clothing can be washed in hot water and detergent.

- Wood of affected ohia trees should not be transported to other areas of Hawaii Island or interisland. All cut wood should be left on-site to avoid spreading the disease. The pathogen may remain viable for over a year in dead wood. The HDOA has passed a new quarantine rule that prohibits interisland movement, except by permit, of all ohia plant or plant parts.

Thank you for your efforts to conserve listed species and native habitats. Please contact Fish and Wildlife Biologist Jay Nelson (phone: 808-792-9441, email: jay_nelson@fws.gov) if you have any questions or for further guidance.

Sincerely,

Michelle Bogardus
Island Team Leader
Maui Nui and Hawaii Island

cc: Ms. Emma Yuen, NARS

From: Vetter, John <john_vetter@fws.gov>
Sent: Friday, July 07, 2017 2:03 PM
To: Futrell-Griggs, Montona
Cc: michelle_bogardus@fws.gov; jay_nelson@fws.com; Charrier, Jodi; Ellis, Steven; Blanco, Caroline M; Kettley, Lisa/HNL; Hamilton, Kristen; Rau, Michelle/COS; Amy Little
Subject: Re: Pu'u Maka'ala NEON Domain 20 Field Site Section 7 Consultation [EXTERNAL]
Attachments: Plantago_hawaiiensis_CH_PMNAR.pdf

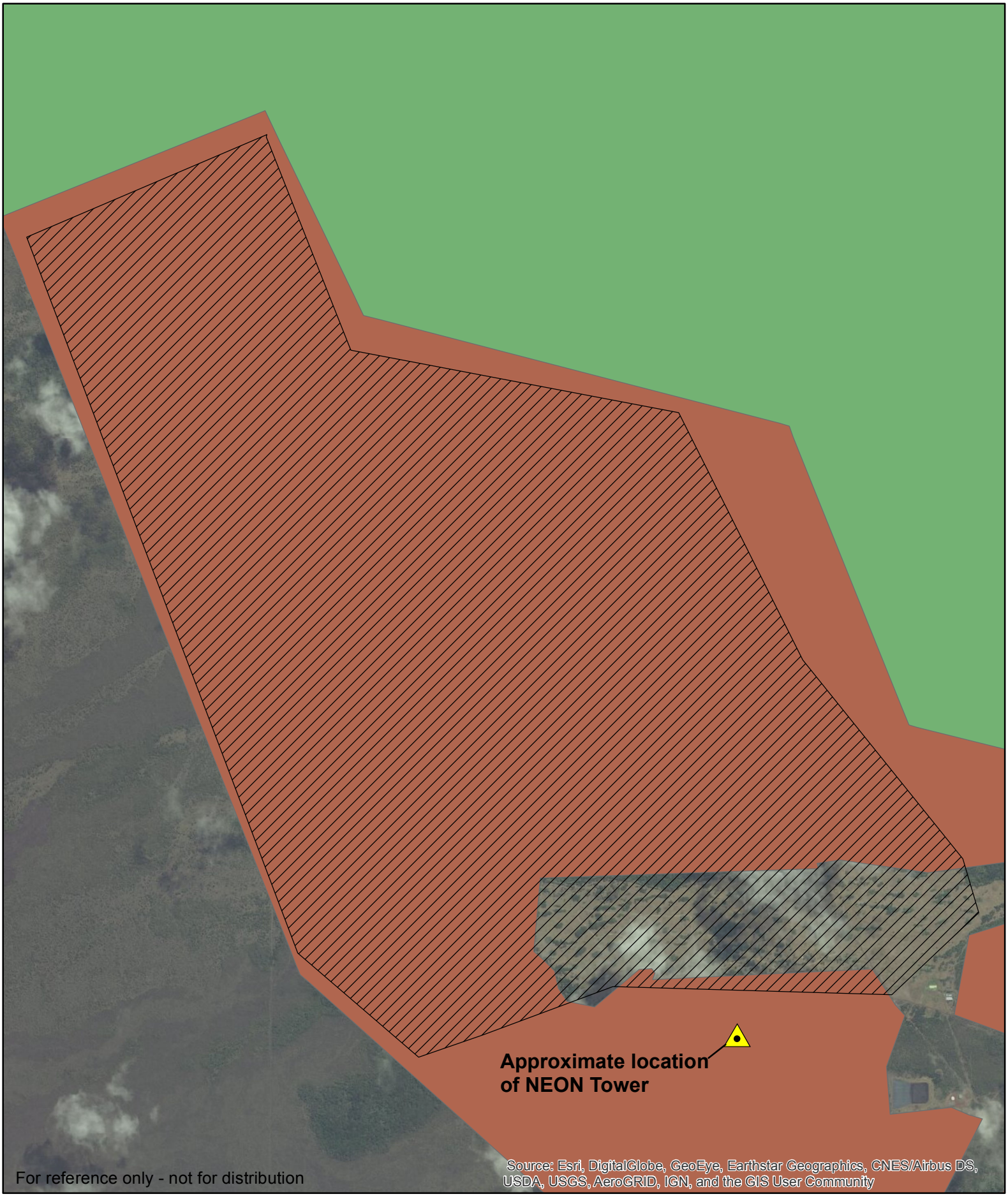
Good afternoon Montona,

I have been writing up the consultation for the NEON Domain 20 site at Puu Makaala Natural Area Reserve on Hawaii Island based on the information you provided. While working on this, I discovered that there is a species with critical habitat in the NAR that was not included in the BA that you sent. This was an oversight due to an error in the critical habitat notice when it was issued in 2003 - we apologize for not noticing this before. My analysis will need to include this species as well. I do not anticipate this causing any additional concerns nor delaying the BO. However, I did want to inform you of this fact, so that you are aware. The details on the species is below.

Plantago hawaiiensis was listed as endangered in 1994 and is endemic to the island of Hawaii. Critical habitat was designated in three units in 2003, including a portion of Puu Makaala NAR (see my basic map attached). In the critical habitat listing document for this species, the map for the third unit (Unit c), which is the portion within the NAR is mislabeled as *Phyllostegia hawaiiensis*, which is not a valid taxon. However, the waypoints included in that notice are labeled correctly as *Plantago hawaiiensis*. This was an error on the Service's part.

Please let me know if you have any questions about this. If you could acknowledge the inclusion of this species in the BO in a response, that would be great.

Thanks,
John


Approximate location
of NEON Tower
For reference only - not for distribution
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
N
W
E
S
Plantago hawaiiensis
Critical Habitat
Puu Makaala Natural Area Reserve
Upper Waiakea Forest Reserve

From: Futrell-Griggs, Montona <mfutrell@nsf.gov>
Sent: Tuesday, July 11, 2017 11:14 AM
To: Vetter, John
Cc: michelle_bogardus@fws.gov; jay_nelson@fws.com; Charrier, Jodi; Ellis, Steven; Blanco, Caroline M; Kettley, Lisa/HNL; Hamilton, Kristen; Rau, Michelle/COS; Amy Little
Subject: Re: Pu'u Maka'ala NEON Domain 20 Field Site Section 7 Consultation [EXTERNAL]

Good afternoon John,

The inclusion of *Plantago hawaiiensis* into the BO is acknowledged. Lisa has also incorporated the change into the Final EA. If you are able, could you provide us with the GIS data for this critical habitat unit?

We really appreciate all of the work that is going into the development of the BO. Please know that we are planning to go to the July 31st NARS Commission meeting so if there is an update before then that you can provide us, it would really be helpful for the discussions with the commission members.

Thank you,
Montona

Montona Futrell-Griggs
NEON Program/MSB Program/BIO Clearance Liaison
NSF-BIO/DBI
703-292-7162
4201 Wilson Blvd
Arlington, VA 22230

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Finding of No Significant Impact

Domain 20 Field Site for the National Ecological Observatory Network for the National Science Foundation

Pu‘u Maka‘ala Natural Area Reserve
South Hilo District, Hawai‘i Island, Hawai‘i

The National Ecological Observatory Network (NEON) is a continental-scale ecological observation facility sponsored by the National Science Foundation (NSF) and operated by Battelle Memorial Institute (Battelle). It is designed to gather and synthesize data needed to study the impacts of climate change, land use change and invasive species on natural resources and biodiversity. NSF is proposing to establish a NEON field study site within the Pu‘u Maka‘ala Natural Area Reserve (NAR) on the eastern side of Hawai‘i Island, part of the statewide Natural Area Reserves System (NARS). The proposed field study site would provide data for NEON’s Pacific Tropical domain (Domain 20), and would be the only site representing this domain for the continental-wide network.

NSF prepared an Environmental Assessment (EA) pursuant the National Environmental Policy Act (NEPA) and its implementing regulations (40 *Code of Federal Regulations* [CFR] Part 1500 through Part 1508) and NSF NEPA-implementing regulations (40 CFR 640). The EA was also prepared in compliance with Hawaii Revised Statutes (HRS) Chapter 343 and its implementing rules (Hawaii Administrative Rules [HAR] 11-200). The EA has been incorporated by reference into this Finding of No Significant Impact (FONSI).

Purpose and Need

Need for Action

The nation’s Grand Challenges in environmental science, which were reviewed by the National Research Council (NRC), the International Geosphere-Biosphere Programme, the Millennium Ecosystem Assessment, Diversitas, and the U.S. Climate Change Science Program, identify tasks within the environmental science field requiring additional research to yield scientific and practical information for the future. Three challenges were identified as causes of change in continental-scale ecology that could be addressed by a continental-scale observatory system: climate change, land use change, and invasive species.

NEON was developed in response to the Grand Challenges, and is the first ecological observatory network designed to test and develop ecological theory by detecting and forecasting ecological change at a continental-scale over multiple decades. It will establish and sustain the scientific infrastructure needed to address critical questions about land use and climate changes on ecological systems and to evaluate the impacts of those changes on the environment and human culture.

Based on comprehensive planning and design efforts completed to date, sites in many of the other 19 ecoclimatic domains are currently either under construction or are complete. The target is for the entire network of field study sites to be fully operational by 2018. However, the NEON project team determined that it is not feasible to construct the core field study site for the Pacific Tropical domain (Domain 20, represented by the Hawaiian Islands) at Laupāhoehoe NAR, the location that was originally selected for implementation. To complete the continental-scale network and dataset representing the full spectrum of environmental variability across the United States, Alaska, Hawai‘i, and Puerto Rico,

construction and operation of a core field study site that meets the NEON site criteria is needed to represent Domain 20.

Project Purpose

The purpose of the proposed project is to construct and operate a core field study site for Domain 20 as part of NEON. A uniform and standardized design across the network of sites is essential to informing the science, testing the hypotheses, and conducting research at a continental scale. Similar to other NEON core sites, the proposed Domain 20 site in Hawai'i would include a standard set of scientific infrastructure and equipment to collect abiotic, biological, biophysical, biogeochemical, and land use data. The proposed scientific infrastructure and equipment would include one tower, a panelized modular enclosure (referred to as an instrument hut), an array of soil plots with soil sensors, a soil horizon pit, a precipitation gauge, electrical equipment, and a suite of distributed terrestrial sampling protocols. The site would be operated for 30 years, with data collection and streaming to the online NEON portal starting in 2018. Such data would be made freely available to the scientific community and general public for use in analyzing ecological conditions in the Hawaiian Islands and would be comparable to data collected across the continental United States, Puerto Rico, and Alaska.

Description of Proposed Action and Alternatives

Uniform infrastructure and standardized data collection methods are required to achieve the overall NEON objectives. Some modifications have been made to tailor the infrastructure and sampling protocols to the local ecology and site-specific conditions. However, alternatives based on fundamentally different technologies, scientific infrastructure and equipment, sampling protocols, and implementation timing and schedule were not considered, as these would not be consistent with NEON's standardized approach, and therefore, would not meet the project's purpose and need.

A range of locations were considered for the Domain 20 field study site as part of a detailed identification and selection process. This process included input from the ecological research community and other stakeholders, and an in-depth evaluation of scientific data collection needs, constructability and impacts to sensitive resources. Given the substantial screening of alternative sites over the course of this process and the site suitability requirements for NEON, only a single alternative was identified as viable for consideration (in addition to the No Action alternative).

Alternatives Considered but Not Carried Forward

As summarized in Section 1.1 of the EA, a thorough process was conducted to identify, evaluate, and select sites for deployment of NEON infrastructure within each of the 20 domains. The NEON project team established site criteria and a detailed selection and review process. Specific site criteria for field study sites include (1) a "wildland" area comprised of undeveloped, natural land representing the dominant vegetation and soil type for that domain, (2) contiguous habitat over an area large enough to implement the sampling protocols, (3) areas subject to minimal disturbance (i.e., not pristine, but still high quality habitat), (4) adequate soil depth to implement sampling protocols, (5) site accessibility, and (6) proximity to an existing power supply.

Through the site selection process, the location of the core field study site identified for Domain 20 was within the Laupāhoehoe Forest unit of the Hawai'i Experimental Tropical Forest, located in the North Hilo District on Hawai'i Island. This area is managed by the DLNR Division of Forestry and Wildlife (DOFAW) and the U.S. Forest Service (USFS) for protection of natural resources. The proposed Laupāhoehoe site was subsequently determined to be unsuitable because of logistical challenges in implementing the design. At the time the site selection and evaluation process was completed, it was

believed that the power requirements for the infrastructure could be met through supplemental power sources, as no power is available onsite. However, through the detailed design process, it was determined that the power requirements were more substantial, and would require a dedicated electrical line to the site. The lack of access to power and the need to bring in an electrical line over a long distance prevented this location from being further pursued as a viable site.

Following dismissal of the Laupāhoehoe site, the NEON project team coordinated with the ecological research community and DOFAW staff to identify a suitable replacement site. Through this effort, the Upper Waiakea Forest Reserve was recommended for consideration based on the known site conditions and NEON project requirements. Detailed evaluation of site conditions and scientific suitability, as well as stakeholder outreach was conducted over the course of more than a year. Through this process and based on input from DOFAW staff, it was determined that the forest reserve is heavily used by the public for hunting. In the interest of minimizing potential conflicts with recreational use by the local community, DOFAW staff recommended the site instead be located within the boundary of a Natural Area Reserve (NAR), where there is less visitation by the public and hunting is not allowed. Based on the potential for the Domain 20 core site to be incompatible with ongoing hunting activities, the Upper Waiakea Forest Reserve site was dismissed from further consideration.

Subsequent to the dismissal of the Upper Waiakea Forest Reserve site and at the recommendation of DOFAW staff, the NEON project team reviewed multiple sites within the Pu‘u Maka‘ala NAR. An iterative process involving multiple site visits and site evaluations was conducted in coordination with DOFAW and NARS staff. In total, 11 possible sites were initially identified within Pu‘u Maka‘ala NAR based on the NEON requirements and high-level information regarding site conditions. Again, an iterative process involving multiple site visits and site evaluations was conducted in coordination with DOFAW and NARS staff. Eleven possible sites within the NAR were initially considered, one of which was unanimously identified as the most suitable replacement site.

Proposed Action Alternative

The proposed action alternative (proposed project) involves construction and operation of the Domain 20 core field study site within Pu‘u Maka‘ala NAR, as part of the continental-scale network of long-term ecological infrastructure deployments for NEON. The scientific infrastructure would be installed in the northwestern portion of the NAR, approximately 1 mile (1.7 kilometers) northwest of the Kūlani Correctional Facility. Terrestrial sampling protocols would be conducted within distributed sampling plots located in the surrounding areas within Pu‘u Maka‘ala NAR.

This site was selected as the proposed location for Domain 20 because it was determined to be the best fit based on the NEON scientific requirements and Pu‘u Maka‘ala NAR management goals. Site-specific characteristics that make the selected location highly suitable for construction and operation of the Domain 20 core field study site include the following:

- The forest in this area is highly representative of the dominant vegetation and soil types across the Hawaiian Islands. It is relatively high-quality, intact habitat with very little development, which meets the NEON criteria for a “wildland” area. However, the scientific infrastructure would be within an area that has been subject to some degree of disturbance, such that it would not affect otherwise pristine forest habitat. The site includes adequate ground and canopy openings such that the tower and instrument hut can be installed with a very minimal amount of vegetation clearing and trimming. In addition, former pastureland located adjacent to the forested area would allow for the precipitation gauge to be proximate to the tower without impacting native species.

- The soils are deeper than those encountered at alternative sites, which provides better opportunity to implement NEON's proposed soil protocols and installation of soil sensors.
- The site is readily accessible by existing access roads, but does not overlap with any trails or other recreational resources. The area does not support hunting (as it is located within ungulate fencing), and given its proximity to the Kūlani Correctional Facility, the site is rarely (if ever) accessed by the public.
- Existing electrical lines are located reasonably close to the proposed site, thus minimizing the distance of the proposed power run.

As a core field study site in NEON, the proposed project includes deployment of standardized infrastructure and equipment, as well as terrestrial sampling and data collection consistent with NEON protocols. For a detailed explanation of the project components, please see Section 2.2.1 of the EA.

No Action Alternative

Because the Council on Environmental Quality (CEQ) regulations for implementing NEPA require consideration of the No Action Alternative (40 CFR 1502.14(d)), a No Action Alternative is evaluated in the EA. The No Action Alternative would not satisfy the need for action. Inclusion of the No Action Alternative serves as a benchmark for evaluating the potential effects of the proposed project.

Under the No Action Alteration, NEON research infrastructure and equipment would not be deployed to the site within Puʻu Makaʻala NAR to represent Domain 20. Biological, biophysical, biogeochemical, and land use data would not be collected or made available to the ecological sciences research community. Implementation of the No Action Alternative would eliminate the opportunity to study ecosystem responses and changes at the local scale in Hawaiʻi as part of NEON. In addition, it would preclude integration of data from the Pacific Tropical domain into the continental-wide dataset, thus reducing the potential for broad-scale analysis and the overall integrity of NEON.

Environmental Impacts and Mitigation Measures

The EA, which is incorporated by reference into this FONSI, examined the potential effects of the proposed project on environmental and socioeconomic resources. Mitigation measures or best management practices (BMPs) that would be implemented to avoid or minimize potential impacts were identified, where relevant. Table 1 provides a summary of the anticipated impacts and associated mitigation measures. In addition to the mitigation measures summarized in Table 1, any additional measures identified in the US Fish and Wildlife Service (USFWS) Biological Opinion (BO) would also be implemented.

Agency Coordination and Public Participation

Stakeholder engagement has been conducted to comprehensively address NSF policies, as well as to comply with specific regulatory requirements relating to public involvement and agency consultation. In particular, NEPA and HRS Chapter 343 require the opportunity for public participation as part of the environmental review process. All agencies, organizations, and members of the public having a potential interest in the proposed project were urged to participate. In addition, consultation was conducted for other federal regulations, including National Historic Preservation Act (NHPA) Section 106 and Endangered Species Act (ESA) Section 7.

Sections 1.5 and 5.1 of the EA summarize the efforts conducted by NSF relative to agency coordination and public participation. The EA was revised, based on comments received during the public review period and from consulting agencies.

Conclusion

Based on the findings of the EA, as summarized above and incorporated by reference, it has been determined that the implementation of the proposed project would have no significant direct, indirect or cumulative impacts on the quality of the natural or human environment. Because no significant environmental impacts would result from implementing the Proposed Action, an environmental impact statement (EIS) is not required and will not be prepared.

Decision

NSF will issue its final decision upon issuance of the BO by USFWS and after all other compliance requirements and environmental clearances have been obtained.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
General	N/A	A Project Work Plan detailing the SOPs would be developed and executed. The Plan would be subject to DOFAW/NARS approval (with a request for review and input from USFWS) before project implementation, and would continue to be refined over the lifetime of the project. SOPs would include (but not be limited to) the following (as summarized in EA Section 2.2.2): • Communication Procedures • Staff Training • Decontamination Procedures • Site Access and Route Planning • Ongoing Impact Assessment and Adaptive Mitigation • Vegetation Trimming • Collection of Listed Plant Species • Stakeholder and Community Engagement
Climate	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact relative to climate; no avoidance or minimization measures are proposed.
Land Use and Recreation	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact relative to land use and recreation; no avoidance or minimization measures are proposed.
Geology and Soils	Construction: Minor, short-term impact Operation: Minor, short-term impact (decommissioning)	Measures to avoid and minimize potential impacts related to soil erosion include the following: • The extent of ground disturbance would be minimized to the extent practicable. • Temporarily disturbed areas would be stabilized and revegetated as quickly as possible.
Water Resources	Construction: Negligible, short-term impact Operation: Negligible, short-term impact (decommissioning)	Measures to minimize the potential for water quality impacts to receiving waters would be implemented during construction and operation (particularly decommissioning), and are expected to include the following: • Erosion and sediment control measures (such as silt fences) would be installed before earth-moving activities are initiated, and would be inspected and properly maintained throughout the construction period. • Disturbance of soil would be minimized during periods of heavy rain. • Vehicles and equipment would be inspected for leaks or contamination daily. • In the event of a spill/leak of fuel or lubricants from onsite equipment, the materials would be cleaned in a timely manner and disposed at an approved site.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Biological Resources (Vegetation)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on vegetation include: • Any vegetation removal required during construction or operation would be conducted in accordance with the SOPs for the project (see Section 2.2.2), including prior approval by the NEON science team, permitting team and site host. A qualified arborist with specific knowledge of the target species and site conditions would be engaged, as needed. • Terrestrial sampling activities would be conducted in accordance with the SOPs for the proposed project, particularly those related to site access, route planning, and ongoing impact assessment and mitigation. • In sampling plots where tree tagging is needed, coiled wire would be wrapped around the tree (instead of using standard tree tags) to avoid physical impact to the tree. • Areas temporarily disturbed during construction, decommissioning, or both, would be revegetated. Revegetation efforts would utilize species (or propagules of such species) that are native to the area and appropriate for the specific disturbed area. Revegetation efforts would be coordinated with DOFAW and NARS staff.
Biological Resources (Wildlife)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts on wildlife include those listed as part of the SOPs (see Section 2.2.2), including site access and route planning efforts designed to limit potential disturbance, and ongoing impact assessment and mitigation.
Biological Resources (Critical Habitat)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts to critical habitat include: • The distributed plots are sufficiently large to allow discretion in the location of soil and vegetation sampling, and beetle pitfall traps within the larger distributed plot, and these locations would be selected in coordination with DOFAW and NARS staff.
Biological Resources (Threatened and Endangered Species)	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential impacts to threatened and endangered species include: **Plant Species** • Preconstruction surveys would be conducted throughout the construction limits. If a protected plant species is identified, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid potential impacts. • Temporary protective fencing would be erected around any protected plant species located adjacent to the access road or construction limits. • The clip harvesting of herbaceous plant material would be specifically sited to avoid protected species. Similarly, the foliar biogeochemistry sampling, which involves harvest of sunlit canopy dominant species would be sited to avoid any trees with protected plant species growing into the canopy. If it is subsequently determined that collection or harvest of a threatened or endangered plant species is necessary to achieve the project's scientific goals, then the NEON researcher would obtain appropriate federal and state permits prior to any such collection. • Researchers would be trained to identify protected plant species and would select microsites for activities within the sampling plots (e.g., soil sampling or beetle traps) that would not result in removal of or damage to protected plant species. ***Nēnē*** • A biologist familiar with the nesting behavior of the *nēnē* would survey suitable habitat within the construction area before the initiation of any construction activities, or after any subsequent delay in work of 3 or more days (during which time, the birds could attempt nesting). If a nest were discovered, USFWS would be contacted.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• All NEON staff would be trained to identify *nēnē* and know the appropriate steps to take if *nēnē* are present within the project area or encountered in transit to sampling locations. • If a *nēnē* is encountered within the project area, the bird would not be approached, and all activities within 100 feet of the bird would cease until the bird leaves the area of its own volition. • If a *nēnē* is encountered while in transit to a sampling location, the researcher(s) would stop and remain in place until the bird moved more than 100 feet from the travel route of its own volition or slowly retreat and return for sampling at a later time. • A maximum speed limit of 15 mph would be enforced for all project vehicles traveling within the project site to minimize potential collisions with *nēnē*. ***Hawaiian Hawk*** • Vegetation clearing or construction would be avoided during the Hawaiian hawk breeding season (March through September) to the extent possible. If it is not possible to avoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest is found) would be coordinated with USFWS. • If determined to be needed, nesting deterrents would be placed on the tower. Any deterrent used would first be approved by USFWS and DOFAW. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. • NEON staff would be trained to recognize the Hawaiian hawk and their nests. In the event that a Hawaiian hawk nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest were identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied. **Honeycreepers (*ʻakiapōlāʻau*, Hawaiʻi *ʻākepa*, *alawi*, and *ʻiʻiwi*)** • Vegetation clearing and construction activities would be avoided during the honeycreepers' nesting season (February through July), to the extent possible. If it is not possible to avoideavoid vegetation clearing or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 500 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. ***ʻAlalā*** • Vegetation clearing and construction activities would be avoided during the *ʻalalā* breeding season (February through July), to the extent possible. If it is not possible to avoid vegetation clear or construction during these months, a nest survey would first be conducted by a qualified biologist. The survey would be conducted no more than 14 days before the start of vegetation clearing or construction, and would include all areas within 1,600 feet of the construction area. Appropriate survey methodology (including avoidance and minimization measures in the event a nest occurs) would be coordinated with USFWS. • The use of shiny materials would be minimized and shiny surfaces would be masked to decrease their attractiveness to *ʻalalā*. Specifically, the tower would be constructed of materials that are a dull, galvanized gray. An exterior treatment involving dark or dull colors would be added to any shiny surfaces, such as power boxes and communication equipment.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
		• All trash would be placed into appropriate containers and promptly removed from the project site, to avoid inadvertent discarding of shiny materials or other items that may be of interest to *ʻalalā*. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. • The beetle traps would be fitted or retrofitted, depending on timing of *ʻalalā* releases, with chicken wire to limit the extent to which *ʻalalā* could access the traps. Any preservatives used in the beetle traps would be verified to be non-toxic to birds. • Noise dampening mufflers would be developed to further reduce noise from the tower and instrument hut, as needed. • NEON staff would be trained to recognize *ʻalalā* and their nests. In the event that an *ʻalalā* nest is identified within or directly adjacent to a terrestrial sampling plot, sampling activities would be temporarily halted until the nest is no longer occupied. If a nest is identified along the pedestrian route to a sampling plot, an alternate route that is at least 1,600 feet from the nest would be used until the nest were no longer occupied. **Seabirds** • Construction activities would be restricted to daylight hours to avoid the use of nighttime lighting that could attract seabirds. • Installation of outside lighting would be avoided, to the extent possible. If outside lights are required for safety or security purposes, directional lighting or shielded lighting would be used to prevent upward radiation. The shields would be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below. Outside lights that are not needed for security and safety would be turned off from dusk through dawn during the seabird fledging season (September 15 to December 15). • The guy wires for the research tower would not extend above the top of the tree canopy to minimize the potential for bird strikes. • The guy wires for the research tower would be fitted with bird flight diverters to increase their visibility to birds. **Hawaiian Hoary Bat** • No trees taller than 15 feet are planned to be trimmed or removed as a result of the project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees. However, if it is subsequently determined that a limited number of trees need to be trimmed or removed during that time period, a qualified biologist would conduct observations following standard protocols to determine whether any of the trees that would be removed are being used by bats and could harbor juveniles. If any trees are determined to be used by bats, they would not be trimmed or removed until after September 15. • No fences are proposed to be installed as part of the proposed project. In the event a fence is needed; it would have barbless top-strand wire to prevent entanglement of Hawaiian hoary bats on barbed wire. **Picture-Wing Fly** • No *loulu* or wet montane forest habitat would be cleared or trimmed, nor would vegetation biomass be harvested as part of sampling within areas that are designated critical habitat for *Drosophila mulli*. If *loulu* is to be cleared, trimmed or harvested in portions of the project area that are not within designated critical habitat, they would first be inspected for *Drosophila mulli* by a qualified biologist. If *Drosophila mulli* are found, the NEON project team would work directly with DOFAW and NARS staff to adjust the construction limits or implement design modifications to avoid impacts to the occupied *loulu*. Temporary protective fencing would be installed around the occupied *loulu*, as appropriate. • Mosquito traps would not be installed within 1,000 feet of critical habitat for *Drosophila mulli* or any location where the species was previously documented within Puʻu Makaʻala NAR.
Biological Resources (Invasive Species)	Construction: Minor, short-term impact	To avoid and minimize the potential for introduction and spread of invasive species, the sanitation procedures utilized by DOFAW/NARS staff will be implemented over the lifetime of the project. The current procedures are listed below; any future modifications or additions made by DOFAW/NARS will be incorporated, as appropriate.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
	Operation: Minor, long-term impact	• All vehicles, tools, equipment and building materials, and packaging and shipping containers will be cleaned and fumigated before being shipped to Hawai'i and again once they arrive. The same protocol will be followed before leaving the local port. • All vehicles, equipment, and materials will be stored offsite at a clean staging area and will be subject to sanitation protocols daily before they are returned to the site. This measure will be randomly inspected for compliance and enforced. • All other materials (including personal equipment and boots) will be inspected for foreign matter (including dirt, seeds, eggs, larvae, or other propagules) and cleaned before entering the site. • All workers would be instructed on specific procedures to prevent the introduction and spread of invasive species in the project area. • All trash, including food waste, would be placed into appropriate containers, removed from the project site, and properly disposed of. • NEON domain staff would conduct regular monitoring for invasive species within the project area throughout the operational period. If invasive species were detected, removal and control would be coordinated with the NARS Specialist. To avoid and minimize the potential for Rapid *'Ōhi'a* Death to spread to the proposed project area, the sanitation procedures set forth by the Rapid *'Ōhi'a* Death multi-agency working group would be implemented throughout construction and operations of the NEON site. The current procedures are listed below; any future modifications or additions to these procedures will be adopted for the proposed project, as appropriate. • A survey of the proposed project site would be conducted no more than two weeks before any tree cutting to determine if there are any infected *'ōhi'a* trees. If infected *'ōhi'a* are suspected at the site, the appropriate agencies would be contacted for further guidance (including USFWS, University of Hawai'i Cooperative Extension Service, USDA Forest Service and USDA Agriculture Research Service). • Tools used to cut *'ōhi'a* would be cleaned with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. If a bleach solution is used, tools would be oiled afterwards to prevent corrosion. Chainsaw blades would be brushed clean, sprayed with the cleaning solution, and run briefly to lubricate the chain. • Personal gear, including shoes and clothes, would be cleaned before and after entering the forest. Shoes would be brushed to remove soil, then sprayed with a 70 percent rubbing alcohol solution or a freshly prepared 10 percent chlorine bleach solution. Other personal gear would also be sprayed with the cleaning solution. Clothing would be washed with hot water and detergent. • Vehicles used off-road or in infected forest areas would be thoroughly cleaned using a pressure-washer and detergent. All soil would be removed from the tires and vehicle undercarriage. • If clearing or trimming of *'ōhi'a* is required for the proposed project, the cut wood would be left onsite and would not be transported.
Archaeological, Architectural, and Cultural Resources	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The following measures would be implemented to avoid and minimize potential impacts to archaeological resources, should they be discovered: • If previously unidentified archaeological resources were discovered during project activities, ground disturbing activities would be halted near the find and NSF would consult with the SHPD and other consulting parties, as appropriate, regarding eligibility for listing in the NRHP, project effects, necessary mitigation, or other treatment measures. • An unanticipated discovery plan would be developed before construction activities to address archaeological and cultural resources that might be discovered. Measures to avoid and minimize impacts to culturally important species, including *'alalā* and Hawaiian hawk are addressed as part of Biological Resources.
Visual Resources	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize the potential for impacts to visual resources include the following: • To minimize the potential obtrusiveness of the proposed infrastructure, the tower and ancillary components would be designed to blend into the surrounding environment to the degree possible. The tower would be constructed of galvanized steel, which blends well with forest vegetation. Cloaking methodologies would be applied to decrease the visibility of specific objects, including the auxiliary portal and electrical lines.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Hazardous Materials	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize the potential for impacts related to hazardous materials include the following: • Use of proper handling and storage procedures for construction equipment fuel and lubricants • Routine inspection of vehicles and equipment for leaks
Air Quality	Construction: Minor, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize potential impacts on air quality include the following: • All construction vehicles and equipment would be maintained in proper tune per manufacturer's specifications. • The number of vehicles accessing and moving within the project area would be limited to the extent possible. Vehicles speed on unpaved roads within the project area would be limited to 15 miles per hour or less. • Vehicles and equipment would not be allowed to idle for extended periods of time (i.e., greater than 20 minutes). • The extent of ground disturbance would be minimized where possible. Temporarily disturbed areas would be stabilized and revegetated as quickly as possible. • All trucks hauling soil or other loose materials would be covered. • The entrance to the project site would be stabilized to avoid offsite tracking of sediment.
Noise	Construction: Minor, short-term impact Operation: Minor, long-term impact	Pursuant to HAR 11-46-7, a permit would be obtained from HDOH to allow the operation of construction-related equipment, as needed. It is expected that the permit would restrict the times of day when construction activities may emit noise in excess of the maximum permissible sound levels. The HDOH may also require the incorporation of noise mitigation into the construction plan. BMPs that would be implemented to reduce noise levels during construction are expected to include the following: • Proper tuning and balancing of construction equipment, and maintenance in accordance with the manufacturer's specifications • Use of noise barriers or mufflers on diesel and gasoline engines • Restriction of construction activities to typical working days/hours • Keeping unnecessary noise to a minimum Measures to avoid and minimize potential impacts during project operations include the following: • If needed, engineered mufflers may be added to the pumps to reduce noise levels during operations.
Transportation and Traffic	Construction: Minor, short-term impact Operation: Minor, long-term impact	Measures to avoid and minimize potential traffic-related impacts include the following: • Large vehicle deliveries along Stainback Highway would be timed to avoid typical commute hours to minimize the potential impacts to other motorists, particularly residents traveling to and from Mountain View via North Kūlani Road, to the extent possible. • The timing of large vehicle deliveries would also be coordinated with Kūlani Correctional Facility to minimize impacts to their staff and visitors, as appropriate. • Traffic controls (including signage, flagging, or other similar methods) would be implemented as needed, in coordination with the HDOT District Engineer, to further minimize impacts to other vehicles travelling on Stainback Highway. • Vehicular traffic within Pu'u Maka'ala NAR would be minimized to the extent practicable, to decrease potential roadway impacts. This effort will include (1) coordination of deliveries to minimize the total number of trips needed and (2) carpooling requirements for construction and operations staff.

TABLE 1
Summary of Potential Impacts and Proposed Mitigation Measures

Resource Category	Impacts	Mitigation Measures to Avoid or Minimize Impact
Human Health and Safety	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	Measures to avoid and minimize potential human health and safety impacts include the following: • All personnel and contractors working at the site would comply with applicable OSHA regulations. • The construction contractor would develop and implement a Health and Safety Plan to minimize risks associated with potential hazards.
Public Services and Utilities	Construction: Negligible, short-term impact Operation: No impact	The proposed project would be expected to have a negligible impact relative to public services and utilities. Measures to avoid and minimize potential impacts to public services and utilities include the following: • Notification would be provided to NOAA prior to the start of construction and sensor installation, such that they can monitor data from the NWR system for any variances.
Socioeconomics	Construction: Negligible, short-term impact Operation: Negligible, long-term impact	The proposed project would be expected to have a negligible impact on socioeconomics; no avoidance or minimization measures are proposed.