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November 22, 2011

Gary Hooser, Director
Office of Environmental Quality Control
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813

Dear Mr. Hooser,

Subject: Draft Supplemental Environmental Assessment for the Kahikinui Koa Forest Protection and Restoration, TMK 2nd 1-8-001:005, 006, 009, Hana District, Maui, Hawai'i.

Dear Director:

The Department of Land and Natural Resources has reviewed a Draft Supplemental Environmental Assessment (SEA) for the subject project, and anticipates a Finding of No Significant Impact (FONSI) determination. Please publish notice of availability for this project in the next available OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form and one (1) copy of the document in pdf format on a CD; and one (1) hardcopy of the Draft EA. Please call David Leonard at 783-2163 or David.L.Leonard@hawaii.gov if you have any questions.

Sincerely,

Paul J Conry

PAUL J. CONRY, Administrator
Division of Forestry and Wildlife

Publication Form
The Environmental Notice
Office of Environmental Quality Control

Instructions: Please submit one hardcopy of the document along a with determination letter from the agency. On a compact disk, put an electronic copy of this publication form in MS Word and a PDF of the EA or EIS. Please make sure that your PDF documents are ADA compliant. Mahalo.

Project Name: Kahikinui Koa Forest Protection and Restoration, Nakula Ahupua'a, Island of Maui, Hawai'i

Applicable Law: This document is prepared pursuant to the Hawai'i Environmental Act, Chapter 343, Hawai'i Revised Statutes, and Title 11, Chapter 200, Hawai'i Department of Health Administrative Rules.

Type of Document: DRAFT Supplemental Environmental Assessment (SEA)

Island: Maui
District: Hana
TMK: 2nd 1-8-001:005, 006, 009
Permits Required: None

Applicant or
Proposing Agency:
State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife
1151 Punchbowl Street Rm. 325, Honolulu, HI 96813

Contact - David Leonard, Ph.D., Hawaii Division of Forestry and Wildlife, Cell (808) 783-2163

Approving Agency:
Division of Forestry and Wildlife, State of Hawai'i Department of Land and Natural Resources
1151 Punchbowl Street Rm. 325, Honolulu, HI 96813

Accepting Authority:
Division of Forestry and Wildlife, State of Hawai'i Department of Land and Natural Resources
1151 Punchbowl Street Rm. 325, Honolulu, HI 96813

Consultant:Garcia and Associates
146 Hekili St., Suite 101
Kailua, HI 96734
Michael Desilets
808-262-1387

Contact: Michael Desilets

Project Summary: Summary of the direct, indirect, secondary, and cumulative impacts of the proposed action (less than 200 words). Please keep the summary brief and on this one page.

The primary action of the DOFAW Leeward Haleakalā Watershed Restoration Project (LHWRP) is the construction of an ungulate-proof fence that will enclose approximately 2,350 acres of native remnant *koa* (*Acacia koa*) forest and degraded, but high-value, conservation lands. In addition to the ungulate exclosure fence, DOFAW intends to facilitate public access to the area through the construction of a 19.8 kilometer trail system and six proposed backcountry cabins. Trail alignments and cabin locations are provisional, pending field confirmation of the absence of threaten or endangered species and cultural resource sites. No negative primary impacts are anticipated from LHWRP exclusion fencing or cabin and trail construction if mitigation measure in the SEA are followed. The principal sources of secondary impact are the long-term exclusion of ungulates from the project area and active ecological management of the area, including species reintroduction. Secondary impacts are expected to include long-term recovery and restoration of dry mesic *koa* forest habitat and the subsequent reintroduction of threatened and endangered native species. The secondary environmental impacts of the project are therefore considered to be a net positive. All categories of impact identified in the SEA will either be mitigated or are extremely minor and will therefore not tend to accumulate in relation to this or other projects. Substantial beneficial cumulative impacts are expected for biological resources.

DRAFT Supplemental Environmental Assessment

Kahikinui Koa Forest Protection and Restoration
Nakula Ahupuaʻa, Island of Maui, Hawaiʻi

TMK 2nd 1-8-001:005, 006, 009

Prepared For:

State of Hawaiʻi
Department of Land and Natural Resources
Division of Forestry and Wildlife

Prepared By:

Garcia and Associates
146 Hekili St., Suite 101
Kailua, Hawaiʻi 96734

21 November 2011

MANAGEMENT SUMMARY

This Supplemental Environmental Assessment supports the Hawai‘i State Department of Land and Natural Resources, Division of Forestry and Wildlife’s (DOFAW), proposed fencing on the upland slopes of Kahikinui Moku, Leeward Maui. The primary action of the DOFAW Leeward Haleakalā Watershed Restoration Project is the construction of an ungulate-proof fence that will enclose approximately 2,350 acres of native remnant *koa* (*Acacia koa*) forest and degraded, but high-value, conservation lands. The area to be fenced encompasses the Nakula Natural Area Reserve and portions of the Kahikinui Forest Reserve. This project is part of an ongoing landscape-scale restoration effort being conducted across leeward east Maui by the Leeward Haleakalā Watershed Restoration Partnership. The overall goal of the project is the restoration of native mesic forest to the entire project area. Fencing the proposed area is the first step in this long-term restoration effort. Natural recruitment may occur once ungulates are removed, however complete forest recovery will likely take decades.

In addition to the ungulate exclosure fence, the DOFAW intends to facilitate public access to the area through the construction of a 19.8 kilometer trail system and six proposed backcountry cabins. Trail alignments and cabin locations in this assessment are provisional, pending field confirmation of the absence of threaten or endangered species and cultural resource sites.

Proposing Agency: State of Hawai‘i, Department of Land and Natural Resources, Division of Forestry and Wildlife

Accepting Agency: State of Hawai‘i, Department of Land and Natural Resources, Division of Forestry and Wildlife

Location of Proposed Action: TMK: 2nd 1-8:001:005, 006, 009

Class of Action: Use of State Lands and Funds, Use of Conservation District

Landowner: State of Hawai‘i

Existing Use: Undeveloped land–Forest Reserve, limited hunting

Anticipated Determination: Finding of No Significant Impact

Authority: This document is prepared pursuant to the Hawai‘i Environmental Act, Chapter 343, Hawai‘i Revised Statutes, and Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules.

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1.0 INTRODUCTION

This Supplemental Environmental Assessment (SEA) follows a previous Environmental Assessment (EA) for proposed development of a Leeward Haleakalā Watershed Restoration Project (LHWRP) on the upland slopes of Kahikinui Moku, Leeward Maui (LHWRP-EA 2004). The EA for the LHWRP produced a Finding of No Significant Impact. The lead agency for this program is the Hawai‘i State Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW).

The principal proposed action under the LHWRP originally included fence exclosure of approximately 1,500 acres along the previous fence alignments shown in Figure 1. The current SEA covers significant redesign of the exclosure alignments resulting in an expansion of the area to approximately 2,350 acres. Following installation of exclosure fencing, feral ungulate eradication efforts are also expected.

Ungulate removal from the project area will produce a protected habitat suitable for regeneration of native upland canopy. Although the resident seedbank is expected to support rapid regeneration in some areas, highly degraded areas will require active outplanting. Long-term management tactics will include control of alien weeds, fire mitigation, and outplanting of native species to achieve optimal forest regeneration. These project components are part of DOFAW's larger programmatic goal of developing effective management schemes for the remnant native upland forests of southern Haleakalā. The management scheme used for this project centers on active management and feral ungulate control to restore and protect critical upland forest habitat. Although full forest recovery is expected to take decades, this project will initiate a process for long-term recovery, and is expected to provide approximately 2,350 acres of *koa* (*Acacia koa*) forest habitat for dozens of native threatened and endangered plant and animal species.

An additional important revision to the original EA is the inclusion of public access trails and backcountry cabins. This new supplemental action developed out of community consultation for the LHWRP EA. The trail routes and cabin locations are not yet finalized, and are subject to revision based on the biological and cultural resource mitigation provisions included in this SEA, as well as on-going community consultation.

The potential for environmental effects associated with these supplemental actions are considered in this document.

1.1 Proposed Supplemental Action

The proposed supplemental action (henceforth referred to simply as the proposed action) will consist of two primary elements: 1) a revised habitat exclosure formed by fence alignments and 2) a system of recreational trails and cabins designed to facilitate public access to Kahikinui Forest Reserve.

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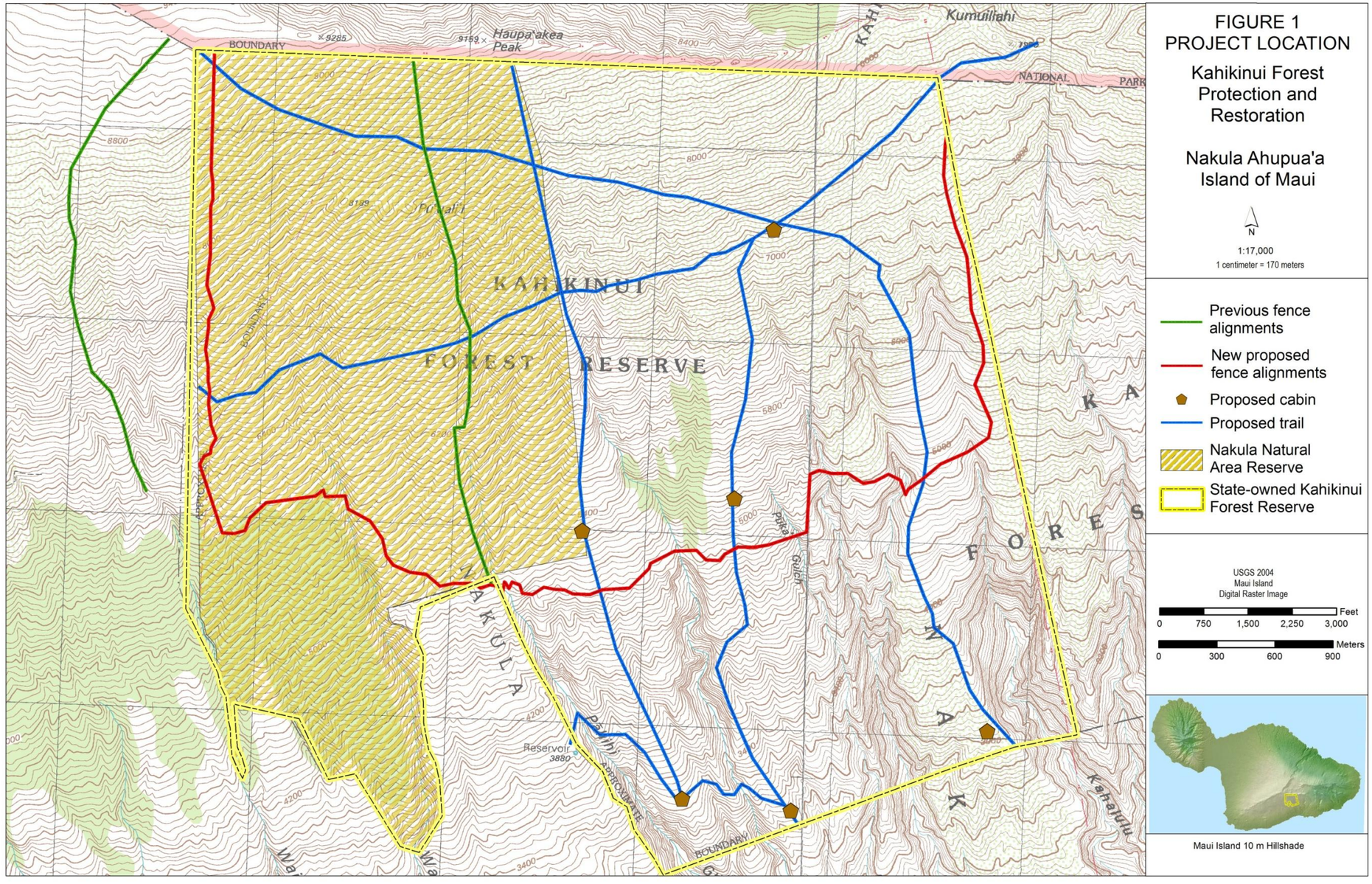

Figure 1. Project area showing previous and newly proposed actions.

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1.1.1 Fencing Redesign

The newly proposed fencing will result in a total exclosed area of ca. 2,350 acres (951 ha) in the upper portion of the State-owned Kahikinui Forest parcel. Figure 1 shows both the original and new alignments. The new alignments are between 4,800 and 9,200 ft above mean sea level (amsl) and consist of three sections: 1) eastern and 2) western alignments paralleling the slope on the east and west boundaries of Nakula Ahupuaʻa, and 3) a southern alignment crossing the slope at around 4,800 ft amsl (see Figure 1). The three proposed fence alignments will enclose the 2,350-acre habitat by connecting to a National Park Service (NPS) fence on the north and an existing 8-ft fence along the southwestern boundary of the parcel.

1.1.1.1 Fencing Specifications

Exclusion fence will be 2.1 m high, with 1.2 m of woven hog-wire secured by 3-m-tall T-posts. Single-strand wire will extend 1 m above the hog-wire. Access gates will be placed at the *mauka* and *makai* ends of the exclosure. In consultation with other groups including Ka ʻOhana O Kahikinui, Kahikinui Game and Land Management ʻOhana, and Living Indigenous Forest Ecosystems, DOFAW may install additional gates for special purpose access. Fencing specifications are subject to adjustment based on field conditions (i.e., irregular topography) and overall installation feasibility.

1.1.2 Trails and Cabins

An additional supplemental action consists of installation of a system of access trails and cabins throughout Kahikinui Forest Reserve (see Figure 1). Although the exact locations of the proposed trails and cabins have yet to be determined, the general plan is to distribute the recreational infrastructure throughout the parcel to allow public access to the State lands.

The proposed recreational trails span the entire region from 9,200 ft amsl to the southern project boundary at roughly 2,600 ft amsl (see Figure 1). The trails are aligned north-south along prominent and steep ridge tops and across the slope and deeply dissected terrain. Six cabins are proposed along ridge tops adjacent to some of the trails (see Figure 1).

Specific trail courses will be designed and constructed with reference to the standards and guidelines in the NPS's *Guide to Sustainable Mountain Trails* wherever possible. These guidelines will help ensure the long-term viability of the trails and prevent environmental impacts. They are in keeping with DOFAW policy to implement projects with minimal short-term impact as well as maintaining long-term sustainability. The larger-scale route system will be finalized in coordination with leading consulting groups, as noted above for fencing. Route finalization will also be dependent on completion of biological surveys.

1.2 Sources of Primary Environmental Impact

Primary impacts are defined in Hawaiʻi Administrative Rules (HAR) §11-200-1 as "effects which are caused by the action and occur at the same time and place." Primary impacts from the LHWRP may potentially result from the physical installation of exclusion fencing.

1.3 Sources of Secondary Environmental Impact

Secondary impacts are defined in Hawai‘i Administrative Rules (HAR) §11-200-1 as “effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” The principal sources of secondary impact are the long-term exclusion of ungulates from the project area and active ecological management of the area, including species reintroduction. Secondary impacts are expected to include long-term recovery and restoration of dry mesic *koa* forest habitat and the subsequent reintroduction of threatened and endangered native species. The secondary environmental impacts of the project are therefore considered to be a net positive.

1.4 Agency Identification

The Hawai‘i State Department of Land and Natural Resources, DOFAW, is the agency assuming responsibility for the SEA in accordance with Chapter 343, Hawai‘i Revised Statues. The primary contact is Mr. David Leonard from DOFAW.

1.5 Location

The proposed development of the LHWRP is located on the south slope of Haleakalā between approximately 2,600 and 9,200 ft amsl (see Figure 1). The parcel encompasses TMKs 2nd 1-8-001:005, 006, and 009 in the uplands of Nakula Ahupua‘a, Hana District. The parcel lies within the Kahikinui Forest Reserve and is comprised of the uplands of Nakula Ahupua‘a and an adjacent section of Nu‘u Ahupua‘a to the east. The newly instituted Nakula Natural Area Reserve is located in the western half of the project parcel.

1.6 Land Ownership

The property is owned by the State of Hawai‘i and managed by DOFAW (Figure 2). Haleakalā Ranch leases the southwestern corner of the parcel for pasture.

1.7 Funding

The budget for the project is currently set at $1,165,000, funded by the State of Hawai‘i through grants from the U.S. Fish and Wildlife Service and the U.S. Forest Service. Additional funds are pending for future fiscal years, and significant in-kind services will be contributed by agency collaborators.

1.8 Required Permits and Approvals

Approval from the State Historic Preservation Division is required for this action.

1.9 Alternatives Considered

Alternatives to the proposed action include No Action, Delayed Action, and Project Relocation. These alternatives are discussed as follows.

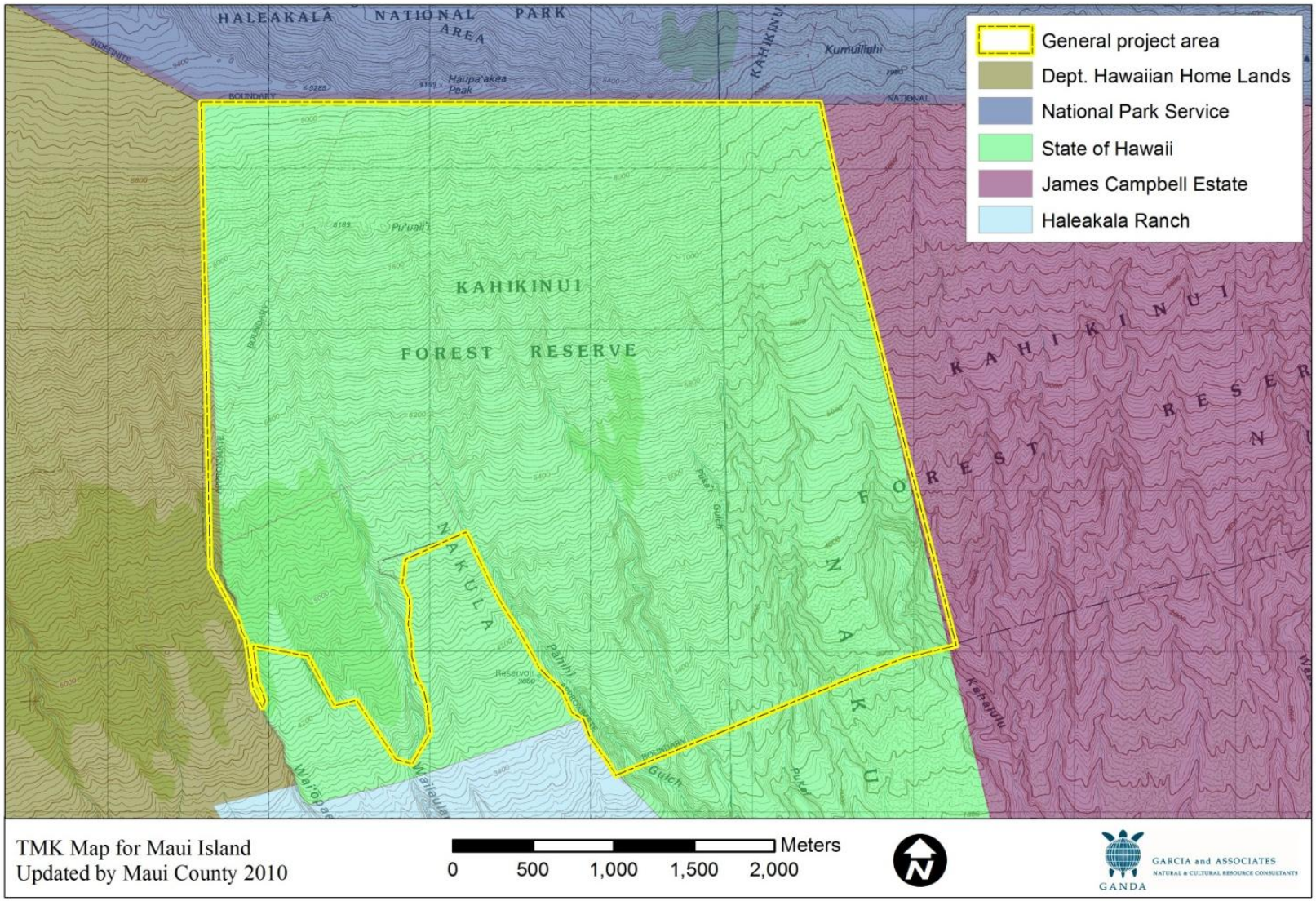

Figure 2. Tax Map Key showing landowners in project area and vicinity.

1.9.1 No Action

Under the No Action alternative, the exclusion fence would not be installed and forest restoration activities would not be implemented. Under this alternative, forest degradation in the project area is expected to continue, with no realistic prospect for natural habitat rejuvenation. Resident threatened and endangered plant and animal species will continue to decline and possibly become extinct within the project area. More broadly, progress in the development of strategic and tactical management strategies suitable to the forest reserve's dry mesic forests will be seriously retarded by adoption of the No Action alternative.

For these reasons, the No Action alternative was determined to be undesirable for this project.

1.9.2 Delayed Action

Consideration of the Delayed Action alternative follows some of the same points raised for No Action. Forest degradation due to ungulate grazing and trampling in upland Kahikinui is an ongoing, time-sensitive process. Delay in this program is expected to result in continued habitat decay and reductions in the few native species extant on the landscape. It is also apparent that the longer such an effort is delayed, the more difficult and expensive habitat restoration becomes. Other important consequences of delaying the action include ongoing accelerated soil erosion on the denuded slopes and resultant high rates of sedimentation in the adjacent drainages.

The Delayed Action alternative was therefore considered undesirable for this project.

1.9.3 Alternative Action

Alternative Action considerations for this project fall into two classes: programmatic and location-specific.

Programmatically, the eradication of ungulates is central to the approach of this project. Ungulate eradication has a long history of success in habitat restoration efforts in Hawaiʻi and around the world. Moreover, it is considered to be an essential precondition for habitat restoration where ungulate grazing and trampling constitute the primary environmental impact vector. Barring development of a habitat restoration and management strategy which incorporates the presence of ungulates on the landscape—an unlikely prospect—these non-native mammals must be eradicated for native Hawaiian plants and animals, including threatened or endangered species, to thrive.

The present project location was selected based on the following conservation and ecological considerations and because the lands in question are owned and controlled by the Department of Land Natural Resources. Koa forests on leeward Haleakalā are a unique resource that is rapidly disappearing. This project will protect a significant portion of the forest that remains in the area. Moreover, the dramatic elevation change across the area and the corresponding change in moisture regimes results in a compression of native habitats, and therefore diversity, into a relatively small area. The project area is also part of U.S Fish and Wildlife Service recovery habitat for the Maui Parrotbill (*Pseudonestor xanthophrys*) and Akohekohe (*Palmeria dolei*), two federally and state endangered birds, as well as the rest of Maui's native forest birds. In addition, the area proposed

for fencing and restoration is a potential site for the establishment of a second Maui Parrotbill population (USFWS 2006). Finally, the project area also has the potential to support populations of the federally endangered Hawaiian Petrel (*Pterodroma sandwichensis*), Nēnē (*Branta sandvicensis*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), and Blackburn's sphinx moth (*Manduca blackburni*), as well as approximately 20 rare plants, eight of which are federally endangered.

Movement of the project to private lands is not a feasible option, considering the foreseeable effects of Delayed Action. Due to legal considerations, movement of the project to private lands would almost certainly result in extensive project delays, and would be unlikely to have ecological advantages over the current proposed location. Likewise, movement of the project to other comparable State-owned lands would present no foreseeable advantage in terms of environmental impact.

For these reasons, no Alternative Actions were determined to be desirable for this project.

2.0 AFFECTED ENVIRONMENT

This section presents an overview of baseline physical, biological, socio-economic, and cultural conditions within the revised LHWRP exclusion area. These baseline conditions constitute the 'affected environment' that may be impacted by the proposed action.

2.1 Physical Environment

The physical environment of the project area is described by a diverse set of traits ranging from geology and soils to air and viewshed quality. Overall, the physical environment for the proposed action consists of 1,623 ha (4,011 acres) of remote, degraded upland forest between 3,000 and 9,200 ft amsl.

2.1.1 Geology, Topography, and Soils

2.1.1.1 Geology

The LHWRP project location under consideration in this SEA lies on the southern slope of Maui's eastern volcano, Haleakalā. Haleakalā is a shield volcano built up by three major eruption series. Earliest, and comprising the foundation of the mountain, are the Honomanu lavas. Pahoehoe and aa flows of the Honomanu Series are composed of thoeleiite, tholeiitic olivine basalt, and oceanite. The individual flows average 5 m in thickness and have extremely limited exposures. Although they are almost completely overlain by subsequent series, the nearest Honomanu outcrops to the project area are at Kipahulu and Mananwainui Valleys, and possibly the lower south wall of Haleakalā Crater (Macdonald et al. 1983:388).

The Kula Series followed the Honomanu Series. Kula eruptions were generally more explosive, forming many large cinder cones. Kula lavas are predominantly hawaiite with small amounts of alkalic olivine basalt and ankaramite. Individual flows are predominantly aa, ranging in thickness from 6 to 15 m. Total Kula Series thickness ranges from over 750 m at Haleakalā's summit to 15–60 m near the coast. Kula eruptions became less frequent near the end of the series, with intervals sufficient to allow development of significant erosional features in some areas.

The revised LHWRP project area is situated on Kula Series flows and Kula-derived soils.

2.1.1.2 Soils

Soils in the project area consist of two basic types: Very Stony land and Puu Pa very stony silt loam (Foote et al. 1972:Sheet 118) (Figure 3). Very Stony land occurs between roughly 4,200 and 9,200 ft amsl. Soils consist of a thin layer of volcanic ash over young aa. The land type is generally covered in cobbles and boulders. A sliver of cinder land overlaps the northwest corner of the project area.

Puu Pa very stony land occurs between 2,600 and 4,200 ft amsl. Puu Pa series soils are inceptisols developed in volcanic ash overlying fragmental aa. They are well-drained with moderately rapid permeability and slow to medium runoff. In a representative stratigraphic profile

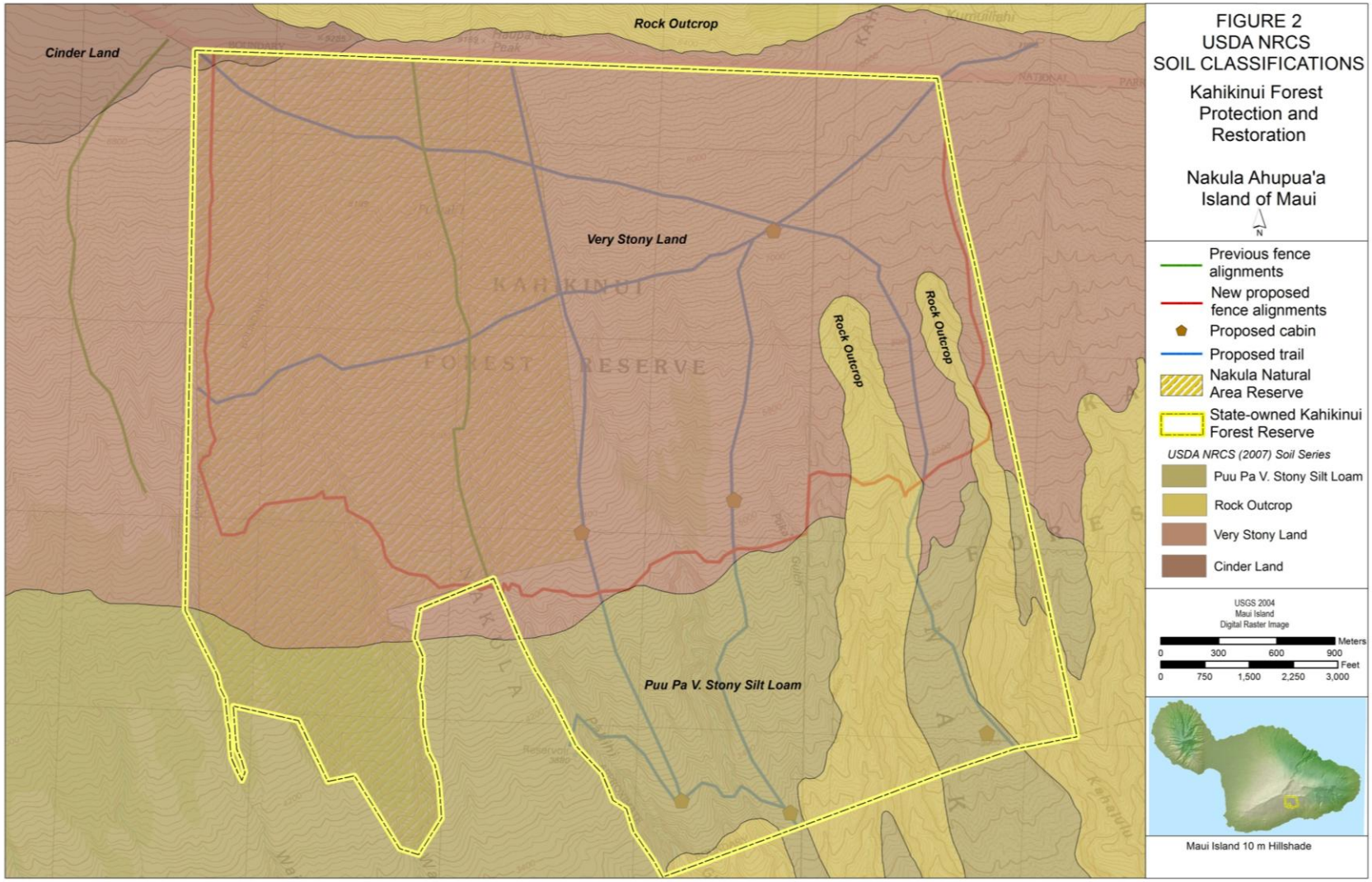

Figure 3. Soil classification map for project area.

recorded by Foote et al. 1972, a very stony silt loam A horizon extends to 0.25–0.38 m below surface. This is underlain by C horizon soils dominated by aa fragments of various sizes and extending to 1.2 m below surface. A horizon soil is slightly to medium acid whereas the C horizon is neutral. Roots extend to up to 1 m or more in areas of deep soil, commonly between cracks in the underlying aa. Depth to bedrock can range from 0.5 to 1.2 m.

2.1.1.3 Topography

Project area topography consists in its upper part of a generally smooth slope of southern aspect. Slope ranges from 7 to 30 percent, but is primarily on the upper end of this range. One major landscape feature, Puu Alii, is present at 8,000 ft amsl.

In the middle parts of the project area, the slope becomes heavily dissected by very steeply sloped gulches. Some of these converge into major drainages, including, from east to west, Kahalulu, Pukai, Pāhihi, and Wailau Gulches. The lowest portion of the project area consists of highly eroded, moderately sloping grasslands forming plateaus between these major gulches.

2.1.2 Hydrology

Groundwater resources on Maui's leeward flank consist mainly of basal water floating on salt water. The lens-shaped basal groundwater layer, or Ghyben-Herzberg Lens, forms an aquifer under the leeward volcanic flank known as the Kahikinui Sector. This sector has a sustainable yield of 21–56 million gallons per day (Juvik and Juvik 1998:88). Aquifer sectors are further divided into hydro-geologically continuous "systems." The aquifer system underlying the study area is known as the Nakula System. The Nakula System supports two high-level, unconfined perched, freshwater aquifers (HHAO-EA 2010:2-34).

The standard structural features associated with Maui's basaltic lava bedrock, such as clinker sections, void spaces, shrinkage joints, fractures, and lava tubes, contribute to a very high permeability and porosity. Surface flow on the leeward slopes is minimal and generally restricted to short-duration flash events. There are no perennial streams within the study area and the large gulches that develop further downslope are dry most of the year.

2.1.3 Climate

Climatic conditions in the study area are characteristic of a leeward, moderately high elevation volcanic flank. Average temperature at the summit, about 1000 ft above the highest point of the study area, ranges between 43 and 52 degrees Fahrenheit. Diurnal variation is significant at the higher elevations and even exceeds the ca. 10 degree annual seasonal variation (Armstrong 1973:58). Average annual rainfall ranges from 1 to 1.5 m. Monthly rainfall exceeds 0.1 m during the winter months and drops to 0.05 m or less in summer (measured at Haleakalā Summit rain gauge; Juvik and Juvik 1998:56). Average annual solar radiation intensity in the study area is moderately high at 200 watts per square meter.

Surface winds are driven by west-southwesterly prevailing trade winds. When trade winds are light, however, diurnal local winds resulting from warming and cooling of the land mass are

dominant. Under these conditions, winds blow upslope from the coast during the day and then offshore and downslope at night.

2.1.4 Air Quality

As with most mountainous areas on Maui, air quality in the project area is very good. Fresh trade winds and mountain drafts ensure a high degree of circulation and air flow. Typical anthropogenic sources of air pollutants, such as automobile and industrial emission, are not present and have no impact on the project area.

2.1.5 Noise Levels

Noise is defined as any unwanted sound, typically generated as a by-product of other activities. Acoustically, it may also be understood as an unwanted perturbation of a desired signal, or, alternatively, a meaningless sound of greater than usual volume.

Due to its remote, high-elevation location, the project area experiences very low sound levels. Ambient sound is dominated by wind, occasionally punctuated by bird and mammal calls. These natural environmental sounds are generally not considered to be unwanted or undesirable. Other than infrequent low-flying aircraft, no other sounds are common to the project area and it therefore experiences a noise level approaching zero in its natural state.

2.1.6 Hazardous Substances

No known hazardous substances are present in the project area, which is vacant and does not appear to have undergone significant active land use in modern times.

2.2 Biological Environment

The revised project area contains degraded mesic forest from approximately 3,200–6,500 ft amsl, transitioning into subalpine native vegetation from 6,500–9,300 ft amsl. Grazing and browsing from introduced ungulates has significantly impacted the native vegetation throughout the proposed exclosure, leaving a mosaic of remnant vegetation interspersed with introduced grasses. Remnant native vegetation is primarily restricted to the steep-sided gulches. The ridgelines and upper elevation slopes are rocky and lightly vegetated.

The corridor previously proposed for fencing was thoroughly surveyed by biologists from the DOFAW. During 2003–2004, ten trips were conducted by avian biologists and botanists during which all fence lines were repeatedly surveyed. Among other factors, the actual fence alignment was chosen to avoid disturbance to sensitive plant or animal species. No threatened or endangered plant or animal species as listed by the U.S. Fish and Wildlife Service or the State of Hawai‘i were present on the alignment. The revised alignments are situated on terrain almost identical to that of the original alignments. Based on prior observation of the project area, as well as a field survey of the revised alignment conducted March 22–24, 2011, the likelihood for threatened or endangered flora or fauna along the rocky, degraded ridges proposed for fencing is very low .

2.2.1 Botanical

Currently, major native vegetation components in the mesic forest include an *ʻohiʻa/koa* overstory (*Metrosideros polymorpha/Acacia koa*); a middle canopy layer of trees and shrubs, including *olapa* (*Cheirodendron trigynum*), *pilo* (*Coprosma montana*), *ohelo* (*Vaccinium calycinum*), *akala* (*Rubus hawaiiensis*), *pukiawe* (*Styphelia tameiameiae*), *kawau* (*Ilex anomala*), and *kolea* (*Myrsine lessertiana*), *aʻaliʻi* (*Dodonea viscosa*), and *mamane* (*Sophora chrysophylla*); and a lower canopy ground layer dominated by a rich diversity of ferns, including *Cibotium*, *Sadleria*, *Dryopteris*, and *Pteridium*. Native grasses such as *Deschampsia* and *Eragrostis* are present but not widespread in many areas.

Parts of the project area have been designated critical habitat for four endangered plants including *Alectryon macrocossus kalealaha*, *Bidens micrantha kalealaha*, *Germanium multiflorum*, and *Agyroxiphium sandwicense macroceph*. A total of four listed endangered understory species including *Clermontia lindseyana*, *Diplazium molokaiense*, *Bidens micrantha kalealaha*, and *Phyllostegia mollis*, have been documented in the project area.

Despite heavy disturbance, few alien weeds have invaded the area. Alien species of consequence are mostly limited to grasses, including molasses grass (*Melinis minutiflora*), velvet grass (*Holcus lanatus*), sweet vernal grass (*Anthoxanthum odoratum*), kikuyu grass (*Pennisetum clandestinum*), and plume poppy (*Bocconia frutescens*).

2.2.2 Avian

Native birds in the area include *ʻapapane* (*Himatione sanguinea*), *ʻamakihi* (*Hemignathus virens*), *pueo* (*Asio flammeus*), *kolea* (*Pluvialis fulva*), and *koaʻe kea* (*Phaethon lepturus dorotheae*). In addition, Maui *ʻalauhio* (*Paroreomyza montana*), Maui Parrotbill (*Pseudonestor xanthophrys*), *poʻouli* (*Melamprosops phaeosoma*), and *ʻakohekohe* (*Palmeri dolei*) were likely once common but are now no longer present. *Nene*, Hawaiian Goose (*Branta sandwichensis*), is found just to the west and east and may frequent grasslands and alpine shrublands of the site on occasion, although it has not been observed to date. Introduced passerine birds include house finch (*Carpodacus mexicanus*), nutmeg manikin (*Lonchura punctulata*), red-billed leiothrix (*Leiothrix lutea*), Chinese hwamei (*Leucodioptron canorum*), Japanese white-eye (*Zosterops japonicus*), northern mockingbird (*Mimus polyglottos*), Eurasian skylark (*Alauda arvensis*), common myna (*Acridotheres tristis*), and northern cardinal (*Cardinalis cardinalis*).

The endangered Hawaiian Petrel (*ʻUaʻu*) (*Pterodroma sandwichensis*) is known from subalpine areas within the region where ungulate and predator control programs exist, but is probably absent or present in only very small numbers in the subject area. Although burrows may be present in the region, none were observed within 100 m of the former proposed fenceline, nor were any burrows observed within the former proposed exclosure area.

2.2.2.1 Ornithological Assessment of Revised Alignment

Seabird and Forest Bird Biologist Seth Judge, from University of Hawaiʻi at Hilo, Department of Tropical Conservation Biology, conducted an ornithological assessment of the revised fence alignments March 22–25, 2011 (Appendix A). The field survey identified small

populations of native and non-native birds in the general project area; two endangered species were observed flying over the area.

The endangered Hawaiian Petrel is known to nest near the rim of Haleakalā within the Haleakalā National Park just north of the project area. Thus, similar nest sites were anticipated in the northern-most elevations of the project area given its close proximity to the NPS boundary and crater rim.

No Hawaiian Petrel nests were found along the proposed fence alignments. However, during evening hours in the project area, Hawaiian Petrel were heard overhead and six petrel were observed flying in an eastward direction. Two endangered Hawaiian Geese were observed flying in a southeast direction in the project area during the morning hours of the field survey. One white-tailed tropicbird (*Phaethon lepturus*) was observed flying in an eastward direction in the late afternoon of the field survey. It is unknown whether any of these endangered birds use habitat within the project area.

'Apapane and *'amakihi* were heard and seen foraging in remnant stands of *'ohi'a* and *koa* in the project area. Most of these trees were only surviving in steep areas, typically within deeply cut ravines.

Non-native species detected in the survey include small numbers of Japanese white-eye, house finch, skylark, ring-necked pheasant (*Phasianus colchicus*), and chukar partridge (*Alectoris chukar*).

2.2.3 Mammalia

One endangered species, the Hawaiian hoary bat (*Lasiurus cinereus semotus*), inhabits the forested south slope of Haleakalā. Hoary bats typically roost in trees and shrubs where they will leave their young during foraging expeditions. Although no evidence of hoary bat was observed during survey, it is possible that they are present in the surrounding area, or may move into the area by the time the proposed action is implemented.

2.2.4 Arthorpoda

Manduca blackburni, an endangered sphinx moth, is present on the south slope of Haleakalā and has critical habitat nearby (although not within) the affected area. The moth's native food plant tree, *'aiea* (*Nothocestrum latifolium*), can occur up to 5,020 ft amsl but usually occurs lower than elevations proposed for fencing. The trail and cabin areas, extending down to as low as 2,600 ft amsl, are in elevation zones that typically support *'aiea*, and hence have an elevated probability for supporting populations of sphinx moth.

2.3 Socio-economic Environment

The project area is located in the less-populated Hana District of East Maui, within the traditional *ahupua'a* of Nakula. The *ahupua'a* is approximately 12 square miles and stretches from the southern, leeward coast of Maui to the crater rim of Haleakalā. The closest town to Nakula is Kihei, located roughly 20 miles to the west.

2.3.1 Population

The island of Maui has experienced a swift population growth during recent times with a 13% increase population experienced in Maui County since 2000. The 2009 census bureau data shows Maui County with an estimated population of 145,157 (U.S. Census Bureau 2011). The current project area contains no human population. The Hana CDP, containing most of Nakula Ahupuaʻa with the exception of the current project area, has an estimated 2009 population of 549. In contrast, Census Tract 303.01, referring to most of the upland Ulupalakua-Kula region to the west and the current project area, contains 7,836 residents, compared to 6,659 residents documented in the 2000 census.

Native Hawaiians, who constitute 8.9 percent of the population on Maui, are proportionally more numerous in the area from Ulupalakua to Hana, an area less affected by the visitor industry and commercial development. Lifestyles and social systems in this area are more in keeping with traditional Hawaiian and "local" values.

2.3.2 Existing Land Use

As mentioned previously, the project area consists of a remote upland landscape that is inaccessible by vehicle, and difficult to traverse on foot. There are currently no formal trails leading to this area and use of the land is therefore limited to visits by DOFAW staff and occasional use by hunters.

Many areas on the slopes of Haleakalā are used for hunting, an activity that provides food, recreation, and social interaction for many residents. Discussions with local hunters indicate that because of the difficulty of access, relatively little hunting occurs in the subject area itself, although areas directly adjacent (e.g., the Living Indigenous Forest Ecosystems leased area of Department of Hawaiian Home Lands near the 7,000-foot elevation) are hunted regularly.

2.3.3 Recreation

Due to remoteness and difficulty of access, there is currently no known recreational activity, other than occasional hunting (see 2.3.2 above), within the project area.

2.3.4 Scenic and Visual Resources

The scenic and visual landscape of leeward Haleakalā ranges from bare and rugged aa, to rolling grasslands, to forested upland areas. The retreat of the forest in the project area, along with the spread of alien vegetation, has reduced its scenic value. Visually, the project area is not easily discerned from the lower elevations, and is commonly enshrouded in mist. Population on the leeward side, in areas where the project area would be visible, is very low. These areas are also not considered high or moderate-volume tourist destinations. Hence, the project area's scenic resource value is relatively low compared to other parts of Haleakalā.

2.3.5 Infrastructure and Utilities

There is currently no road access to the project area. A very rough, four-wheel drive ranch roads leads from Pi‘ilani Highway (Highway 31) through Haleakalā Ranch to a point near, but not at, the *makai* boundary of the subject area.

No utilities or other public services are present within the project area.

2.3.6 Cultural Resources

While the project area is in the current administrative district of Hana, it straddles the traditional districts of Kahikinui and Kaupō, and is now largely the concern of groups centered in Kahikinui. For this reason, the treatment of cultural resources in the final environmental assessment for the action focused on Kahikinui. The revised fence design considered in this SEA has expanded the exclosure area some two kilometers to the east, while reducing the western boundary a little over 750 m to lie completely within State-owned land. The broadly considered area scope for cultural resources, however, is essentially the same.

A number of sources were consulted in assessing the existing cultural resources of Kahikinui and the project’s potential adverse and beneficial impacts upon them. Several publications have examined the cultural resources of the area, including the *East Maui Resource Inventory* (USDOI-NPS 1998), as well as a planning practicum of the Department of Urban and Regional Planning at the University of Hawai‘i at Manoa (UH-Manoa, DURP 2000) entitled *Ka ‘Ohana O Kahikinui: Community Based Economic Development and Makai Management Plan, Moku of Kahikinui*. Other documentary sources included a compendium of archaeological studies entitled *Ke Mea Kahiko O Kahikinui* (Kirch 1997). The most important and invaluable sources, however, were Maui residents who were knowledgeable about the natural and cultural resources of the area. These included Lea and Nohea Kaiaokamalie, Donna Simpson, Leon K. Sterling, Walter Kanamu, Art Medeiros, and Kawika Davidson.

2.3.6.1 Ethno-Historical Background

Much of what is known about the history of East Maui is derived from *oli*, or chants, which pass along legends, historical events, and genealogies. Abraham Fornander, a 19th century Maui judge, and Samuel Kamakau, who, among other positions, was also a Maui judge, recorded a number of stories concerning the area. As summarized in the *East Maui Resource Inventory*, which consulted Fornander and Kamakau’s work:

> . . . According to the *oli*, the Hawaiian people were created by the pairing of the divine Wakea and Papa, the sky-father and earth-mother. Their pairing created the two major Hawaiian genealogies—the Nana‘ulu and ‘Ulu, the ruling class. The Nana‘ulu line ruled O‘ahu and Kaua‘i, and the ‘Ulu governed the islands of Maui and Hawai‘i.
>
> (USDOI-NPS 1998:7).

The *East Maui Resource Inventory* goes on to explain that during the twelfth century, Maui became split into two warring kingdoms. Eventually, Pi‘ilani, the king of West Maui, united all of

Maui under one rule. An era of peace and monumental constructions (including the magnificent *heiau* of Piʻilanihale in ʻUlaʻino) ensued. Many of the prominent *aliʻi nui* of the post-contact era, including Kahekili of Maui, Boki of Oʻahu, Queen Kaʻahumanu, King Kaumualiʻi of Kauai, Princess Victoria Kamamalu, Liholiho (Kamehameha II), Kauikeauoli (Kamehameha III), Queen Liliʻuokalani, as well as many others, can be traced as descendants of Kekaulike of the Piʻilani line, who died in 1736. Between 1786 and 1794, the Hawaiʻi chief Kamehameha used modern gunnery to fight the Maui chief Kahekili, who was legendary for both ferocity and political acumen, and who was thought by many to be the chief most likely to unite the Hawaiian islands. In a decisive 1794 battle, Kamehameha finally prevailed. During the 19th century, Maui, along with the other Hawaiian Islands, experienced debilitating diseases, increasing Western presence through whaling, sandalwood cutting, missionaries, and sugar planters, and the gradual displacement of native land tenure and political control.

Kahikinui is one of the traditional *moku*, or land divisions, of Maui. It is located on the southwest slope of Maui and sweeps from the dry, cliffed coastline through the better-watered uplands before terminating in the dry uplands on the southern rim of Haleakalā Crater. The origin of the name Kahikinui is not entirely certain, as it has been translated as "the great rising" Handy (1972), as well as the "Great Tahiti" (Pukui and Elbert 1974:6), perhaps because of the similarities in shape and appearance between the islands of Tahiti and Maui. It may also refer to a navigational star (Pukui and Elbert 1986:112). Perhaps the name is meant to evoke a rich variety of meanings.

In an oral tradition for the area:

> Pele travels from the northwest corner of Ka Pae ʻAina of Hawaii, residing and dwelling in different areas then proceeding to move down the island chain to her final resting spot at Haleamaʻumaʻu on the island of Hawaii. One account speaks of Pele, upon her arrival at Kilauea, arriving from "Kahiki", which often times is referenced as from her point of origin at Polapola (Borabora).
>
> (UH-Manoa, DURP 2000: 19)

Kahikinui, along with Kaupō and other *moku* on the west and south of Haleakalā, was extensively developed for dryland farming of ʻ*uala* (sweet potato) and taro. Water was a limiting factor and ingenious agricultural methods were devised to conserve soil moisture. *ʻUala* was often grown in *makaliʻi* (Handy 1972:129), which were rocky areas specially prepared for planting. The arduous and risky nature of farming the *ʻaina maloʻo*—or dry lands—may account for the numerous temples to Lono, the deity responsible for rainfall and thunder (Kirch 1997:2). Abundant natural resources were present, including a wide variety of dryland forest trees such as *wiliwili* (*Erythrina sandwichensis*) and many herbs, including *ʻuhaloa* (*Waltheria indica*). Perhaps even more important were marine resources such as fish, shellfish, and crustaceans, and the fresh water springs that emerged near the coastline.

Kahikinui and Kaupō, although not untouched during the 19th century, did not experience the intense changes in land use and population that occurred in many locations in Hawaiʻi. One of the few visitors was the French explorer Jean-François de Galoup de la Pérouse, who reported only a

few small villages along the coast. Archaeological work reported in Kirch (1997) indicates that a much larger population was still living *mauka*, at around 1,000 ft amsl, which was hidden by distance and topography from la Pérouse.

Despite the dominance of the Congregationalist missionaries throughout the island, Catholicism spread rapidly on Maui. Though officially outlawed by the missionary-influenced government, it became particularly prevalent in Kahikinui, where a thatched church was established at the site of the present St. Ynez ruin in Nakaohu. A famous incident of civil disobedience occurred in Kahikinui in 1843, when police arrested worshipping Catholic Hawaiian women, then proceeded to bind and march them through Hana to Wailuku, a distance of 90 miles. As other Hawaiians saw the women's plight, they joined them, eventually gathering a throng of about 1,000 people, which induced the police to dismiss the charges.

In the *Mahele* of 1848, which installed a Western system of land title that ultimately disenfranchised many commoners, Kahikinui ended up in the hands of the government and in the personal holdings of Princess Ruth Keʻelikolani. Very few *kuleana* were awarded in the Kahikinui area. Just as disease began to decimate the population and more and more rural Hawaiians were drawn to the attractions of the growing port cities, cattle ranching began to dominate Kahikinui, no doubt aided by the ability to secure title to land. By the 1880s, a Portuguese named M. Pico (also called "Paiko") was ranching Kahikinui, and much of Kaupō was also being ranched. The Hawaiian Homes Commission Act of 1920 established lands held in trust for the benefit of Native Hawaiians, and the government lands in Kahikinui were part of this trust. Lands above 4,000 ft amsl were placed in the forest reserve of the territorial government, and lands below 4,000 ft amsl were leased to cattle ranchers. ʻUlupalakua Ranch ended up leasing the lands of Kahikinui in the 20th century, and Haleakalā Ranch leased lands in Kaupō. The traces of a long Hawaiian occupation were gradually obscured but not erased by alien vegetation, cattle trampling, and soil erosion. The forest resources that sustained the Hawaiian culture also gradually degraded, and as late as 1910 the forest was much denser (Rock 1913).

According to the planning practicum cited previously (UH-Manoa, DURP 2000), the preserved, hidden resources of Kahikinui (and, for that matter, parts of Kaupō) offer special, almost unique values for the perpetuation of Hawaiian culture:

> Aside from the abundance of natural resources, Kahikinui is endowed with a wealth of cultural assets, gifts left by the ancestors. Because Kahikinui has experienced relatively little physical impact from the post-contact period such as urban development and large-scale agricultural use, it contains an abundance of intact sites, which include villages, heiau, agricultural structures and shrines. Sites are scattered across the moku in relative abundance with particularly high concentrations along the coastline and in the upland areas. Kahikinui may well be the only area in the State where this kind of concentration and variety of sites exist and as such it is an excellent living laboratory to study past Hawaiian life and land usage.
>
> (UH-Manoa, DURP 2000:20).

According to an ethnobotanical study of a site in leeward Haleakalā (Medeiros et al. 1994), forest restoration is of cultural importance because many plants with traditional uses are rapidly disappearing from the area. One example is the famed mature *koa* trees of Haleakalā, which are prized for canoes (Fielding 2003) but are failing to be replenished.

Preserving and enhancing the cultural resources of Kahikinui, Kaupō, and other regions of leeward Haleakalā—which are increasingly seen as including biological resources—is the goal of a number of governmental and non-profit organizations. The Hawai‘i State Department of Hawaiian Home Lands, in response to request from beneficiaries, awarded a number of homesteads in Kahikinui. The Kahikinui homesteaders have a community organization, *Ka ‘Ohana O Kahikinui*, and are active in programs that promote conservation and cultural preservation. Another organization centered in the Kahikinui area is Living Indigenous Forest Ecosystems. This organization currently holds a long-term lease on Hawaiian Homelands property *mauka* of the homestead area and is currently involved in restoration efforts there. The Leeward Haleakalā Watershed Restoration Partnership, a group of ten government and private landowners, is working towards restoration of native ecosystems on Maui, from ‘Ulupalakua to Kaupō, on 43,000 acres *mauka* of 3,500 ft amsl. There is growing recognition that cultural perpetuation is inextricably tied to the preservation and restoration of the unique biological resources that Hawaiians utilized and husbanded for a wide variety of purposes over the course of centuries.

2.3.6.2 Archaeological Resources

An archaeological assessment was conducted by Garcia and Associates of revised fence alignments and newly proposed recreational trails and cabins included in the State-owned Kahikinui Forest Reserve, which includes Nakula Natural Area Reserve (Appendix B). The goal of this assessment was to determine through field survey and background research whether construction of the revised project elements will have a significant effect on historic or cultural properties in the project area.

2.3.6.2.1 Previous Archaeology

Rechtman Consulting, LLC conducted an Archaeological Assessment Survey (Desilets and Rechtman 2004) along two fence alignments originally proposed as exclusion fences for a Natural Area Reserve in the western portion of the Kahikinui Forest Reserve project area. No significant cultural or archaeological resources were recorded in the surveyed corridor that extended between 5,000 ft and 9,200 ft amsl. No other archaeological investigations have been conducted in the project area.

Archaeological surveys conducted at neighboring Kahikinui (Dixon et al. 2000:327) and the Haleakalā summit (Chatters 1991; Bushnell and Hammatt 2000; and Fredericksen and Fredericksen 2003) provide data indicative of traditional Hawaiian land use and settlement on the leeward slope and nearby summit of Haleakalā Mountain. The upper Haleakalā sites suggest the rim and crater interior were occupied on a temporary basis mostly during travel, ritual activities, and for collection of resources, such as rock material and plants. The Kahikinui sites indicate Haleakalā’s leeward slope contained an upland zone of permanent occupation from 2,110–2,415 ft amsl and temporary occupation in the higher elevations from 2,415–3,020 ft amsl.

2.3.6.2.2 Fieldwork

Fieldwork was conducted between March 22 and 24, 2011, by a Garcia and Associates' archaeologist accompanied by a DOFAW Natural Area Reserve System specialist, and Forest Bird biologist (Appendix B). The survey crew conducted the pedestrian survey in a downhill direction on the eastern and western fence alignments starting from the NPS fence line on the north ends. Survey of the south fence alignment was done in two sections starting from the bottom of the east or west fence alignments, respectively. Ground visibility was excellent throughout the project area because of the absence of vegetation. The sloped angle of the surrounding landscape also allowed broad down slope views of the project area. No field survey was conducted at the proposed recreational trails and cabins because their locations were tentative at the time of the project.

2.3.6.2.3 Findings

Two rock cairns (Cairn 1 and 2) were identified near or on the western fence alignment at 9,160 ft amsl and 8,440 ft amsl, respectively. The two cairns are roughly aligned along the western boundary of the state-owned portion of Kahikinui Forest Reserve and current project area. The cairns likely represent survey markers created along a more recent land division, such as the Kahikinui Forest Reserve. No other archaeological sites were identified in the proposed fence alignments located between 4,800 and 9,200 amsl. The upper elevations of the project area are therefore evaluated as having a low probability for containing sites.

Based on previous archaeological investigations, the lower, unsurveyed portion of the project area below roughly 3,000 ft amsl is evaluated as archaeologically sensitive given that traditional Hawaiian occupation sites were identified at neighboring Kahikinui between 2,110 and 3,020 ft amsl (Dixon 2000:327). Historic features related to ranching activities, such as cattle walls, also likely exist in the lower elevations since the land abuts current and former ranch land. The potential for ranch-related sites is evidenced by a cattle wall observed by a DOFAW Natural Area Reserve System specialist at 3,880 ft amsl near Pāhihi Gulch.

3.0 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section evaluates the potential environmental impacts of the Proposed Action and suggests mitigation measures for adverse impacts. As discussed in Sections 1.2 and 1.3, impacts may be either Primary or Secondary. Impacts may also be of short-term or long term duration, and may furthermore have cumulative effects over time that must be considered. This analysis examines impacts to resource classes in proportion to the magnitude of the potential effects. More detailed consideration is given to resource classes that have a reasonably high potential for adverse effect.

3.1 Physical Environment

3.1.1 Geology, Topography, and Soils

The proposed action will involve no earth disturbance other than installation of fence posts. It will therefore have no significant impact on the underlying geologic substrate of the project area, nor any impact on landscape topography.

3.1.1.1 Exclusion Fence

Installation of the exclusion fence is anticipated to have no significant short-term, direct impact on project area soils. Installation of fence posts will involve very minor disturbance to the shallow soils with no significant increase in erosion relative to the existing landscape. Indirect, long-term effects are anticipated to be beneficial with respect to revegetation, soil retention, and reduced erosion rates.

Installation of the exclusion fence and subsequent ungulate eradication will eliminate the primary source of soil destabilization and accelerated erosion. Over time, it is expected that natural and assisted revegetation will stabilize soils and significantly reduce erosion rates.

3.1.1.2 Cabins and Trails

Construction of proposed cabins and trails are expected to have no significant impact on project area soils. Cabins will be constructed above-ground, and necessitate no ground disturbance. Short-term, direct impacts are expected to be negligible. Long-term secondary impacts associated with cabin use by the public may include excessive trampling and resultant devegetation of the surrounding landscape over time. Given the generally unvegetated or very sparsely vegetated landscape, however, these potential impacts will not significantly alter the landscape from its current state. Relative to the overall project area, the spatial extent of potential impact (i.e., the immediate cabin vicinity) is very small. Potential impacts from cabin construction are therefore considered to be less than significant.

Trails will run over a mix of unvegetated and sparsely vegetated terrain. Trails may potentially increase soil exposure if use is heavy, and provide new flow routes for surface water during heavy rains. Given the remote location of the area, and difficulty of access, it is anticipated that trail use will be infrequent and largely restricted to hunters and determined naturalists.

3.1.1.3 Mitigation

Potential adverse environmental impact associated with trail construction and long-term use can be mitigated almost entirely through the use of proper trail design and construction techniques. As mentioned previously, the trails illustrated in Figure 1 are intended to show general routes only, not precise trail courses. Specific trail courses will be designed and constructed with reference to the standards and guidelines in the NPS's *Guide to Sustainable Mountain Trails* wherever possible. Reference will also be made to the NPS's *Construction of Trails* and the U.S. Forest Service's *Trail Construction and Maintenance Notebook: 2007 Edition*. These guidelines pursue an ethic of trail sustainability over long time periods. The ethic presumes that mountain trail project should not unnecessarily impact the natural, cultural, or visual environment. The concept of mountain trail sustainability is best summarized as follows:

> Sustainability of backcountry trail corridors is defined as the ability of the travel surface to support current and anticipated appropriate uses with minimal impact to the adjoining natural systems and cultural resources. Sustainable trails have negligible soil loss or movement and allow the naturally occurring plant systems to inhabit the area, while allowing for the occasional pruning and removal of plants necessary to build and maintain the trail. If well-designed, built, and maintained, a sustainable trail minimizes braiding, seasonal muddiness and erosion. It should not normally affect natural fauna adversely nor require re-routing and major maintenance over long periods of time.
>
> NPS Natural Resource Management Reference Manual # 77, 2006

Special emphasis will be given to factors affecting soil erosion such as profile grade, prevailing cross slope grade, tread width, and potential drainage improvements. Design and construction of access trail systems according to the mountain trail sustainability guidelines will adequately mitigate adverse impacts to project area soils.

3.1.2 Hydrology

Two types of hydrologic resource are relevant to the proposed action: ground water and surface water. Construction of the exclusion fence, trail system, and cabins will have no short-term direct impact on ground water resources.

Long-term indirect impacts to groundwater from the trails and cabins are likewise negligible. Exclusion fencing is expected to have a minimal long-term effect on groundwater resources. Soil stabilization and revegetation resulting from ungulate exclusion and eradication can be expected to cause an increase in the organic fraction of the soil, increased root density, and slightly reduced permeability. A small part of the annual water budget that originally went straight to groundwater will be taken up by roots and exit the system via transpiration. The aquifer recharge rate may therefore be slightly reduced. However, due to the small size of the fenced exclusion area relative to the surface area contributing to the Nakula aquifer system, the impact is considered less than significant. Overall, reforestation has net positive effects on watersheds including enhancement of deep soil water transfer to upper soil horizons, thereby increasing soil moisture, slowing runoff,

and preventing erosion. At larger scales, the restoration effort is expected to enhance water quality and decrease sedimentation levels in the downslope lands and near-shore marine waters.

Surface water flow patterns may potentially be affected by trail system construction and use. However, if best management practices outlined in the NPS's *Guide to Sustainable Mountain Trails* are followed (see Section 3.1.1.3), there should be no long-term environmental impact to or from surface water resources.

3.1.3 Climate

Construction and use of trail systems and cabins will have no effect on climate. Revegetation within the exclusion area, particularly large-scale reforestation, will almost certainly affect the local micro-climate. Canopy serves to "buffer the understory, moderating levels of incoming and outgoing energy components (Chen et al. 1996)" (Chen et al. 1999:291). Added canopy in the exclusion area can be expected to produce an increase in average soil moisture and decreases in surface temperature (i.e., air temperature at ground surface), soil temperature, solar intensity, and wind speed. Furthermore, spatial and temporal variability of these variables will likely decrease with restoration of overstory (Chen 1999:291).

Exclusion area reforestation is expected to produce a beneficial long-term impact on local micro-climate. Canopy-induced micro-climactic changes will help support the restoration of native biota. Importantly, tracking of variation in local climate may be a helpful method for monitoring the effects of different forest management methods within Kahikinui Forest Reserve (Chen 1999).

3.1.4 Air Quality

Construction and use of trail systems will have no short or long-term effect on air quality. Construction of exclusion fencing and cabins may create highly localized, short term impacts to air quality if materials are air-lifted to the site via helicopter. Use of gas-powered tools to install fence posts or construct cabins may also create highly localized, short term impacts to air quality. Prevailing trade winds should disperse any emissions generated by construction activities. There are no long-term air quality issues for cabins and exclusion fencing. Overall, the proposed action will have a less than significant effect on air quality.

3.1.5 Noise Levels

Although long-term use and management of the exclusion fence area, access trail systems, and cabins will have no significant acoustic impact, there may be short-term impacts during construction of fence and cabins. As indicated in the previous section, construction of cabins and exclusion fencing may require transport of materials via helicopter. Helicopter rotor, engine, and transmission sounds are almost universally considered noise, the principal sources being the main and tail rotors.

Transportation of materials via helicopter will cause short-term elevation in background noise levels in the project area. Installation of fencing may also cause localized increases in noise level. These noise spikes will be of short duration and will therefore have no long-term adverse effect on natural, cultural, or socio-economic resources. Due to the lack of sensitive uses within

several miles, it is not expected that the contractor will be required to obtain a permit per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. If necessary, Department of Health will review the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers.

3.1.6 Hazardous Substances

No known hazardous substances are present on the properties. Construction of fence line and cabins with power equipment can potentially expose areas to hazardous substances such as oil, solvents, and fuel.

3.1.6.1 Mitigation

The fencing contractor will be required as a condition of the contract to develop and implement Best Management Practices that prevent the release of any hazardous substances, including oil, fuel, and solvents.

3.2 Biological Environment

This section presents an assessment of anticipated environmental impacts to biological resources resulting from the proposed action. Mitigation measures are proposed for adverse impacts that are determined to be significant.

3.2.1 Botanical

The project area currently consists of a highly degraded upland mesic forest. Previous surveys conducted for the original exclusion area produced no evidence of threatened or endangered species. This suggests that these resources are very sparse within the preferred terrain type (i.e., rocky, exposed ridgetops) for fence installation. Parts of the revised project area, however, have been designated critical habitat for four endangered plants including *Alectryon macrocossus kalealaha*, *Bidens micrantha kalealaha*, *Germanium multiflorum*, and *Agyroxiphium sandwicense macroceph*. Four listed endangered understory species (*Clermontia lindseyana*, *Diplazium molokaiense*, *Bidens micrantha kalealaha*, and *Phyllostegia mollis*) have also been documented in the project area.

Survey of the revised fence alignment produced no evidence of rare, threatened or endangered plants. Vegetation along the rocky ridgetops is very sparse, and native and rare plants do not appear to be present. It is expected that threatened and endangered native plants persist only on steep and relatively inaccessible gulch walls. These areas will not be impacted by fence, trail, or cabin installation. For the longer term, it should be noted that feral goats are cited as the major contributor to degradation of critical habitat and native ecosystems in the 2010 five-year reviews for the above-listed endangered plants. The ecosystem restoration necessary to stabilize, and eventually downlist, these species will be a primary outcome of LHWRP broadly and the ungulate exclusion fencing and eradication action specifically.

3.2.2 Avian

Ornithological survey of the revised fence alignment was conducted on March 22–25, 2011. The full text of the report is included in Appendix A. Survey results indicate that there are no avian species inhabiting the area along the alignment. Forest birds survive only where there are remnant *ʻohiʻa* stands, typically within the steep gulches.

The endangered Hawaiian Petrel is known to nest near the rim of Haleakalā National Park and therefore might be expected within similar environments of the upper elevation portions of the project area. Although the alignment and a 10–20 m buffer were searched thoroughly, no evidence of nesting or other activity was found. Given that a substantial amount of time may pass between the time of this survey and when the proposed action is implemented, pre-construction surveys will be conducted if construction is planned during Hawaiian Petrel nesting season (March–October). With this stipulation in place, the proposed fencing action will have no short-term adverse impact to avian resources. Long-term impacts from fencing, ungulate eradication, and subsequent reforestation are expected to be beneficial to petrels. In the years following elimination of ungulates, petrels may begin to recolonize the exclosed area. Regeneration of native vegetation and elimination of ungulates that trample burrows would have a significant positive impact on the reproductive success of this species. In addition, DOFAW has indicated that a predator control program may be implemented if petrels are found to be nesting within the exclosure in future years. As a result of these measures, overall productivity and survival of petrels would be expected to increase within the exclosure, contributing significantly to the overall recovery of this listed species.

Since the proposed trail routes and cabin sites were only provisional at this time, they were not surveyed for threatened and endangered avian taxa. Trail routes and cabin siting decisions therefore have the potential to negatively impact avian resources.

3.2.2.1 Mitigation

Full biological surveys, including avian resources, will be conducted for the final proposed trail alignments and cabin locations. If any threatened or endangered species are discovered (e.g., Hawaiian Petrel, Nene) the trails and cabins will be redesigned so that there are no adverse impacts to existing species. As noted above, pre-construction surveys will be conducted for the fence alignment if construction is to occur during Hawaiian Petrel nesting season.

To prevent petrel fence-strikes, reflective tape will be woven into the fence to increase its visibility.

Under this mitigation plan, the proposed action will have no short or long-term adverse impact to avian resources.

3.2.3 Mammalia

The Hawaiian hoary bat (*Lasiurus cinereus semotus*) inhabits trees and shrubs along the forested south slope of Haleakalā and may be present in the project area.

3.2.3.1 Mitigation

To prevent impact to hoary bats and their young, no woody plants greater than 4.6 meters tall will be removed or trimmed between June 1 and September 15. Additionally, to reduce the potential for entanglement, no barbed wire will be used on the fence.

3.2.4 Arthropoda

Manduca blackburni, an endangered sphinx moth, is present on the south slope of Haleakalā and may be present in the lower elevations of the affected area. Biological survey of the revised exclusion fence line produced no evidence of sphinx moth within the corridor. Most of this area is too high in elevation to support the moth's native food plant tree, *'aiea*. Construction of the fenceline will therefore have no short-term adverse impact on the sphinx moth. In the long-term, rejuvenation of the *koa* forest ecosystem will likely produce suitable habitat for the sphinx moth in the lower elevation portions of the fenced area. A program of outplanting *'aiea* may be conducted by DOFAW and would likely increase the moth's abundance. The long-term impact of the action on the sphinx moth will therefore be beneficial.

Access trails and cabins proposed for this project are in areas that may contain *'aiea*, and by extension, sphinx moth.

3.2.4.1 Mitigation

Trail and cabin areas will be surveyed for sphinx moth habitat prior to design finalization and construction. All such habitat areas will be avoided. Installation of trails and cabins will involve no cutting of *'aiea*. Under these mitigation measures, the proposed action will have no short or long-term adverse impact to the endangered sphinx moth.

3.3 Socio-economic Environment

This section presents assessments of the impact of the proposed action on various elements of the socio-economic environment. Mitigation measures are proposed for elements that may incur significant impacts from the project, of for which there is insufficient data to make a firm determination. Implementation of the proposed mitigation measures will result in a 'less than significant' impact determination for these elements.

3.3.1 Population

The proposed action does not involve elements that would have a significant effect on the leeward Haleakalā population. Although some increase in temporary, short-term land use can be expected following installation of access trails and cabins, the action would not result in increased development or increases in the population levels in the surrounding region.

3.3.2 Land Use

The proposed action would result in minimal change to current land use activities. Exclusion fencing and reforestation fall within the current conservation-oriented land use for the Nakula NAR and Kahikinui Forest Reserve. Installation of access trails and cabins is expected to increase recreational and subsistence land uses. This change is seen as a neutral impact, in that it is not

anticipated to introduce significant secondary impacts. Overall land use levels, though elevated with greater access, are still expected to remain at relatively low levels in the near and medium-term. DOFAW will monitor annual usage levels for trails and cabins to ensure that unanticipated spikes in use are tracked and assessed for adverse impacts according to standard Environmental Assessment categories. Tracking will be accomplished by consultation with local user groups and by hiker sign-in sheets at trail heads.

DOFAW is mandated to protect high-value conservation lands. This includes removing non-native ungulates, which degrade native vegetation, spread weeds, compact soils, increase erosion, and create breeding habitat for mosquitoes. As per DOFAW policy, public participation in animal removal will be facilitated as long as it is feasible, effective, and safe. In the long-term, the complete removal of ungulates from the project area will result in a reduction in potential hunting opportunities. However, access is limited and extremely difficult. The site is therefore rarely used by hunters.

3.3.3 Recreation

The proposed action will have a beneficial impact to non-hunting recreation (see 3.3.2 above for hunting). Installation of trails and cabins will provide increased public access to remote areas. Ungulate exclusion fencing and long-term forest restoration will result in a marked increase in native species in the project area, thereby improving the quality of ecologically-oriented recreation.

3.3.4 Scenic and Visual Resources

The proposed action will have a negligible impact to scenic and visual resources. From the distance at which the public typically view the leeward Haleakalā uplands, the exclusion fence, trails, and cabins will not be visible, and will therefore not impact the visual character of landscape. Over the long-term, reforestation within the fenced area will result in a beneficial impact, by restoring the natural biota and the former appearance of the pre-Contact landscape.

3.3.5 Infrastructure and Utilities

There is currently no road access to the project area and no roads will be constructed as part of the proposed action. Transport of material and personnel will occur primarily by helicopter. There will therefore be no effect on roads or infrastructure.

No utilities or other public services are present at the site and none will be constructed as part of the project. The proposed action will therefore have no impact on utilities or public services.

3.3.6 Cultural Resources

Special Contract Requirements that will be incorporated into the fence construction contract documents will stipulate that in case a previously undetected lava tube is breached during construction, DOFAW will notify the State Historic Preservation Division and cease work in the vicinity immediately to ensure that no historic or burial resources are adversely affected.

3.3.6.1 Archaeological Resources

Field survey of the proposed fence alignments by Garcia and Associates identified two potential historic era cairns along the upper, eastern fence alignment. Construction of the fence as designed will impact one of the cairns (Cairn #2) and lie within 10 m of the other cairn (Cairn #1). Recommended mitigation is to reroute the fence alignment around both cairns to avoid adverse effect to these potential historic properties. If such avoidance strategies are implemented for the two cairns, then construction of the fence alignments will have no adverse effect on archaeological or cultural resources.

The proposed trails and cabins, although tentative in design, will follow prominent ridges and cross-cut drainages from the southern to northern-most boundaries of the Kahikinui Forest Reserve (see Figures 3 and 4). Based on previous and current surveys in the project area, the middle and upper elevations between 4,800–9,200 ft amsl have a low probability for containing sites, particularly below 8,000 ft amsl where the ridges are eroded to the point that very little topsoil remains on the ground surface. Therefore, construction of recreational trails and cabins between 4,900–9,200 ft amsl will most likely not have an adverse effect to archaeological or cultural resources.

The lower, unsurveyed portion of the project area below roughly 3,000 ft amsl is evaluated as archaeologically sensitive given that traditional Hawaiian occupation sites were identified at neighboring Kahikinui between 2,110 and 3,020 ft amsl and historic ranch sites are anticipated near the south boundary of the Forest Preserve parcel. Therefore, an adverse effect to archaeological or cultural resources is possible if ground-disturbing activities occur below the approximately 3,000 ft amsl contour. A field survey or aerial reconnaissance of these lower elevations would be necessary to determine if significant historic properties are present in the archaeologically sensitive area. Alternatively, archaeological monitoring may be employed during final trail and cabin construction to ensure that trails and cabins are not situated in close vicinity to archaeological resources below 3,000 ft amsl.

3.4 Growth-Inducing Impacts

Analysis of growth-inducing impacts examines the potential for a project to induce unplanned development, substantially accelerate planned development, encourage shifts in growth from other areas in the region, or intensify growth beyond the levels anticipated and planned for without the project. No aspect of the project has the potential to encourage growth.

3.5 Cumulative Impacts

Cumulative impacts result when implementation of several projects that individually have minor impacts combine to produce more severe impacts or conflicts among mitigation measures.

All potential adverse impacts of the current project related to most categories of effect (e.g., hydrology, air quality, noise, scenic value, biological resources, historic sites) are either non-existent or extremely restricted in geographic scale, negligible, and capable of mitigation through proper enforcement of permit conditions. There are thus few, if any, appreciable adverse impacts that might accumulate with those of other past, present and future actions to produce more severe

impacts. In the context of the large extent of existing forest of similar type in the area, the small area lost to fencing does not represent a substantial loss, particularly when given the significant benefit in terms of environmental restoration.

Beneficial cumulative impacts to biological resources, which are substantial, are discussed in Section 3.3.

3.6 Consistency with Government Plans and Policies

The project is highly consistent with all government plans and policies, especially those aspects that call for conservation of natural resources.

3.6.1 Hawai‘i State Plan

The Hawai‘i State Plan was adopted in 1978. It was revised in 1986 and again in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended). The Plan establishes a set of goals, objectives and policies that are meant to guide the State's long-run growth and development activities. The proposed project is consistent with State goals and objectives that call for increases in employment, income and job choices, and a growing, diversified economic base extending to the neighbor islands.

Chapter 226-4 sets forth goals associated with the *Hawai‘i State Plan*:

1. A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawai‘i's present and future generations.
2. A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well- being of the people.
3. Physical, social, and economic well-being, for individuals and families in Hawai‘i, that nourishes a sense of community responsibility, of caring, and of participation in community life.

The aspects of the plan most pertinent to the proposed classification are the following:

Chapter 226-11 *Objectives and policies for the physical environment—land-based, shoreline, and marine resources*. Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of prudent use of Hawai‘i's land-based, shoreline, and marine resources and effective protection of Hawai‘i's unique and fragile environmental resources. To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of the State to:

(1) Exercise an overall conservation ethic in the use of Hawai‘i's natural resources.

(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.

(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai‘i.

(7) Pursue compatible relationships among activities, facilities, and natural resources.

(8) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.

3.6.1.1 Discussion

The proposed action is consistent with the goals, objectives and policies of the *Hawai‘i State Plan*. Specifically, it is an appropriate use of an isolated land area that will encourage the protection of rare or endangered plant and animal species and habitats.

3.6.2 Conservation District

The property is in the State Land Use Conservation District, Resource subzone. Any proposed use in such areas must undergo an examination for its consistency with the goals and rules of this district and subzone. Discussion with the Department of Land and Natural Resources' Office of Conservation and Coastal Lands indicates that because the project is inside a Forest Reserve, DOFAW will not be required to obtain a Conservation District Use Permit for the project. Actions to affirmatively manage the forest reserve are viewed as operation and maintenance of an existing use and thus exempt from any requirement for a Conservation District Use Permit. Nevertheless, it should be noted that the project is entirely consistent with the criteria of the Conservation District, as listed in Chapter 13-5, Hawai‘i Administrative Rules:

- The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawai‘i Revised Statutes, entitled *Coastal Zone Management*.
- The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region, and in fact will result in substantial environmental benefit.

- The proposed land use, including fences, is compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.
- The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved and improved upon by allowing forest regeneration. Open space will be preserved.
- Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District. The proposed action will not subdivide the property and will not lead to any increase in intensity of use.

3.6.3 Hawai‘i’s Comprehensive Wildlife Conservation Strategy

The proposed action is consistent with the goals, objectives, and policies of the Hawai‘i’s Comprehensive Wildlife Conservation Strategy (CWCS). The CWCS comprehensively reviews the status of the full range of the State’s native terrestrial and aquatic species and presents strategies for long-term conservation of these species and their habitats. The CWCS identifies the following seven priority conservation objectives for the State:

1) Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive;
2) Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication;
3) Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs;
4) Strengthen existing and create new partnerships and cooperative efforts;
5) Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawai‘i;
6) Support policy changes aimed at improving and protecting native species and habitats; and
7) Enhance funding opportunities to implement needed conservation actions.

The proposed revised LHWRP action is very much in line with the goals and objectives of the CWCS. It is also an implementation of several of the CWCS’s island-specific strategies for Maui under Objective 1 (Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive). These include:

- Support existing conservation management and implement future needs as identified in ‘Management Needs’ section;

- Implement conservation actions identified in the 'Potential Areas for Enhanced Conservation Management' subsection;
- Develop and/or implement recovery plans for threatened and endangered species on Maui;
- Increase the total acreage of ungulate-free and predator-free areas.

4.0 DETERMINATION

Section 11-200-12 of the Hawai‘i State Administrative Rules sets forth the criteria by which the significance of environmental impacts shall be evaluated. The following discussion paraphrases these criteria individually and evaluates the project’s relation to each.

1. *The project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources*.

   In the context of the large extent of existing forest of similar type in the area, the small area lost to fencing does not represent a substantial loss, particularly when given the significant benefit in terms of environmental restoration. No significant natural resources will be irrevocably committed or lost. The State Historic Preservation Division is expected to concur with the determination that no effect to historic properties will occur.

2. *The project will not curtail the range of beneficial uses of the environment*.

   No future beneficial use of the environment will be affected in any way by the proposed project. The land in the immediately surrounding area, which is zoned for conservation, will not be adversely affected.

3. *The project will not conflict with the State’s long-term environmental policies*.

   The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. A number of specific guidelines support these goals. No aspect of the proposed project conflicts with these guidelines. The project’s goals of environmental restoration are a direct fulfillment of policies that call for conserving natural resources.

4. *The project will not substantially affect the economic or social welfare of the community or State*.

   The improvements will benefit the social and economic welfare of Hawai‘i by improving the natural environment.

5. *The project does not substantially affect public health in any detrimental way*.

   No adverse effects to public health are anticipated.

6. *The project will not involve substantial secondary impacts, such as population changes or effects on public facilities*.

   No adverse secondary effects are expected. The project will not enable or encourage development.

7. *The project will not involve a substantial degradation of environmental quality*.

The project will not degrade environmental quality in any substantial way, and will substantially improve the natural environment.

8. *The project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat*.

No endangered species of flora or fauna would be adversely affected in any way by the project, and many such species would significantly benefit from the action.

9. *The project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions*.

For most categories of impact, all adverse impacts will either not occur or are extremely minor and will therefore not tend to accumulate in relation to this or other projects. Substantial beneficial cumulative impacts are expected for biological resources.

10. *The project will not detrimentally affect air or water quality or ambient noise levels.*

The project will have largely beneficial effects to water quality, and will have negligible adverse effects in terms of air quality and noise.

11. *The project will not affect or will likely be damaged as a result of being located within an environmentally sensitive area such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters*.

No hazardous areas or potential to increase hazard to humans or environmentally sensitive areas are involved.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.*

No protected viewplanes will be impacted by the project, which will have no adverse scenic effects.

13. *The project will not require substantial energy consumption*.

A small amount of energy will be required for the fence line construction.

4.1 Conclusion

For the reasons above, and in consideration of comments received on the Draft SEA, the State of Hawai‘i, Department of Land and Natural Resources, DOFAW, has determined that the proposed project will not have any significant effect in the context of Chapter 343, Hawai‘i Revised Statues and section 11-200-12 of the State Administrative Rules, and has issued issue a Finding of No Significant Impact.

5.0 AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

The following agencies received a letter inviting their participation in the preparation of the SEA:

County of Maui

- Office of the Mayor
- Planning Department
- Fire and Public Safety Department
- Department of Public Works
- Department of Environmental Management
- County Council

State of Hawai'i

- Office of Hawaiian Affairs, Honolulu and Maui Offices
- Department of Hawaiian Home Lands
- Department of Health, Maui District Health Office
- Department of Land and Natural Resources, State Historic Preservation Division

U.S. Government

- U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office
- USDA Natural Resources Conservation Service (NRCS), Pacific Islands Area State Office

The following organizations/individuals received a letter soliciting their participation in the preparation of the SEA:

- Leeward Haleakalā Watershed Restoration Partnership
- Friends of Haleakalā National Park
- Ka 'Ohana O Kahikinui
- Sierra Club, Hawai'i Chapter
- KAHEA
- Emily J. Fielding
- Arthur C. Medeiros

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APPENDIX A: BIOLOGICAL ASSESSMENT REPORT

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Biological Assessment of Proposed Fence within Kahikinui NARS

Purpose A fence is proposed in the Kahikinui unit of the Natural Area Reserve System on the southern flank of Haleakala volcano on Maui Island. The proposed fence line was surveyed by Natural Area Reserve Specialist Bryon Stevens, Archaeologist Jennifer Robins, and me on March 22–25, 2011. Potential negative impacts to Hawaii's native avifauna because of the fence and its construction are presented here.

Methods The proposed fence-line was followed by aid of GPS and marked ribbon. Surveyors started at the highest point of the Reserve and walked down and then across the line. The endangered Hawaiian Petrel (*Pterodroma sandwichensis*) is known to nest near the rim of Haleakala within Haleakala National Park (HALE). The highest boundary of the Reserve is adjacent to HALE and likely has similar habitat to known nest sites within the park. The petrels nest out of site in underground burrows, evidence of their activity includes feathers, footprints, carcasses, and droppings near burrow entrances. The fence-line and an area 10-20m adjacent to each side of the line was thoroughly searched for petrel activity. Activity of all other native and non-native birds was also documented to inform managers of the Reserve's natural resources.

Findings Habitat within the Reserve was highly degraded and only small populations of birds were observed. No Hawaiian Petrel nests were found along the proposed fence line during the survey. However, Hawaiian Petrels were seen and heard flying over areas of the Reserve, presumably to staging areas on Haleakala. Staging areas are where petrels socialize and seek pair bonds. A total of six petrels were seen flying in an Eastward direction at ~1900h on March 23rd, and individuals were heard throughout most of the night.

Two endangered Hawaiian Geese (*Branta sandvicensis*) were observed flying in a Southeast direction over the Reserve at ~0900 on March 22, 2011. It is unknown if the birds were using habitat within the Reserve. One White-tailed Tropicbird (*Phaethon lepturus*) was observed flying in an Eastward direction at ~1600h on March 22, 2011. The individual flew out of site, and it is not known if Tropicbirds use habitat within the Reserve. Apapane (*Himatione sanguinea*) and Amakihi (*Hemignathus virens*) were heard and seen foraging in remnant stands of Ohia (*Metrosideros polymorpha*) and Koa (*Acacia koa*). Most trees were only surviving in steep areas, typically within deeply cut ravines. Non-native species detected in the survey include small numbers of Japanese White-eye (*Zosterops japonicus*), House Finch (*Carpodacus mexicanus*), Skylark (*Alauda arvensis*), Ring-necked Pheasant (*Phasianus colchicus*), and Chukar Partridge (*Alectoris chukar*).

Recommendations In my determination, the construction of the fence will not negatively impact native seabirds or forest birds. However, habitat at the highest areas of the Reserve appeared to be suitable for nesting petrels and a thorough search for nests outside the fence line in the area is suggested. Fences can be a dangerous obstruction for nocturnal flying birds, such as the Hawaiian Petrel. Ribbon secured near the top wire of fences can prevent fatal fence strikes. I suggest that every effort be made to reduce the risk of fence strikes on both the Reserve and HALE boundary.

Habitat within the Reserve and near the fence line was severely degraded because of ungulate pressure and erosion. Remnant stands of native forests only persisted in steep areas. Restoration areas could focus on the expansion and protection of remnant stands. Additionally, reforestation efforts that would connect current stands of forests could establish new flight corridors for native forest birds.

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APPENDIX B: ARCHAEOLOGICAL ASSESSMENT REPORT

Final—Archaeological Assessment Survey of Proposed Fence Alignments in the Kahikinui Forest Reserve, Nakula Ahupuaʻa and Kahikinui Ahupuaʻa, Hanā District, Island of Maui

TMK 2-8-001:005, 006 & 009

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GANDA Report No. 2202-1

August 2011

MANAGEMENT SUMMARY

At the request of Department of Natural Resources Division of Forestry and Wildlife, Garcia and Associates conducted archaeological assessment in support of a supplemental Environmental Assessment for newly proposed fence alignments, trails, and cabins in Kahikinui Forest Reserve, Nakula and Kahikinui Ahupuaʻa, Hana District, Island of Maui.

The proposed fence alignments span between 4,800 and 9,200 ft amsl and consist of three sections that will enclose roughly 2,353 acres of habitat in the forest reserve. The recreational trails proposed throughout the project area are located between the Haleakalā summit and south boundary of the project area at roughly 2,600 ft amsl.

Archaeological survey of the proposed fence alignments identified two rock cairns on or near the upper portion of the western fence alignment. The cairns likely mark the northern boundary of Kahikinui Forest Reserve, first established in 1928. The archaeological assessment concludes that construction of the fence alignments will have no adverse effect on archaeological or cultural resources in the project area if the fence line is rerouted to avoid the cairns.

The proposed recreational trails and cabins were not directly surveyed during the project because the locations were only tentative. Based on the absence of archaeological and cultural resources in previous surveys in the project area, however, the middle and upper elevations of the project area (4,800–9,200 ft amsl) are considered to have a low probability for containing archaeological sites. Therefore, construction of recreational trails and cabins in the middle and upper elevations will likely have no adverse effect to archaeological or cultural resources. The lower elevations of the project area (below 3,000 ft amsl) are evaluated as archaeologically sensitive based on the presence of traditional Hawaiian sites at similar elevations in the neighboring Kahikinui District. Therefore, an adverse effect to archaeological or cultural resources is possible if cabins or trails are installed below the 3,000-ft contour.

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1.0 INTRODUCTION

At the request of David Leonard, of Department of Natural Resources Division of Forestry and Wildlife (DLNR/DOFAW), Garcia and Associates conducted an archaeological assessment of proposed fence alignments, recreational trails, and cabins located in the Kahikinui Forest Reserve, in Nakula Ahupuaʻa and a northeast corner of Kahikinui Ahupuaʻa, Hanā District, Island of Maui (Figure 1 and 2). This assessment report is a required component of a supplemental Environmental Assessment (EA) prepared by DLNR/DOFAW for a habitat restoration project on State-owned lands in Kahikinui Forest Reserve. The EA is prepared in compliance with Office of Environmental Control, Chapter 343 of the Hawaii Revised Statutes.

The goal of this assessment is to determine through a field survey whether construction of the project elements may have a significant effect on historic or cultural properties in the project area.

1.1 Project Area Description

The project area is within the State-owned parcel of the Kahikinui Forest Reserve on the south slope of Haleakalā between approximately 2,600 ft to 9,200 ft above mean sea level (amsl). The parcel encompasses the uplands of Nakula Ahupuaʻa and a northeast corner of the larger Kahikinui Ahupuaʻa located to the west. Both project *ahupua'a* are currently located in the administrative district of Hanā. According to the Hawaiian Government Survey map (Dodge 1885; Figure 33) Nakula Ahupuaʻa was originally part of Kaupō District and lands to the west were within the Kahikinui District. Kahikinui District once comprised at least eight traditional *ahupuaʻa* (Dixon 2000:4), including Manawainui Ahupuaʻa bordering Nakula Ahupuaʻa on the west side, which possibly overlapped the northwest corner of the current project area.

The Dodge (1885) map also shows a place name or person's name "*Kaniakani*" in the southeast corner of the State-owned parcel (and current project area). This name is perpetuated on current Tax Map Key (TMK) maps as "*Puʻu Kaniakani*" and listed as a separate parcel: TMK 1-8-001-008 (see Figure 2).

The project area is composed of lava flows from Haleakalā Volcano associated with differing aged Kula and Hana Volcanic Series (MacDonald et al. 1986:383). Two primary vegetation zones are within the project area: the dry shrub or forest subalpine zone above 5,248 ft amsl and currently degraded *Koa-ʻOhia* Montane Mesic Forest in the remaining lower elevations.

1.2 The Undertaking

The newly proposed fence alignments span between 4,800 and 9,200 ft amsl and consist of three sections: the eastern and western alignments paralleling the slope on the east and west boundaries of the forest reserve and the southern alignment crossing the slope at around 4,800 ft amsl (Figure 4). The three proposed fence alignments will enclose a roughly 2,500-acre habitat by connecting with the National Park Service (NPS) fence to the north and Haleakalā Ranch fence on the southwest corner of the parcel.

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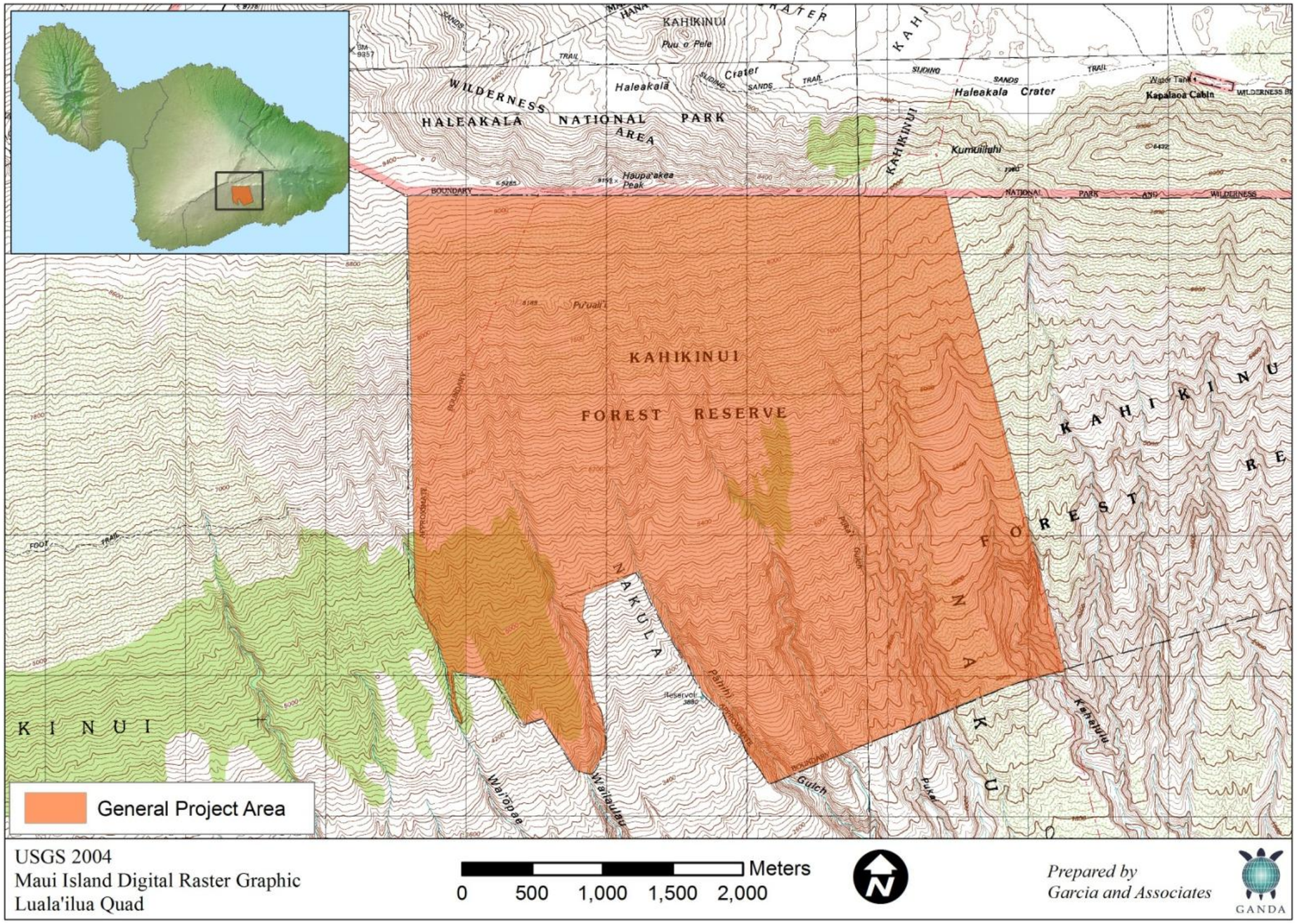

Figure 1. USGS map and Hillshade Imagery showing location of Kahikinui Forest Reserve project area, Kahikinui and Nakula ahupuaʻa, Hanā District, Maui.

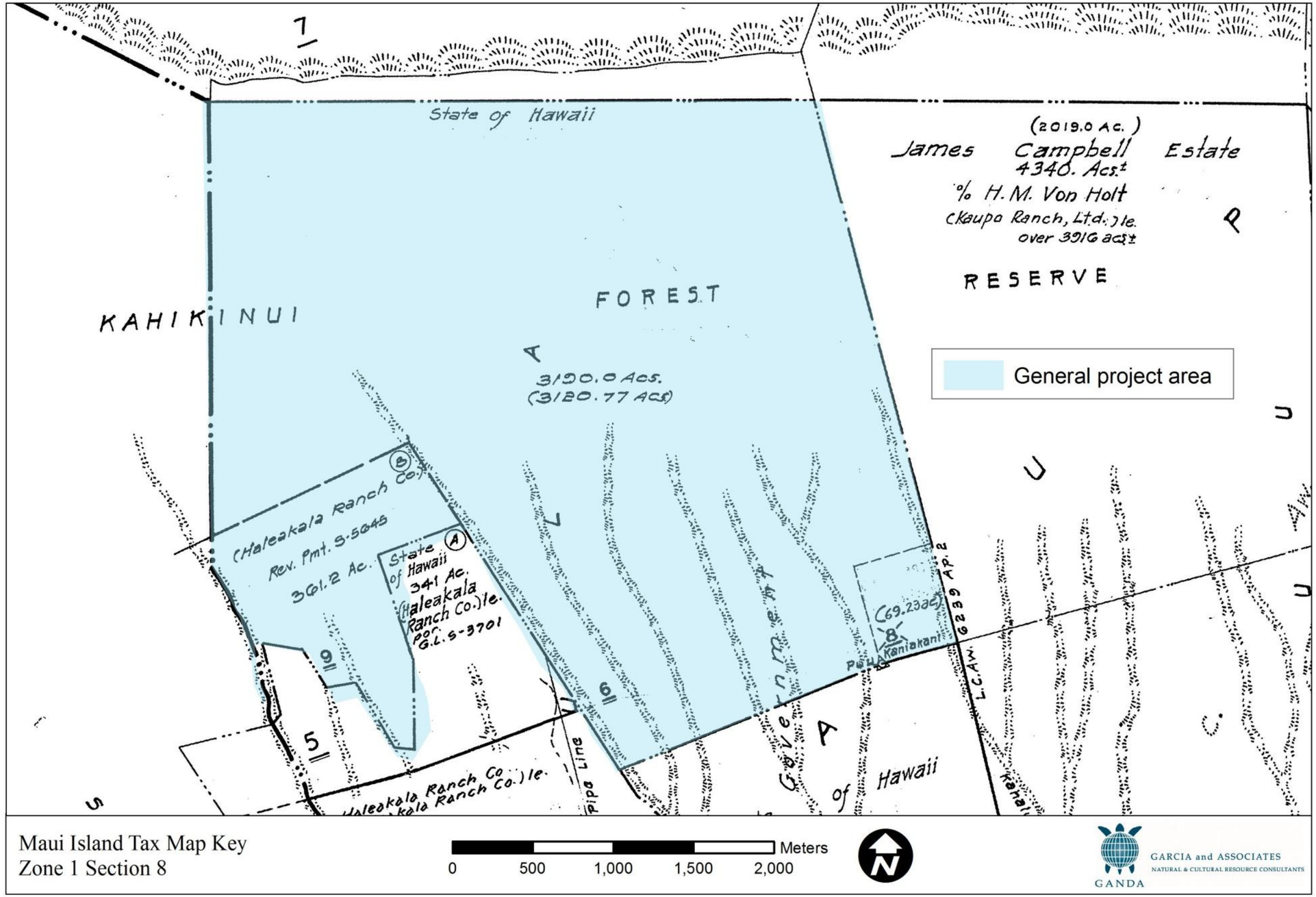

Figure 2. TMK map showing Kahikinui Forest Reserve project area, Nakula and Kahikinui *ahupua'a*, Hanā District, Maui Island.

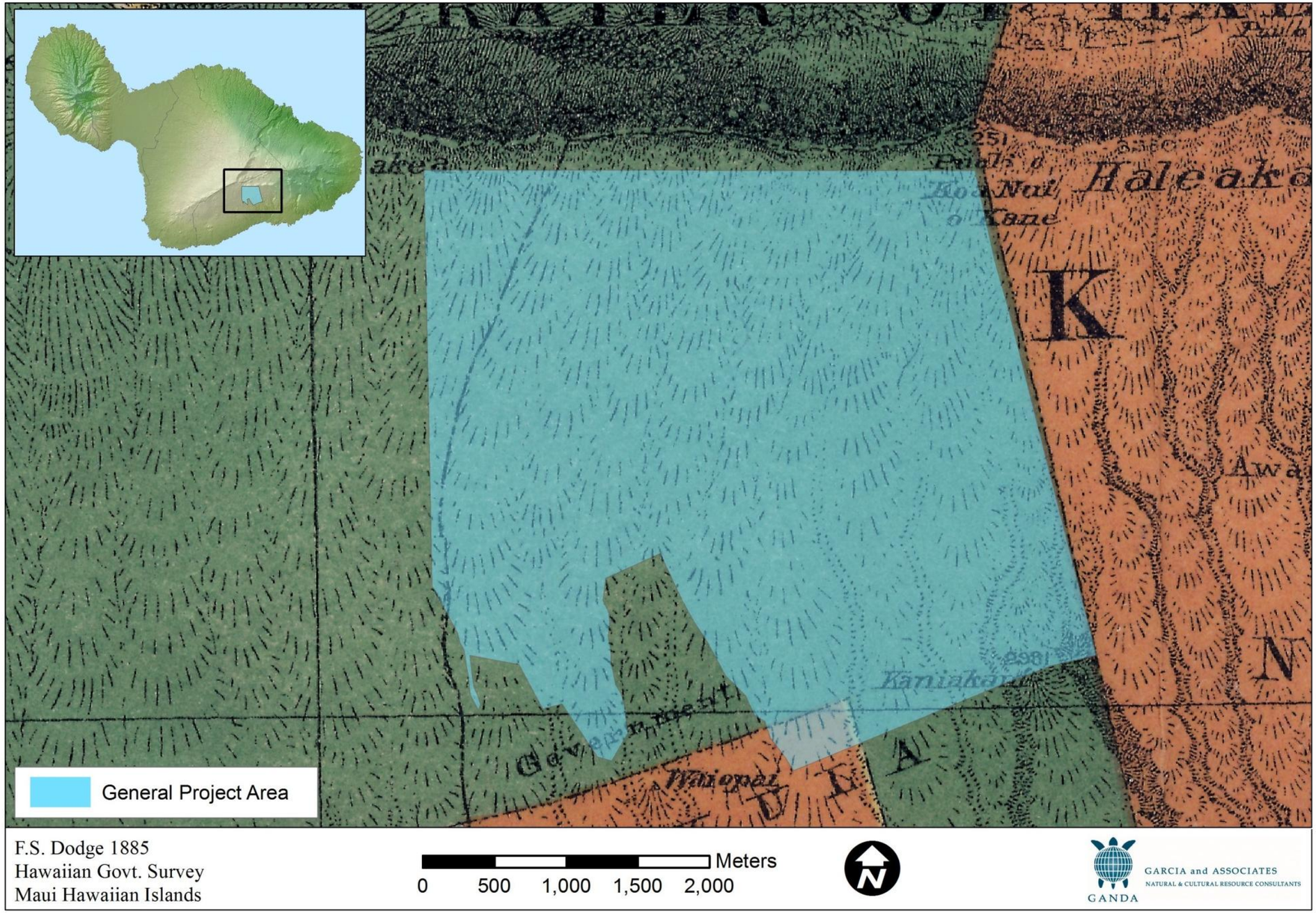

Figure 3. Portion of Hawaiian Government Survey map of Maui (Dodge 1885) showing overlay of Kahikinui Forest Reserve project area and *Kaniakani* reference in southeast corner, Nakula and Kahikinui *ahupua'a*, Hanā District, Maui Island.

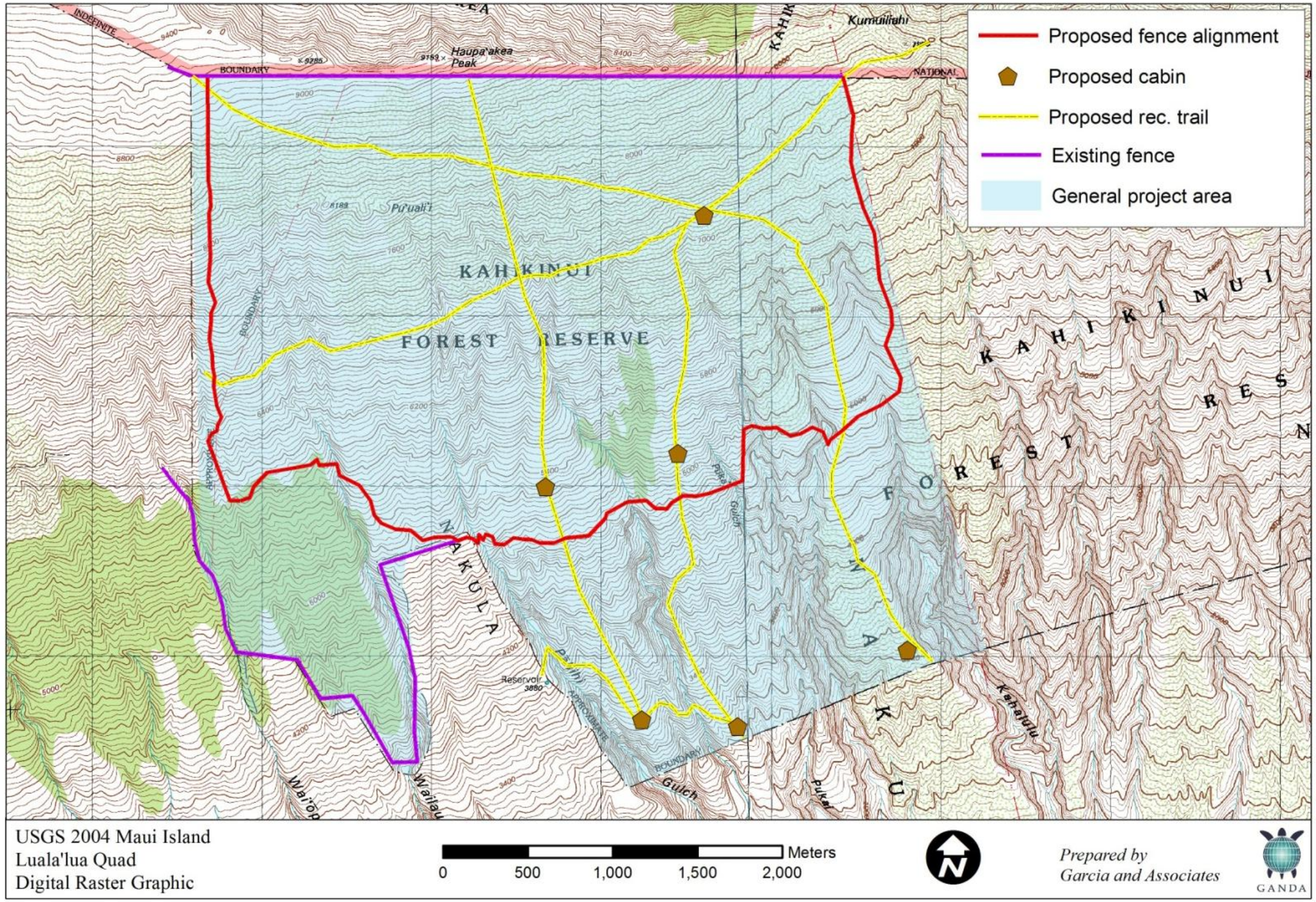

Figure 4. USGS quad map showing Kahikinui Forest Reserve project area with existing fence alignments and current project proposed elements.

The recreational trails proposed throughout the project area are located between the Haleakalā summit and south boundary of the project area at roughly 2,600 ft amsl (see Figures 3 and 4). The trails are aligned north-south along prominent and steep ridge tops and across the slope and deeply dissected terrain. Six proposed cabins are distributed along the ridge tops adjacent to some of the trails (see Figures 3 and 4). One of the proposed cabins and the south end of one of the trails is located within the *Kaniakani* parcel mentioned above.

The proposed recreational trails and cabins were not surveyed during the current project because the locations are only tentative in design. The archaeological sensitivity of the proposed trails and cabins is speculated in the Conclusions section of this report.

2.0 PREVIOUS ARCHAEOLOGY

Rechtman Consulting, LLC, conducted an archaeological assessment survey (Desilets and Rechtman 2004) for DLNR/DOFAW along two fence alignments originally proposed as exclusion fences for a protected habitat area in the western portion of the project area (Figure 5). The current project represents a change to this original design in an effort to enlarge the protected habitat area within Nakula Ahupuaʻa. No significant historic or cultural properties were identified in the original fence alignments. A hunting blind determined to be a recent construction and not an historic property was observed at approximately 6,400 ft amsl. Given the absence of cultural resources in the proposed fence alignments, the archaeological assessment concluded that construction of the fence alignments would have no effect on known archaeological resources.

Although no other archaeological investigations were conducted in the project area, investigations at similar elevations outside of Nakula Ahupuaʻa provide comparable data for predicting archaeological sensitivity. Such studies include Lloyd Soehren's survey work (Soehren 1963) in and around the perimeter of Haleakalā Crater and various investigations at the Science City area on the Haleakalā summit roughly 2 km northwest of the project area (e.g., Chatters 1991; Bushnell and Hammatt 2000; and Fredericksen and Fredericksen 2003). The upper elevation Haleakalā sites are characterized by burials, trails, cairns, rock shelters, temporary habitation shelters (e.g., C-shapes), quarries, petroglyphs, and pictographs. Ritual sites in the form of platforms were typically located in the floor of the crater and temporary shelters are often found constructed against the leeward side of rock formations or on *puʻu* as a windbreak inside and along the edge of the crater (Dagan et al. 2007:44).

A series of archaeological investigations were undertaken on Department of Hawaiian Homelands (DHHL) in the neighboring *ahupuaʻa* of Kahikinui, from the coast to the Kahikinui Forest Reserve boundary at approximately 4,000 ft amsl. The Dixon et al. (2000) investigation is the most comprehensive Kahikinui investigation that documents archaeological sites in three traditional *ahupuaʻa* (Kipapa, Nakaohu, and Nakaʼaha) between roughly 1,600 to 4,000 ft amsl. The investigation identified a dispersed pre-Contact permanent settlement occupied between AD 1300 and Contact, with the densest concentration of permanent residences identified between 2,110–2,415 ft amsl and temporary habitations dominating the site types above 2,415 or 3,020 ft amsl (Dixon et al. 2000:327). The upland settlement also included a *holua* slide, *heiau* and other ritual features, possible burials, dryland agriculture plots, markers, and post-Contact ranch-related structures (Dixon et al. 2000:69).

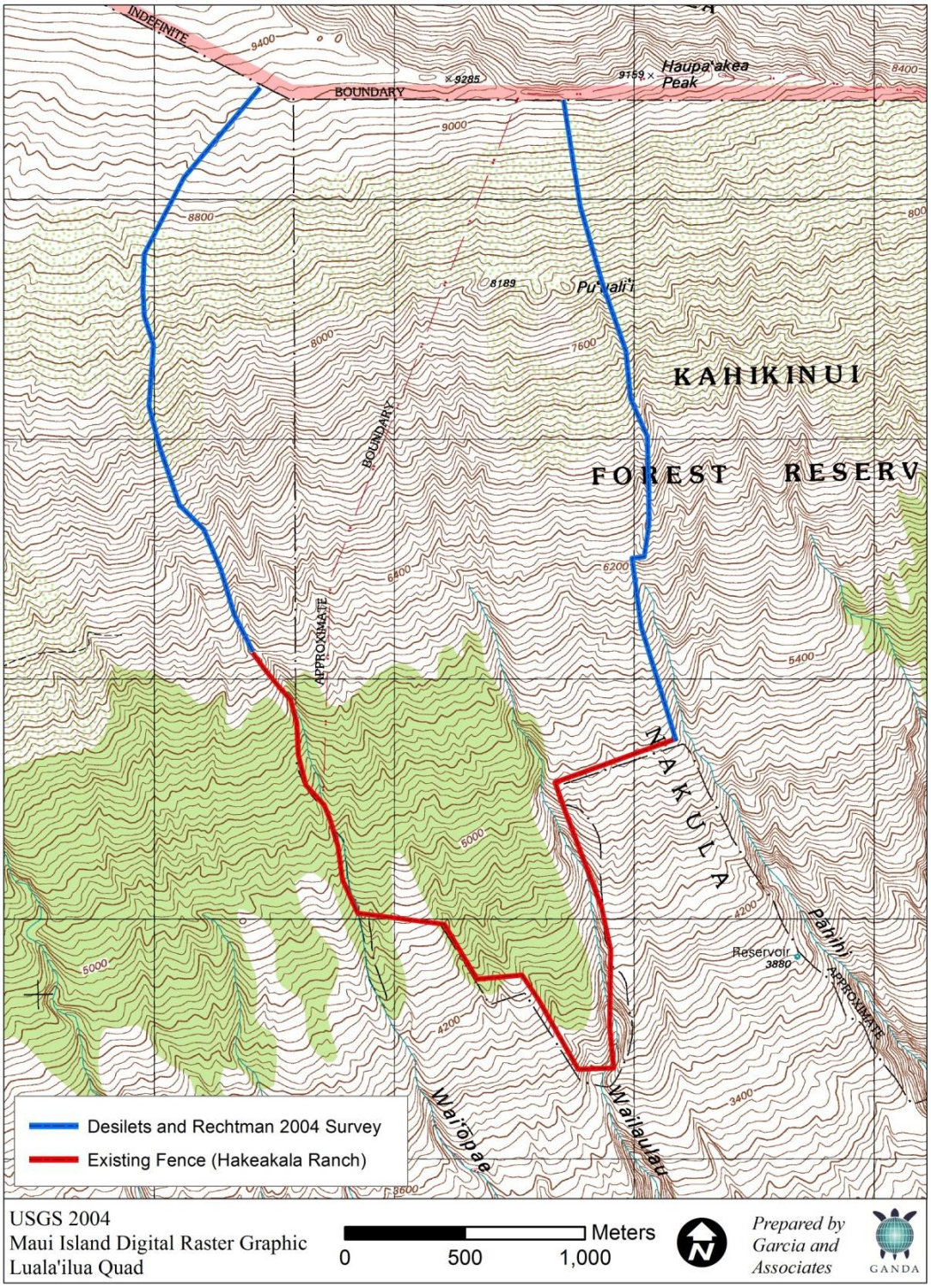

Figure 5. USGS quad map showing previous fence alignment survey (Desilets and Rechtman 2004) and existing fence alignment.

2.1 Anticipated findings

Results of the Desilets and Rechtman (2004) survey of original fence alignments in the western portion of the project area suggests that few if any sites would exist in the middle and upper elevations of Nakula Ahupuaʻa and Kahikinui Ahupuaʻa between 5,160–9,200 ft amsl. If present, sites are likely traditional Hawaiian related to collection of upland resources or travel between the south coast of Maui and Haleakalā Crater and points beyond. Temporary encampments or shelters were expected in the upper-most elevations near the rim of the crater; traditional *mauka*/*makai* trails with cairns as markers were expected along the more prominent ridge tops of all elevations; and caves used for temporary habitation were expected in deep gulches and outcrop ledges throughout the project area.

Based on the Kahikinui investigations at nearby *ahupuaʻa* (e.g., Dixon et al. 2000:327), the current project area below 3,020 ft amsl has potential for containing significant archaeological sites associated possibly with permanent occupation from 2,110–2,415 ft amsl and temporary habitations from 2,415–3,020 ft amsl.

Given the presence of ranching activities in adjacent parcels, ranching sites, such as cattle walls, were also anticipated near the south or *makai* boundary of the project area. According to DOFAW Natural Area Reserves specialist Bryon Stevens, a rock wall possibly associated with a former cattle drive was observed near the southern boundary of the project area near Pāhihi Gulch at around 3,880 ft amsl (B. Stevens personal communication 8 March 2011).

3.0 SURVEY METHODOLOGY

Garcia and Associates' Project Director Jennifer Robins, B.A., between 22–24 March 2011, conducted the archaeological survey, accompanied by Bryon Stevens, DOFAW Natural Area Reserve System specialist, and Seth Judge, Seabird and Forest Bird biologist. Stevens coordinated the logistics of the field project and delineated the fence alignments during the field survey. The field crew camped in the project area for two nights at separate sites along the south fence alignment. Windward Aviation, from Kahului, Maui, provided transportation in and out of the project area and daily transport to the upper ends of the east and west fence alignments.

The survey crew conducted pedestrian survey in a downhill direction, in one transect per alignment. Eastern and western fence alignments were surveyed starting at the northern NPS fence line (Figure 6). Survey of the south fence alignment was conducted in two sections starting from the bottom of the east or west fence alignments, respectively. One steep section of the south fence alignment on the west side of Pukai Gulch was excluded from the survey, because the landscape and potential features were clearly visible from the east side of the gulch (Figure 6). Ground visibility was excellent throughout the project area because of the absence of vegetation and the sloped angle of the surrounding landscape allowing broad, down slope views of the project area.

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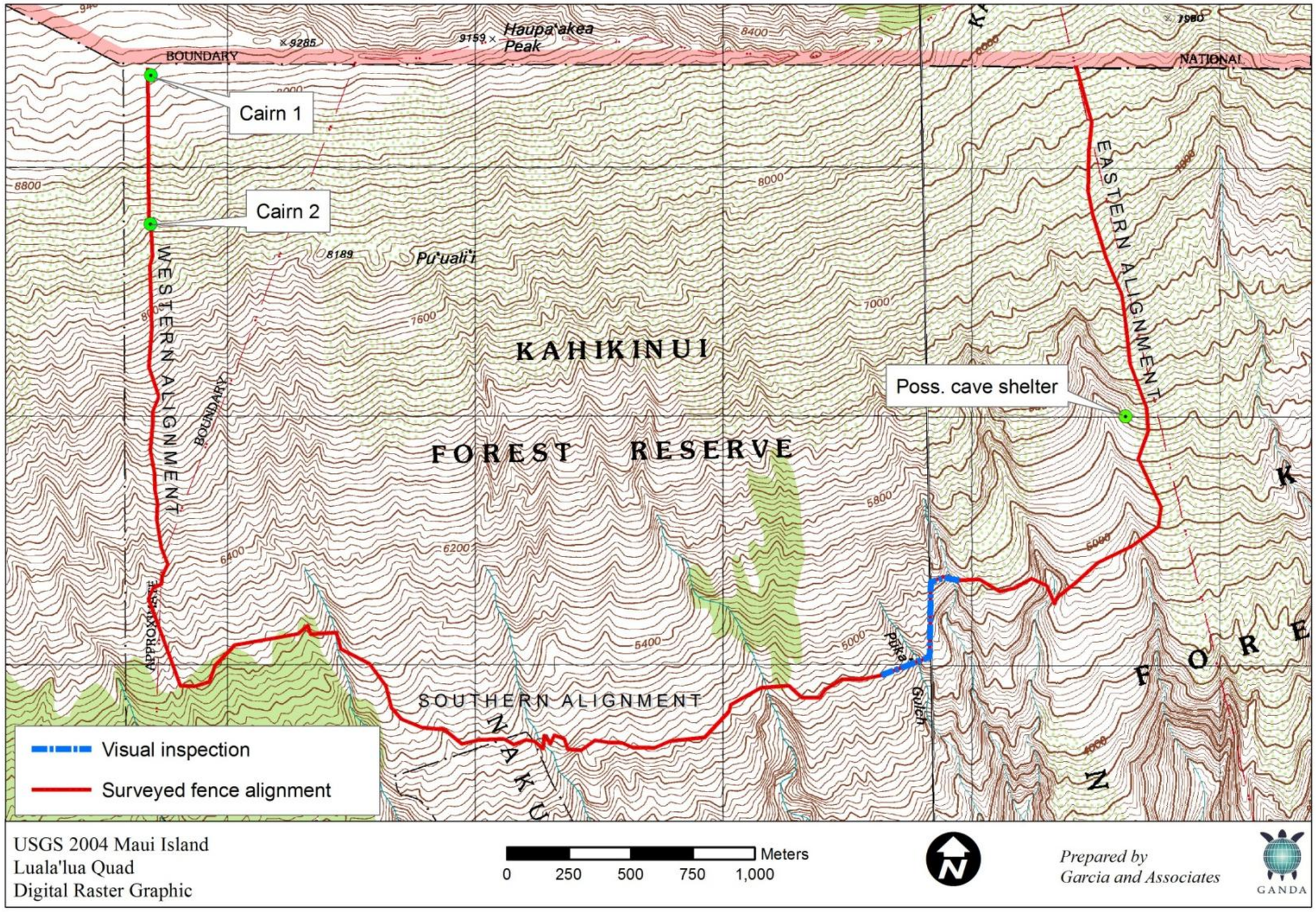

Figure 6. USGS quad showing surveyed fence alignments and locations of cultural resources.

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4.0 ASSESSMENT RESULTS

This section presents the results of archaeological survey along the newly proposed eastern, western, and southern fence alignments.

4.1 Eastern Alignment

The eastern alignment begins in the dry subalpine zone at the NPS fence line at roughly 7,600 ft amsl and terminates on the east edge of Kahalulu Gulch at 5,000 ft amsl. The upper portion of the alignment is dominated by a narrow ridge with a surface of loose cinder and weathered outcrop exposures covered by intermittent stands of *pūkiawe* (*Styphelia tameiameiae*) (Figures 7 and 8). At approximately 7,600 ft amsl, and continuing to the south end of the eastern alignment, the terrain becomes a more highly dissected slope with deep gulches and broad ridge tops. Erosion in these lower elevations is more severe as indicated by a lack of topsoil and intermittent exposures of once buried volcanic soils visible on the ground surface (Figures 9 and 10).

A cave sizable enough to accommodate temporary occupation was observed 100 m west of the eastern alignment in a large gulch at roughly 5,600 ft amsl (see Figures 6 and 11). The presence of this possible habitation cave suggests that other potential habitation caves may be present within the deep gulches of this elevation zone.

No archaeological or cultural resources were identified within the eastern alignment.

4.2 Western Fence Alignment

The western alignment descends from the NPS fence line at roughly 9,200 ft amsl and intersects the southern alignment at 5,800 ft amsl. The upper-most portion of the alignment (8800–9200 ft amsl) is in the dry subalpine zone characterized by a smooth, rocky surface with intermittent *pūkiawe* bushes (Figure 12). From 8,800 to around 6,400 ft amsl, the terrain quickly transitions to a more dissected and dense concentration of angular boulders and outcrop exposures within *pūkiawe* shrubland (Figures 13 and 14). Below the 6,400 ft mark, the terrain transitions to a more moderately sloped pastureland with broader areas of soil and thus, an accelerated rate of erosion.

Two rock cairns (Cairns 1 and 2) were identified on or near the west fence alignment at 9,160 ft amsl and 8,440 ft amsl, respectively (see Figure 6). Cairn 1 was located 10 m east of the eastern fence alignment and 44 m from the northernmost end of the alignment. The two cairns are roughly aligned along the western boundary of the state-owned portion of Kahikinui Forest Reserve. It is important to note that the boundary of the State-owned parcel differs from the Nakula Ahupuaʻa boundary shown on the Dodge 1885 map (see Figure 3), suggesting the current parcel represents a later land division, possibly originating when Kahikinui Forest Reserve was established in 1928. The cairns likely represent survey markers created along a more recent land division, such as the Forest Reserve.

Figure 7. Northeastern fence alignment at NPS fence; view east.

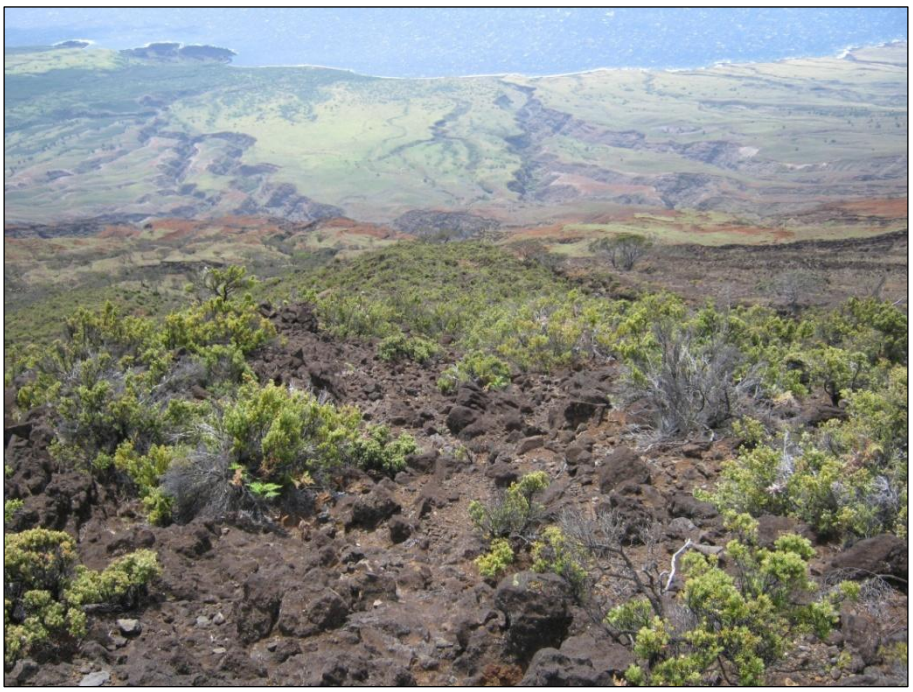

Figure 8. Upper portion of eastern fence alignment; view south.

Figure 9. Lower portion of eastern fence alignment; view south.

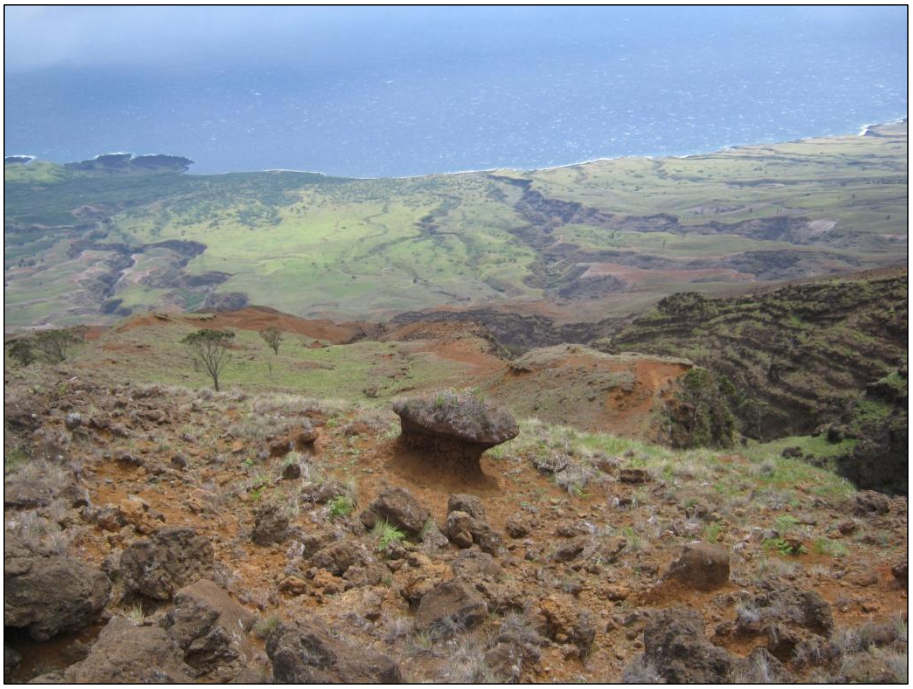

Figure 10. Lower portion of eastern fence alignment; view south.

Figure 11. Possible habitation cave west of eastern fence alignment; view northeast.

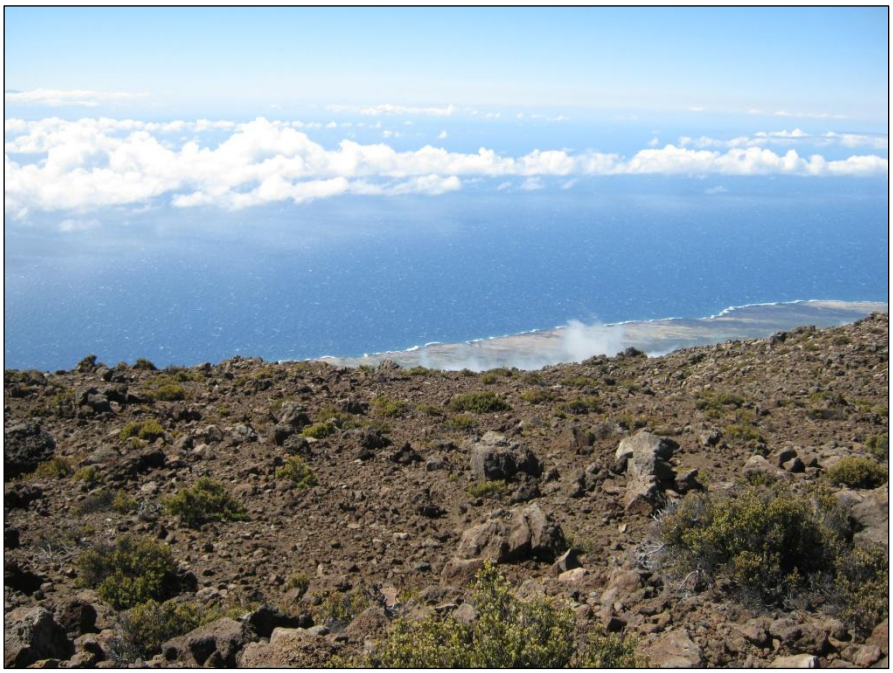

Figure 12. Upper portion of the western fence alignment; view southwest.

Figure 13. Middle section of western fence alignment; view south.

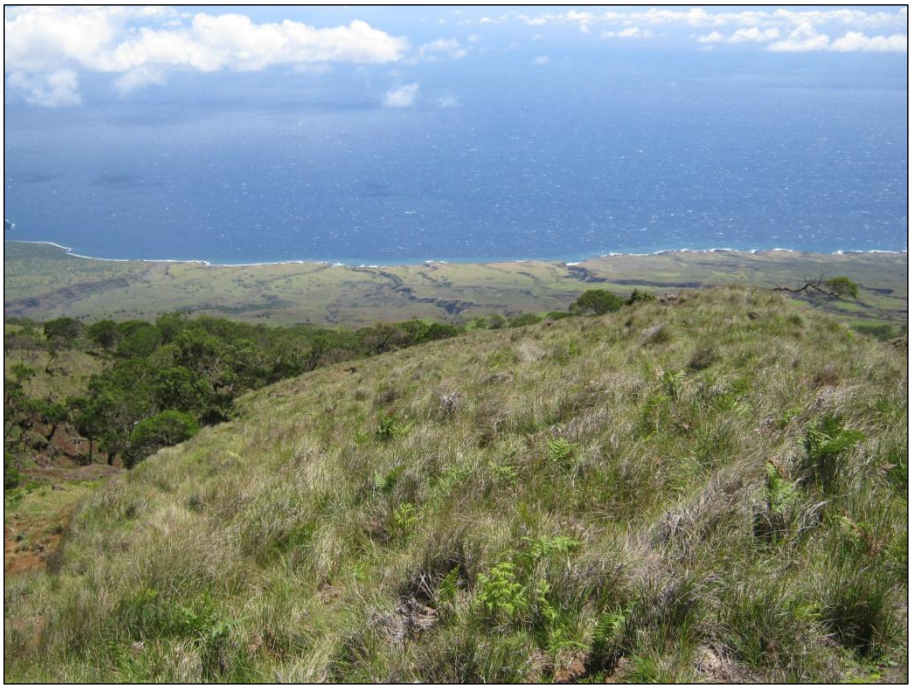

Figure 14. Lower portion of western fence alignment; view south.

Cairn 1 consists of angular small boulders piled against in situ medium boulders (Figure 15). The surrounding terrain is composed of a moderately sloped surface of concentrated cobbles and boulders. The cairn is 1.0 m in diameter and 0.8 m high.

Cairn 2 is located on the centerline of the eastern fence alignment, roughly 630 m from its *mauka* or northern end. The cairn lies on *pāhoehoe* outcrop on the west side of a small gulch. The cairn consists of piled cobbles and small boulders forming a slight pinnacle at the top (Figure 16). It is 1.0 m by 8.0 m and stands 1.0 m high.

No other archaeological or cultural resources were identified along the western fence alignment.

4.3 Southern Fence Alignment

The southern alignment intersects the lower slope of the project area between roughly 5,000 ft amsl on the east end to 5,800 ft amsl on the west end. The alignment crosses highly eroded ridge tops and several steep-sided gulches, including (from west to east) Wailaulau, Pāhihi, Pukai, and Kahalulu (Figure 17). Some of the gulches contain intermittent stands of *koa*, *ʻohiʻa*, and various ferns. The ridge tops in the western end of the alignment adjacent to Haleakalā Ranch consist of pasture grass.

No archaeological or cultural resources were identified along the southern fence alignment.

Figure 15. Cairn 1; view northeast.

Figure 16. Cairn 2; view southwest.

Figure 17. Southern fence alignment showing erosion on ridge top; view west.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Archaeological assessment was conducted in support of a supplemental EA for newly proposed fence alignments designed to enclose a protected habitat in Kahikinui Forest Reserve. Assessment also included consideration of impacts to recreational trails and cabins planned throughout the State-owned portion of the reserve.

5.1 Proposed Fence Alignments

An archaeological survey of proposed fence alignments identified two rock cairns on or near the upper portion of the western fence alignment. The cairns likely mark the northern boundary of the Kahikinui Forest Reserve first established in 1928. Although the age of the post-Contact cairns is undetermined and could be recent constructions, we recommend the fence alignment be built around the small sites to avoid adverse effect to a potential historic property. In the event that the fence collapses, it should be placed at a distance from the site that is equal to the height of the fence. Therefore, if avoidance strategies are implemented for the two cairns located in or near the western alignment, then construction of the fence alignments will have no adverse effect on any known archaeological or cultural resources in the project area.

A sizable lava tube was encountered well outside the proposed fence alignments among the more deeply dissected terrain at 5,600 ft amsl. Though no cultural material was exposed on the surface to confirm human use, the size of the protected cavern indicated that temporary habitation was feasible in the upper elevations of Nakula and Kahikinui, particularly among the more dissected terrain below 6,400 ft amsl.

5.2 Proposed Trails and Cabins

The proposed trails and cabins, although tentative in design, will follow prominent ridges from the southern to northern-most boundaries of the State-owned Kahikinui Forest Reserve (see Figures 3 and 4). Based on the previous and current surveys in the project area, the middle and upper elevations between 4,800–9,200 ft amsl have a low probability for containing sites, particularly below 8,000 ft amsl where the ridges are eroded to the point that very little topsoil remains on the ground surface. Therefore, construction of the recreational trails and cabins between 4,900–9,200 ft amsl will most likely not have an adverse effect to archaeological or cultural resources.

The lower, unsurveyed portion of the project area below roughly 3,000 ft amsl, however, is archaeologically sensitive given that traditional Hawaiian occupation sites were identified at neighboring Kahikinui Ahupuaʻa between 2,110 and 3,020 ft amsl (Dixon 2000:327). Historic features related to ranching activities, such as cattle walls, also likely exist in the lower elevations since the land abuts current and former ranch land. The potential for ranch-related sites is evidenced by the cattle wall (discussed previously) that was observed around 3,880 ft amsl on the edge of Pāhihi Gulch (B. Stevens personal communication 8 March 2011). Historic features might also be associated with the *Kaniakani* reference on the Hawaiian Government Survey map (Dodge 1885, see Figure 3) and later segregated as a TMK parcel (Figure 2). Therefore, an adverse effect to archaeological or cultural resources is possible if cabins or trails are installed below the 3,000-ft contour.

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