UNIVERSITY of HAWAI'I MĀNOA

Office of the Vice Chancellor for Research

January 23, 2014

Mr. Herman Tuiolosega
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

SUBJECT: Draft Supplemental Environmental Assessment for: **Humu'ula Saddle Region of Hawaii Island: A Detailed Hydrologic Evaluation and Exploratory Drilling Program; South Kohala District, Hawaii Island**

Dear Mr. Tuiolosega:

The University of Hawai'i is the proposing agency and accepting authority for the above named project and has reviewed the Draft Supplemental Environmental Assessment for the subject project, and anticipates a finding of No Significant Impact. Please publish a preparation notice in the next available OEQC Environmental Notice.

We have enclosed a completed OEQC Publicaiton Form and one (1) copy of the document in pdf format on a CD; and one (1) hardcopy of the Draft EA. You may contact Dr. Donald Thomas at (808) 895-6547, or at dthomas@soest.hawaii.edu, if you have any questions regarding this submission. Thank you in advance for your assistance in this matter.

Sincerely,

Brian Taylor
Interim Vice Chancellor for Research

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Honolulu, Hawai'i 96822
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AGENCY ACTIONS
SECTION 343-5(B), HRS
PUBLICATION FORM (FEBRUARY 2013 REVISION)

Project Name: Supplemental Environmental Assessment: Humu'ula Saddle Region of Hawaii Island: A Detailed Hydrologic Evaluation and Exploratory Drilling Program
Island: Hawaii Island
District: South Kohala District
TMK: 6-7-001-041
Permits: Non-covered Source Permit; Observation Well Drilling Permit

Proposing/Determination Agency: **University of Hawaii**
Dr. Donald Thomas
Hawaii Institute of Geophysics and Planetology
1680 East West Rd.
Honolulu, HI 96822;
Ph. 808 895-6547;
email: dthomas@soest.hawaii.edu

Accepting Authority:
(for EIS submittals only)
Consultant:

Dr. Donald Thomas
above

Status (check one only):

_x_DEA-AFNSI — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day comment period ensues upon publication in the periodic bulletin.

__FEA-FONSI — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.

__FEA-EISPN — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day consultation period ensues upon publication in the periodic bulletin.

__Act 172-12 EISPN — Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.

__DEIS — The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.

__FEIS — The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.

__ Section 11-200-23 Determination — The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.

__Section 11-200-27 Determination

The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.

__Withdrawal (explain)

Summary:
The proposed action is an investigation of the subsurface geology and hydrology of the Humu'ula Saddle region. The investigation will emplace the second of two small-diameter test bores to a depth of ~2000 m. **Purpose/Need:** The purpose is to collect and analyze core samples that will: provide a record of the geologic structure within the study area and document structures responsible for retention and flow of groundwater through the area. The bores will access one or more saturated aquifers and allow sampling for chemical and isotopic analysis of groundwater for determination of the source and extent of groundwater within the region; the bores will enable long term monitoring of the aquifers to assess the magnitude of the groundwater resource within the region and track the impacts of global climate change on Hawaii's groundwater resources. The need for the information provided by the project is that associated with long-term, sustainable management of Hawaii's groundwater resources in a region where recent limited data have shown that hydrologic conditions are fundamentally different from our prior understanding. **Determination:** Based on the analysis of the impacts from the project, the University of Hawaii anticipates making a **Finding of No Significant Impact** for the project.

DRAFT ENVIRONMENTAL ASSESSMENT

HUMUʻULA SADDLE REGION OF HAWAIʻI ISLAND: A DETAILED HYDROLOGIC EVALUATION AND EXPLORATORY DRILLING PROGRAM

TMK 6-7-001-041
South Kohala District
Island of Hawaii

Hawaiʻi Institute of Geophysics and Planetology
University of Hawaii

January 27, 2014

EXECUTIVE SUMMARY

The proposed project is being undertaken by the University of Hawai‘i, Hawai‘i Institute of Geophysics and Planetology in an effort to develop a better understanding of the hydrologic processes and groundwater system within the Humu‘ula[1] Saddle region of Hawai‘i Island. Recent research on the island has shown that the accumulation and storage of groundwater is substantially greater than prior models have postulated and that the residence time of water within the island is substantially longer than had been thought. An improved understanding of the groundwater system within the island will improve management practices of the island’s groundwater resource while enabling Stakeholders active in the Saddle region to make more efficient use of the resources at their disposal.

This draft environmental assessment is being prepared in accordance with HRS Chapter 343 that mandates that agencies must undertake an environmental assessment for any action that proposes the use of state or county lands or uses State funds. This new draft EA is being prepared as a result of a change in the proposed location of one of the two planned test wells that will be drilled in the Humu‘ula Saddle region. Although test wells are often exempted from this requirement due to their minimal environmental impacts, the University of Hawaii is conducting this review to ensure all stakeholders are informed of the project and are offered an opportunity to provide input into the evaluation of potential impacts. This project is also required to comply with: the Clean Air Act, with respect to emissions from stationary sources; HAR Title 13, Chapter 168, regarding well construction standards; the Endangered Species Act, with respect to endangered flora and fauna resident within the Saddle; Executive Order 13112, requiring project activities to prevent the introduction of invasive species; the Historic Preservation Act, regarding protection of aboriginal remains or artifacts found within the projects region of impact; the Coastal Zone Management Act, regarding impacts on coastal resources; the Clean Water Act, regarding potential impacts on surface or ground waters; and the Farmland Protection Policy Act that preserves valuable farmlands within the United States. The project is compatible with, and supports, many of the objectives of: the Hawai‘i State Plan, Hawai‘i County’s General Plan, the Hawai‘i County Water Use and Development Plan, and the Department of Hawaiian Home Lands long range plan for Central Hawai‘i (Island).

[1]Spellings and diacritical punctuation is based on Pukui et al., 1976 and Pukui and Elbert, 1986.

The proposed action, and the preferred alternative, is to drill a second small-diameter, continuously-cored borehole in the Saddle region on the land parcel designated: **TMK 6-7-001-041**. The selection of the technology is based on screening criteria that include: provides detailed stratigraphic and geologic information on the area of investigation; provides an opportunity to detect groundwater saturation conditions while drilling; enables efficient collection of fluid samples; achieves the scientific objectives cost effectively; and accomplishes the project goals with a minimum of adverse impact on the environment. Diamond wireline core drilling most closely meets this array of criteria. Selection of the drilling location was conducted via a screening process that best met the following criteria: provides a stratigraphic record reflective of most of the constructional mass of Mauna Kea and the Saddle region; minimizes the likelihood that rocks from Hualālai would be encountered; provides the shallowest access to ground water within the Saddle; provides dimensional data on the extent of the groundwater resource confirmed in the prior test hole drilling; allows access to the drilling site using existing roadways; provides access to utilities at minimum cost; conducts the project activities in an area that has already been disturbed by prior uses and thereby minimizes adverse environmental impacts from the project. The prospective site is on land currently under the control of the Army Garrison, Pōhakuloa; the impacts of drilling a test bore on this site are evaluated in this document. The selection of the current preferred site has relied on new information provided by the prior environmental review process as well as the geologic and hydrologic information provided by the first borehole completed at Site I described in the original FEA/FNSI. In the analysis of alternatives, the No Action alternative was also considered. The No Action alternative would not allow us to meet the project objectives and would deprive the Stakeholders, as well as other relevant state agencies and individuals, of valuable information in their efforts to manage groundwater resources while also enabling agriculture and other economic activities to support a satisfactory quality of life to Hawai‘i's residents.

In the assessment of environmental consequences of the proposed action, we considered impacts on: geology and soils; water resources; noise; anthropogenic lighting; air quality; flora; fauna; cultural resources; potable water; wastewater disposal; solid and hazardous wastes; transportation; land use; socioeconomic environment; and environmental justice and

protection of children. The proposed project produced no reasonably anticipated impacts on: geology and soils; cultural resources; potable water; wastewater disposal; land use; and environmental justice and protection of children. The analysis indicated that there may be minor adverse impacts associated with: noise; anthropogenic light; air quality; flora; fauna; solid and hazardous wastes; and transportation. In all cases, the impacts did not meet the threshold for "significant impact" and all were susceptible to mitigation should any adverse effects be observed. Positive impacts can reasonably be anticipated for: water resources and socioeconomic environment.

An analysis of cumulative impacts, to determine whether the combined impacts of the proposed project, when conducted concurrently with planned or reasonably expected projects in the Saddle region would, cumulatively, result in minimal or no significant impacts at the Pōhakuloa Training Area. The planned or expected projects included: continued work on the Saddle Road realignment; development of a Battle Area Complex (BAX); modernization of the Pōhakuloa Training Area; execution of new training for the U.S. Marine Corps MV-22 and Cobra Attack Squadrons; 25th CAB construction of new landing zones for helicopter training; and construction of a Range Maintenance Facility. In the analysis of the environmental attributes that are impacted by the preferred action, we found the following:

1) The impacts associated with noise and anthropogenic lighting for the preferred action occur during night time hours; those planned projects that could contribute to the stationary nighttime lighting and noise were anticipated to be conducted only during daytime hours (e.g. construction activities) and would not contribute to a cumulative impact.
2) The air quality impacts from the planned projects would occur well outside of the region of influence of the preferred action impacts and are unlikely to result in cumulative impacts from the combined projects.
3) The possible impacts on fauna by the preferred action are associated with land clearing at a substantial distance from the other impacts and from nighttime lighting and, hence, a combined effect is not likely to occur.

4) The solid and hazardous waste and transportation impacts from the preferred action are so minor as to not contribute detectably to the existing background waste and traffic loads on the island's infrastructure.

An analysis was conducted of the project impacts as they relate to the thresholds mandated in HRS Chapter 343 that require the completion of an Environmental Impact Statement. In the analysis, the following factors were considered:

1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;
2) Curtails the range of beneficial use of the environment;
3) Conflicts with the State's long-term environmental policies;
4) Adversely affects the economic and social welfare or cultural practices of the community or the State;
5) Substantially affects public health;
6) Involves substantial secondary impacts;
7) Involves a substantial degradation of environmental quality;
8) Is individually limited but cumulatively has considerable effect on the environment or involves a commitment for larger actions;
9) Substantially affects a rare, threatened or endangered species;
10) Detrimentally affects air or water quality or ambient noise levels;
11) Affects, or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water or coastal waters;
12) Substantially affects scenic vistas or view planes identified in County or State plans or studies;
13) Requires substantial energy consumption.

Our analysis found that none of these impacts would meet or exceed mandated thresholds as a result of the preferred action and, hence, our findings are that the project will have no significant effect on the environment. Hence, the University of Hawaii anticipates making the determination of a Finding of No Significant Impact for the proposed project.

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LIST OF ACRONYMS and DEFINITIIONS

AMSL	Above Mean Sea Level
ASEA	Aquifer Sector Area
BAAF	Bradshaw Army Air Field
BAX	Battle Area Complex
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
CZM	Coastal Zone Management
dBA	Decibels, A-weighted
DEA	Draft Environmental Assessment
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
EA	Environmental Assessment
HAMET	High Altitude Mountainous Environmental Training
HAR	Hawaii Administrative Rules
HRS	Hawaii Revised Statutes
HSDP	Hawaii Scientific Drilling Project
LUC	Land Use Classification
LUPAG	Land Use Planning Allocation Guide
mamsl	Meters Above Mean Sea Level
PTA	Pōhakuloa Training Area
ROI	Region of Influence
SY	Sustainable Yield

TMK	Tax Map Key
Tonnes	Metric tons, 1000 kg
USARPAC	U.S. Army Pacific Command
WSR	Western Saddle Region

Chapter 1:
Purpose, Need, and Scope

1.1 Introduction

The University of Hawai‘i, Hawai‘i Institute of Geophysics and Planetology proposes to conduct a detailed hydrologic assessment and core drilling program to further develop our understanding of hydrologic processes occurring inside Hawaii Island. The planned project will be located on a land parcel within the western Humu’ula Saddle region of Hawaii Island on the following parcel: **TMK 6-7-001-041**. The research work will be funded by the Cooperative Ecosystems Studies Unit Network administered by the Army Corps of Engineers. The University of Hawai‘i is preparing this Draft Environmental Assessment (DEA), in compliance with HRS Chapter 343-5; although the preparation of an Environmental Assessment for small diameter test wells is often waived, the University has elected to prepare this Draft SEA in order to evaluate the likely environmental impacts of this program and to ensure that all stakeholders are informed of the project and are provided the maximum opportunity to provide input on the proposed actions and available alternatives.

1.2 Overview and Background

In 1993 the Hawai‘i Scientific Drilling Project completed a research borehole near Hawai‘i Island’s shoreline, in Hilo, that encountered an artesian groundwater aquifer more than 300 meters (m) (>1000) below sea level. Prior to this event, published scientific literature discounted the likelihood of artesian water being present on Hawai‘i Island due to the extreme permeability of Hawai‘i's subaerial lava flows and the absence of carbonate caprock formations that have been found to host artesian aquifers on the island of Oahu. Hilo’s artesian aquifer was found to extend over more than 100 m (>330) of hole depth and to be confined by a sequence of soil and ash layers that marked the transition from Mauna Loa lava flows to those of Mauna Kea. The isotopic composition of the artesian water showed that it was derived from rainfall that entered Mauna Kea at an elevation of more than 2000 m above mean sea level (amsl). The presence of artesian water at these depths was attributed to a freshwater head, within Mauna Kea’s basal lens, of at least 8 m (25) above sea level being able to force basal freshwater to flow below the confining ash layers and out to the ocean as submarine springs (Thomas and Paillet, 1996).

A subsequent research drilling effort, located about 2 kilometers (km) inland from the initial

borehole location, again encountered an artesian aquifer at approximately the same depth, again confined by the soil and ash layers marking the interface between Mauna Loa lava and Mauna Kea lava flows. More striking, however, was that additional artesian freshwater aquifers were encountered at depths ranging from 2000 m to more than 3000 m below sea level. This finding indicated that much larger volumes of freshwater were accumulated in Mauna Kea's aquifers than present models would forecast.

In order to test this hypothesis, University scientists teamed with the U.S. Geological Survey to conduct a series of geophysical surveys across the Humu'ula Saddle from an elevation of ~600 m amsl, on the eastern end of the Saddle, to the Māmalahoa Hwy. on the western end of the Saddle (Figure 1-1). The results of these surveys (Figure 1-2) provided evidence that freshwater-saturated basalts (i.e. groundwater levels) may be present at elevations of more than 1000 m above sea level at some locations within the region. The presence of groundwater at these elevations would then suggest that our understanding of Hawai'i Island's hydrology is far from complete and that, in order to better manage the Island's groundwater resources, further investigation and evaluation of the Big Islands hydrology is warranted. A proposal was developed to conduct test drilling within the Saddle region to confirm the presence of high level water in the area. The first of these holes was completed in late June, 2013. During that drilling high level groundwater was encountered at ~213 m (700') and at 549 m (1800') below the ground surface; the upper zone proved to be a perched aquifer having a thickness of ~150 m (500') but the lower groundwater aquifer was continuous to the total depth drilled (1764 m; 5786'). Hence, the elevation of the water table in the Saddle region is indicated to stand at an elevation of ~1400 m amsl (4600' amsl). Recently published research (Flinders, et. al, 2013) has suggested that this high level water may be associated with a broad dike complex within the Saddle that extends approximately 10 km to the west of the first test hole.

These new findings have led us to re-evaluate the optimal location for the second of the test holes and to select a location that tests the western extent of the dike impounded system. The proposed second test hole is located at a site within the TMK 6-7-001-041, Figure 1-3, parcel owned by the U.S. Army Garrison Pōhakuloa. The new data from the proposed test hole will enable us to better gauge the volume of the water stored within the Saddle region and to develop a better model for recharge and transport of recharge through the aquifers identified.

1.3 Purpose and Need of the Proposed Action

The purpose of the proposed action is to develop a better understanding of the groundwater system contained within Mauna Kea: to confirm the extent of the new aquifers identified in the Saddle by the initial test hole; to document the geologic structures overall as well as those that impact the groundwater system on the western flank of the Saddle; and to conduct sampling and analysis of water samples in order to determine their source(s), their chemical compositions, and their ages/residence times in the Saddle aquifer(s).

The need for this action is driven by a responsibility to manage the groundwater resources in an ocean-island environment. In order for one to manage the groundwater resources in this region, we need to understand the extent of the resource, the source of the recharge into the system, and the residence times of the water within the aquifers underlying the Saddle region. The broader implications of the proposed action will be to provide the residents of the island, and those who manage the groundwater resources for them, with a more accurate understanding of the overall freshwater resource systems within the island and, with that understanding, allow them to better manage how those resources are utilized or deployed.

A somewhat more focused need is driven by increasing use of the Humuʻula Saddle region. Recent decades have seen a substantial increase in the use and "occupancy" of the higher elevation areas of both Mauna Loa and Mauna Kea. Among the more visible activities is the development of state-of-the-art international astronomical facilities at the summit of Mauna Kea as well as a public visitor center with temporary lodging for scientific staff at lower elevations. Less visible has been the increased public use of the Saddle region for recreational activities (e.g. hunting, hiking, nature photography) brought about by improvements in safety and ease of access arising from the Saddle Road improvements. Ongoing training activities at the Pōhakuloa Training Area, as well as a desire for increased leasing activities on the Saddle lands managed by the Department of Hawaiian Home Lands (DHHL), and increased utilization of State parks along the Saddle Road corridor also contribute to current and future utilization of the region. Nearly all of these activities depend on the availability of potable water that, in most cases, must be trucked to the Saddle from Waimea or Hilo – an inefficient and expensive process that consumes a substantial quantity of our scarce liquid fuels. Although demand for a potable drinking water source within the Saddle region more than justifies the installation of

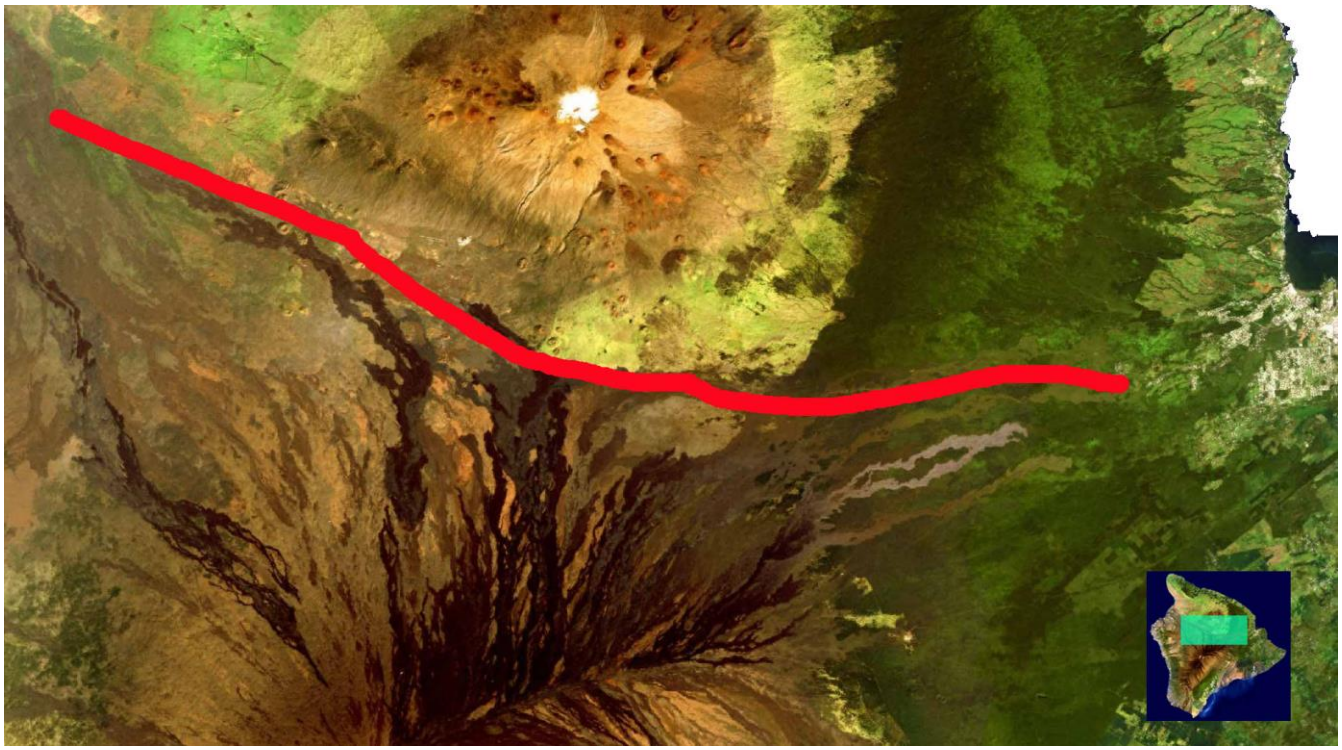


Figure 1-1. Showing the trajectory of the magnetotelluric surveys across the Humu‘ula Saddle of Hawai‘i Island.

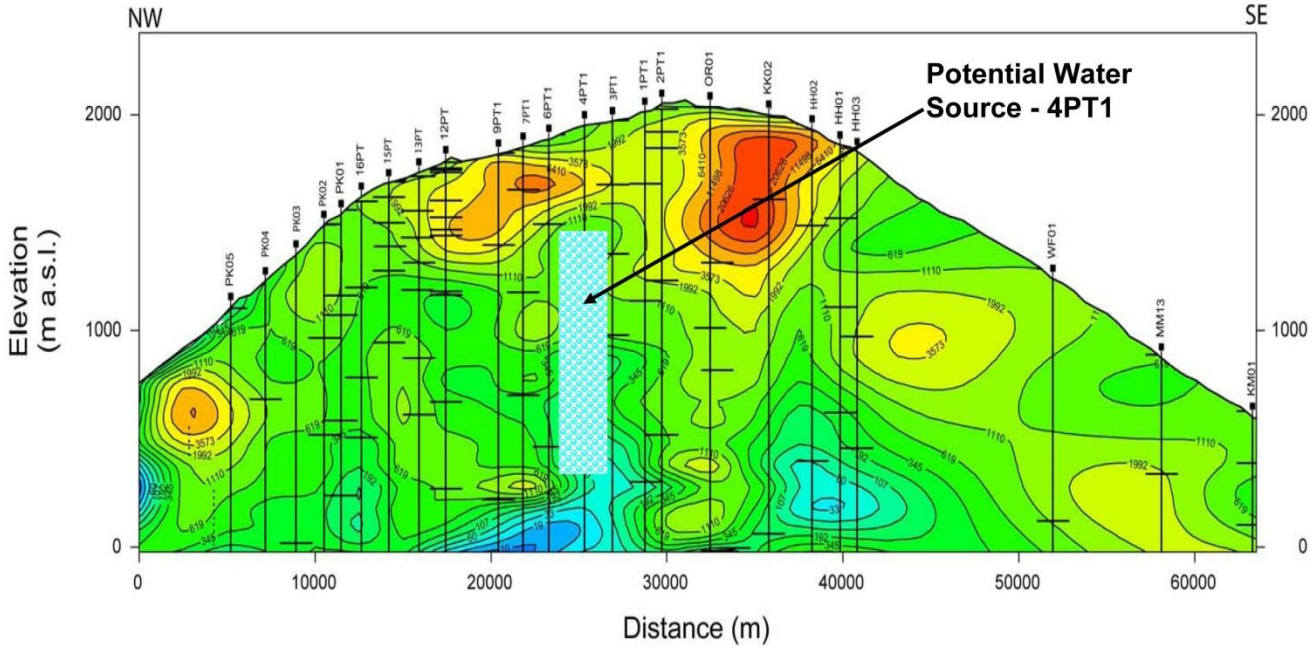


Figure 1-2. The resistivity profile through the Humu‘ula Saddle of Hawai‘i Island. Warm colors represent high resistivity and dry formations; intermediate colors – green – reflect moderate resistivities; and cool colors represent low resistivity formations.

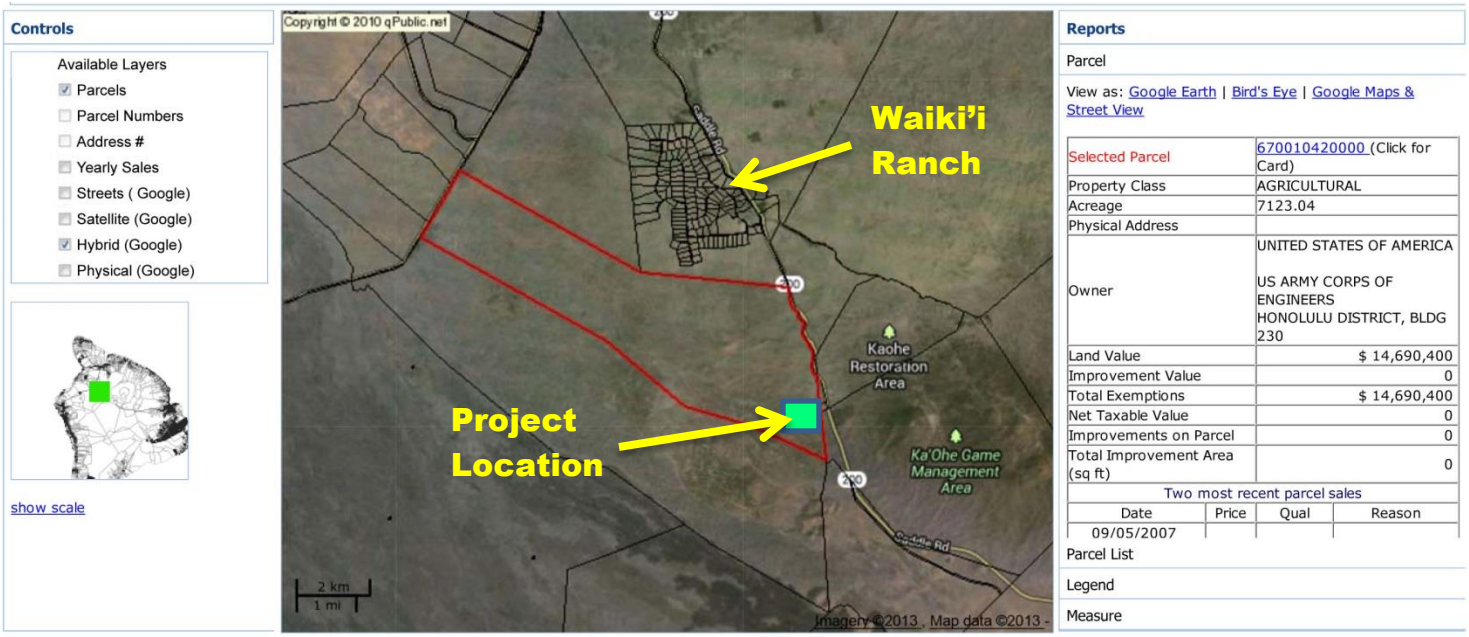


Figure 1-3a. Showing preferred project parcel within the South Kohala District.

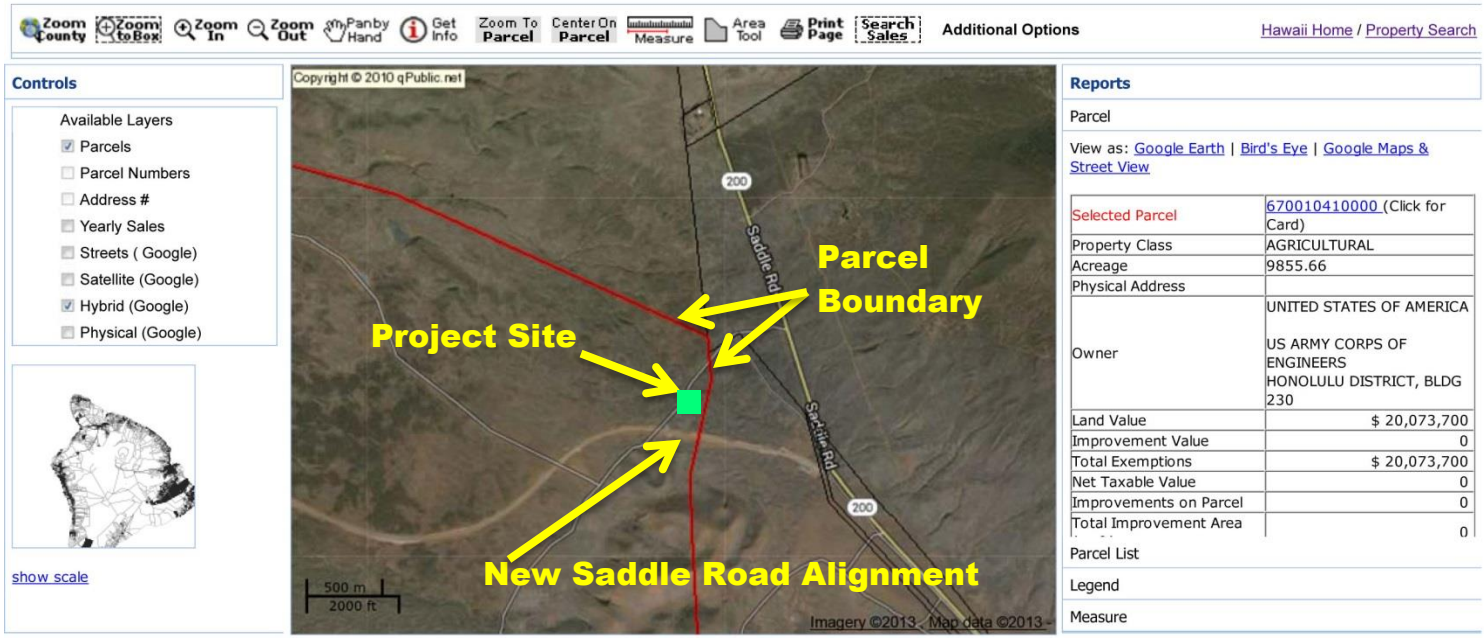


Figure 1-3b. Showing preferred project location within the subject parcel.

a production well in the region, uncertainties about the depth to, and extent of, the resource and the quality of the water have made it difficult to justify the cost of drilling a production well.

The proposed hydrologic assessment and small diameter borehole will enable us to provide a much more detailed understanding of the groundwater system and the geologic structures that host those resources beneath the Humuʻula Saddle and enable the agencies responsible for the region's lands - the Department of Land and Natural Resources, Division of Parks and Recreation, Commission on Water Resources Management, Division of Forestry and Wildlife, the University of Hawaiʻi, Office of Mauna Kea Management, the Department of Hawaiian Home Lands, U.S. Army Garrison, Pōhakuloa (referred to, collectively, in the following discussion as Stakeholders), to plan for, and manage, the lands under their jurisdiction and to manage the groundwater resources associated with those lands.

1.4. Scope and Organization of this Document

This Draft Environmental Assessment considers a single candidate drilling site for location of a small diameter core hole that will provide access to the subsurface geology and hydrologic resources in the region. In our initial EA and FONSI, we stipulated that the selection of the second test hole site would be, in part, based on the results of the drilling at the first location within the PTA cantonment; the results of the first test hole have demonstrated the presence of a high-level groundwater system within the Saddle region and have obviated several of the possible advantages of the other sites considered in the original Environmental Assessment. Hence, we have selected a new site that we consider to be able to provide valuable information on the extent of the new resource identified as well as additional information on the broader characteristics of the resource; the new site will be considered in the context of the two alternative sites considered in the original EA but that were not drilled. This Draft Environmental Assessment also considers the "No Action" alternative which will be considered the benchmark against which the project action alternatives can be evaluated.

Chapter 2: Regulatory Framework and Compatibility with State, County, and District Planning Documents will discuss Federal and State requirements that the project will be subject to and will review the objectives of the project in the context of State, County, and District plans to which the present project is relevant.

Chapter 3: The Proposed Project and Alternatives will discuss the selection of the technology to accomplish the project goals and the selection of prospective locations for execution of the drilling program using a sequence of screening criteria. Development of the technology screening criteria is based on those conditions that will enable the project to attain the scientific goals of the study, using a cost effective technology, while also minimizing and/or mitigating the environmental impact of the overall project; screening criteria for selection of location is based on minimizing adverse environmental impacts, cost effectiveness of the overall project, and maximizing the technical and scientific value of the information recovered from the project.

Chapter 4: Affected Environment and Environmental Consequences will discuss the existing conditions of environmental attributes along with the impacts on each of those attributes that the proposed action may reasonably be expected to have. The effects of the proposed action will be compared with existing, baseline conditions, at the alternative sites, and the effects of the No Action alternative will be discussed and analyzed. The environmental attributes that will be discussed in this analysis include:

- Topography, Soils, and Geology
- Water Resources
- Noise
- Anthropogenic Light
- Air Quality
- Flora
- Fauna
- Cultural Resources
- Potable Water
- Wastewater Disposal
- Solid, Hazardous, and Medical Wastes
- Transportation
- Land Use
- Socioeconomic Environment
- Environmental Justice and Protection of Children

Chapter 5: Cumulative Impacts will discuss and analyze potential cumulative impacts that

may arise from the execution of the proposed action occurring concurrently with recent or planned actions likely to be taken in the Saddle Region whether they are private, State, or Federal actions. This chapter will also consider follow-on impacts that can be reasonably foreseen to occur as a result of the proposed action.

Chapter 6: Determination of Significance and Findings will compare the impacts of the proposed action with the criteria defined in HRS Chapter 343 that require an Environmental Impact Statement to be prepared. The results of that comparison will result in a proposed Finding of No Significant Impact.

Chapters 7, 8, and 9 will present lists of **References** relied upon in this assessment, **Preparers** of this assessment, and **Agencies and Individuals Consulted** during the preparation of this document.

Chapter 2:
Regulatory Framework and Compatibility With State, County, and District Planning Documents

2.1 Introduction

The present document is being prepared under HRS Chapter 343-5(b) which states that "Whenever an agency (of the State) proposes an action in subsection (a), other than ….. that is not a specific type of action declared exempt under section 343-6, the agency shall prepare an environmental assessment for such action at the earliest practicable time to determine whether an environmental impact statement shall be required". In addition to HRS Chapter 343, the proposed action must comply with a number of other State and Federal regulations that will govern the planned approach and mitigation of the impacts of the proposed action. Those regulations that are most relevant to the proposed action are discussed in the following sections.

Although not carrying the same force of law, there are also a number of long-range planning documents at the State, County, and Community level that reflect a consensus view of the desired evolution of the natural, social, and economic future of Hawai‘i's residents. In subsequent sections, the compatibility and consistency of the proposed action with those plans will be examined.

2.2 Regulatory Requirements

2.2.1 Chapter 343 Environmental Impact Statements

Preparation of this Environmental Assessment

As noted above, when an agency, such as the University of Hawai‘i, undertakes any action on state lands that is not specifically exempted within Chapter 343, that agency is required to conduct an environmental assessment and, "A statement shall be required if the agency finds that the proposed action may have a significant effect on the environment." (§343-5(b)(1)(D)). Although the drilling of a test well is often exempted from the requirement to prepare an environmental assessment due to their minor impacts and short duration, this environmental assessment is being prepared to both meet this requirement and to ensure that the public has an opportunity for review and comment on the proposed action.

Public Involvement

Chapter 343 also requires that, pursuant to §343-3, the draft environmental assessment shall be available through the Office of Environmental Quality Control (OEQC) for a period of thirty days for public review and comment and that ”The applicant shall respond in writing to the comments received during the review…” (§343-5(b)(1)(C)).

This Draft Environmental Assessment and Notice will be filed with the OEQC for publication and public comments will be received at:

Hawai‘i Institute of Geophysics and Planetology
Attn: Donald Thomas
1680 East West Road
Honolulu, HI 96822

After incorporation of the written comments and responses, a Final Environmental Assessment, and determination of whether an Environmental Impact Statement will be required, will be prepared by the University of Hawai‘i and will published by the OEQC.

2.2.2 Clean Air Act As Amended (42 USC 7401, et seq.)

The Clean Air Act requires that any stationary source that has the capacity to emit more than threshold quantities of criteria pollutants over a 12-month period must apply for a source permit and meet required air emission limits. The Environmental Protection Agency has delegated enforcement authority under this program to the State of Hawai‘i Department of Health. Because the project will employ one or more diesel engines for drilling, electrical power generation, and air/drilling fluid pumping, the proposed project will be required to procure a Non-Covered Source Permit for these combined sources under this program. If the combined sources are found to have the potential to degrade air quality in the area around the project activities, then limitations will be imposed on the emission rates, or on the configuration of the sources, in order to allow the project to meet air quality standards.

2.2.3 Hawai‘i Administrative Rules Title 13 Chapter 168 Water Use, Wells, and Stream Diversion Works

In order to protect groundwater resources from contamination due to improperly designed wells, Hawai‘i's Administrative rules (§13-168-12 Well construction and pump installation permits) require the project to obtain a well construction permit and comply with “Hawai‘i Well Construction and Pump Installation Standards”. A permit application with the proposed well design, casing schedule, and completion program will be submitted to the Commission on Water Resources Management for approval. Because the diameter of the well is such that production of water, beyond collection of water samples for analysis, is not anticipated, a pump installation permit is not required.

2.2.4 Endangered Species Act, 16 U.S.C. 1536(a)(2) and (4)

Threatened or endangered species in the United States are protected by the Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984 and 1988). The United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) are responsible for compiling the lists of threatened and endangered species of plants and animals and designating the critical habitat for animal species. The ESA defines an endangered species as any species in danger of extinction throughout all or a significant area of its range and a threatened species as any species likely to become endangered in the near future. Hawai‘i Island is known to host the endangered Hawaiian Hawk (*Buteo solitarius*), the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), the threatened Newell’s Shearwater (*Puffinusauricularis newelli*) and the threatened Palila (*Loxioides bailleui*).

Surveys for these endangered species are part of this environmental review and, where appropriate, mitigation measures intended to minimize the likelihood that project activities will adversely impact these endangered species or their habitats will be detailed.

2.2.5 Executive Order 13112 Invasive Species

Executive Order 13112 requires all Federal agencies to prevent the introduction of invasive species, provide control, and minimize the economic, ecologic, and human health impacts that invasive species may cause. Because the project anticipates bringing equipment and supplies from the Mainland U.S. to Hawai‘i that could host plant or animal species that would be

injurious to Hawai‘i’s biological environment, mitigation measures to prevent introduction of invasive species will be detailed in the following discussion.

2.2.6 Historic Preservation Act (16 U.S.C. § 470)

The **National Historic Preservation Act** (NHPA; Public Law 89-665; 16 U.S.C. 470 *et seq.*) seeks to preserve historical, archaeological, and culturally significant sites. As part of this effort, State Historic Preservation Offices have been developed along with listing of recognized significant sites. The act requires Federal agencies to evaluate the impact of Federally funded (or permitted) projects on sites – natural or man-made – that have historical or cultural significance. The evaluation, referred to as a Section 106 Review, is part of the Environmental Assessment process and will be discussed in the appropriate sections below.

2.2.7 Coastal Zone Management Act, 16 U.S.C.1456(c)(1)

The Hawaii Coastal Zone Management Act established the Hawai‘i Coastal Zone Management (CZM) Program in 1977 by establishing HRS Chapter 205A, which requires that projects with federal involvement, whether permitting or funding, must undergo review for consistency with the Hawai‘i’s CZM law.

Under this program, all of Hawai‘i’s lands are considered subject to this review. The CZM objectives are to ensure protection of recreational, historic, and scenic resources as well as protect coastal ecosystems and to take appropriate measures to minimize damage arising from coastal natural hazards. The Federal funding for this project thus triggers the requirement that the proposed actions will undergo review for impacts on the Coastal Zone.

2.2.8 Clean Water Act of 1977; Water Quality Act of 1987 (33 U.S.C. § 1251 *et seq.*); HAR Chapter 11-55 Water Pollution Control

The Clean Water and Water Quality acts are intended to protect surface waters in the United States from pollutant discharges. As currently defined, those waters “...includes only those relatively permanent, standing or continuously flowing bodies of water "forming geographic features" that are described in ordinary parlance as "streams[,] ... oceans, rivers, [and] lakes." (U.S. Supreme Court. *Rapanos v. United States*, 547 U.S. 715 (2006)). Hawai‘i’s Water Pollution Control expands the coverage to include groundwater as well. These regulations require that National Pollutant Discharge Elimination System (NPDES) permits must be

obtained for the discharge of drilling fluids or storm water runoff for certain construction activities. Where permits are required, operators must commit to employing best management practices to minimize the impact of discharges on surface waters and groundwaters. Consultation with the Department of Health will determine whether the proposed project falls within the requirements of an NPDES permit.

2.2.9 Farmland Protection Policy Act (P.L. 97-98, Sec. 1539-1549; 7 U.S.C. 4201, et seq.)

Congress enacted the Farmland Protection Policy Act (FPPA) as a subtitle of the 1981 Farm Bill. The purpose of the law is to "...minimize the extent to which Federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses..." (P.L. 97-98, Sec. 1539-1549; 7 U.S.C. 4201, et seq.). The FPPA also stipulates that federal programs be compatible with state, local and private efforts to protect farmland. Hawai'i's policy and planning program for agricultural lands has assigned management of Agricultural Lands of Importance to the State of Hawai'i (ALISH) to the Department of Agriculture who has surveyed and classified agricultural lands as Prime, Unique, and Other. Lands falling within the "Other" classification include ranching lands on the western end of the Saddle region and DHHL lands on the eastern flank of the Saddle region (Figure 2-1).

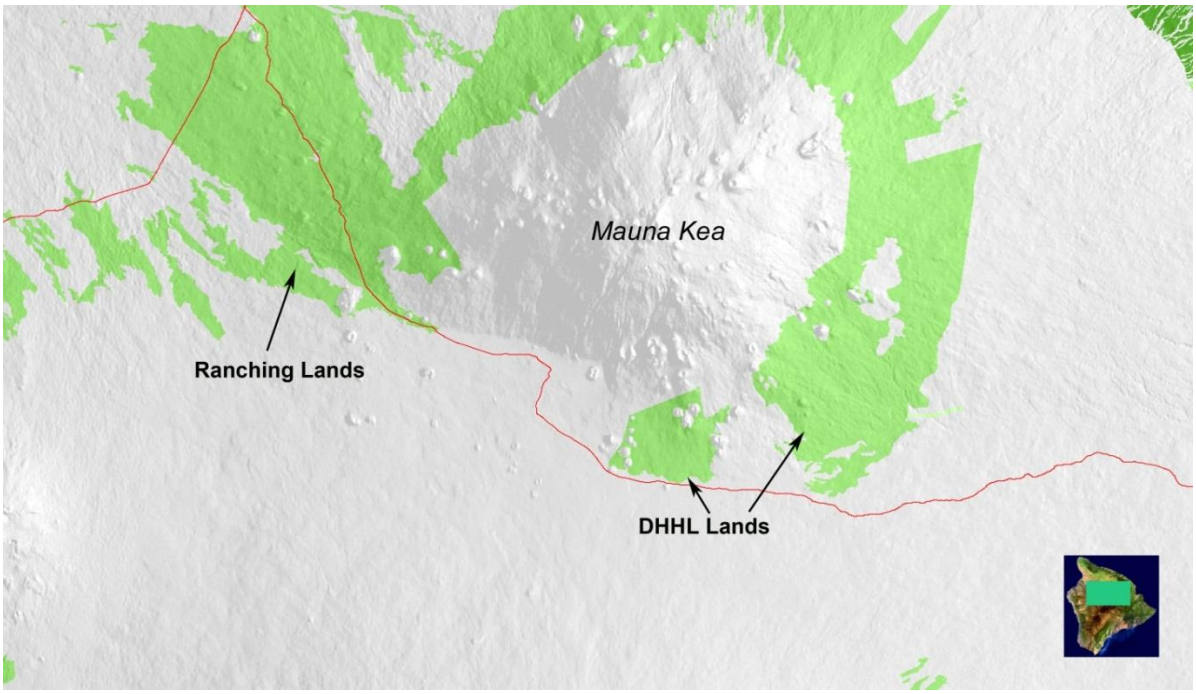


Figure 2-1. Agricultural Lands of Importance to the State of Hawai'i are shown in light green.

Whereas the project activities are not expected to adversely impact either tract of agricultural lands, the results of the first test hole, with its discovery of high level water, indicates that economically accessible water may be available for use in farming and ranching on these lands and, thus, preserve their continuing use for agricultural uses. A positive outcome from this test hole, will further support agricultural uses by defining the extent of this water resource.

2.3 Compatibility With State and County Planning Documents

The proposed project advances and supports a number of community-, economic-, and water-related components of planning documents that have been developed at the State, County, and local level. The following section will highlight each portion of the plan that the project supports or is compatible with along with a brief statement of the impact of the project on the plan.

2.3.1 Hawai‘i State Plan

The Hawai‘i State Plan, adopted in 1978 and revised both in 1986 and in 1991 (HRS Chapter 226, as amended) establishes goals, objectives, and policies that provide guidance to State and County agencies in actions or decisions that affect the States growth, economic development, and cultural development. The proposed drilling will recover additional data with which to characterize the new groundwater resources discovered by the first test well. Under the best possible outcome from this research, the results of this investigation may indicate substantial, economically accessible, sources of groundwater over broad stretches of the island that otherwise have limited agricultural or recreational options; under less favorable findings, the data will provide guidance to State agencies in more accurately assessing the impacts of land-use decisions on a more limited resource. More specific plan elements having relevance to the expected findings in the State Plan are as follows:

§226-7 Objectives and policies for the economy—agriculture:

Objective (2): Growth and development of diversified agriculture throughout the State;

Policy (2): Encourage agriculture by making best use of natural resources.

Policy (3): Provide the governor and the legislature with information and options needed for prudent decision making for the development of agriculture.

Policy (8): Support research and development activities that strengthen economic productivity in agriculture, stimulate greater efficiency, and enhance the development of new products and agricultural by-products.

Policy (10): Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.
Policy (12): Expand Hawai‘i’s agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.

An assessment of the extent of the groundwater resources in the Saddle region will have significant implications for development of traditional agriculture for this region (e.g. ranching) and diversified agriculture (e.g. more temperate food crops) at the higher elevation of the Saddle lands. As will be discussed below, much of the available agricultural lands in the eastern Saddle area are DHHL lands; encouraging findings from the proposed test hole will enable this Department to proceed with planning for the development of groundwater resources that are indicated to be present below their lands. Development of a reliable source of water will enable much more productive farming and ranching activity on those lands than can now be done with uncertain water supplies.

§226-10 Objective and policies for the economy--potential growth activities:
Policy (1): Facilitate investment and employment growth in economic activities that have the potential to expand and diversify Hawai‘i’s economy, including but not limited to **diversified agriculture**, aquaculture, renewable energy development, creative media, and **science and technology-based sectors**;

Favorable results from the test holes would support investment into the development of a water production well that can support not only farming/ranching activities but will (more cost effectively) meet the needs of the observatory community as well as recreational activities in the Mauna Kea summit region.

§226-13 Objectives and policies for the physical environment--land, air, and water quality.
Objective (1): Maintenance and pursuit of improved quality in Hawai‘i’s land, air, and water resources.
Policy (1): Foster educational activities that promote a better understanding of Hawai‘i’s limited environmental resources;

Policy (2): Promote the proper management of Hawai‘i’s land and water resources.

The new scientific data generated by the proposed borehole will provide the State with new insights into groundwater resources, groundwater storage, and groundwater transport within the interior reaches of all of our islands. A better understanding of our resources will, inevitably, enable better management of these resources.

§226-16 Objective and policies for facility systems--water.

Objective (a): Planning for the States facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

Policy (2): Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.

Policy (5): Support water supply services to areas experiencing critical water problems.

The new scientific data generated by the proposed work will enable the State to make better decisions regarding a source of groundwater that has hitherto been considered to be inaccessible or inadequate to be of value in meeting the needs of the Stakeholder communities in the Humu‘ula Saddle as well as in other high elevation areas of Hawai‘i Island.

§226-18 Objectives and policies for facility systems--energy.

Objective (1): Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;

Objective (2): Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;

Objective (3): Greater energy security and diversification in the face of threats to Hawai‘i’s energy supplies and systems; and

Objective (4): Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.

Policy (c)(1): Support research and development as well as promote the use of renewable energy sources;

Policy (c)(7): Promote alternate fuels and transportation energy efficiency;

Policy (c)(8): Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications;

Currently, the water needs of all the Stakeholders using the Saddle region are met in whole, or in part, by water trucked from lower elevations. This method is not only extremely inefficient and expensive, it also places demands on the States liquid fuels that will be much harder to displace/replace than will electrical energy that could be used to pump water to the surface through a high-elevation water production well. Pumping that water using curtailed wind, solar, or geothermal energy would not only displace the transportation fuel, it would avoid the emissions of CO_2 that would otherwise be generated from alternate fossil fuels. Furthermore, favorable results from the project has the potential to stimulate interest in pumped storage as a means of storing excess power from the less "dispatchable" alternate sources of electricity.

§226-23 Objectives and policies for socio-cultural advancement--leisure.

Policy (2): Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.

Policy (3): Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.

Policy (4): Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.

Policy (10): Assure adequate access to significant natural and cultural resources in public ownership.

The availability of on-demand water in the Saddle would enable more island residents to make full use of the Mauna Kea State Park as well as other open State lands in this region. In the past, during droughts, use of the area has been curtailed due to lack of water there; even during periods of ample rainfall, the water available is not potable which will limit the use of the cabins to those willing and able to forego potable water or bring their own. Further, the availability of on-demand water in the region will help address fire control concerns during periods of extended drought.

Within the State Plan, there are additional "Priority Guidelines" with which the proposed work is compatible:

§226-103 Economic priority guidelines. (a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawai'i's people and achieve a stable and diversified economy.

Guideline (d): Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

Policy (2): Assist in providing adequate, reasonably priced **water for agricultural activities**.

Policy (3): Encourage public and private investment to increase water supply and to improve transmission, storage, and irrigation facilities in support of diversified agriculture and aquaculture.

Guideline (e): Priority guidelines for water use and development:

Policy (3): Increase the support for research and development of economically feasible alternative water sources.

Finally, the 2012 Legislature passed Senate Bill 2745, that adds to HRS 226 a new priority guideline to prepare the state to address the impacts of climate change and to develop strategies for adaptation to the expected impacts arising from climate change. Among the more serious impacts that are anticipated to arise from climate change are changes in rainfall and recharge to Hawaii's groundwater aquifers. Of particular significance to the present project are the following provisions in the legislative bill:

" (3) Invest in continued monitoring and research of Hawaii's climate and the impacts of climate change on the State;

(7) Promote sector resilience in areas such as water, roads, airports, and public health, by encouraging the identification of climate change threats, assessment of potential consequences, and evaluation of adaptation options; ".

With the new information provided by the proposed investigatory drilling, all sectors of the government will be better able to manage the groundwater resources available, and to respond more effectively to the impacts associated with both climate change and to changing demographics on the island as well as to maintain a sustainable food supply for Hawaii.

2.3.2 Hawai‘i County General Plan

The Hawai‘i County General Plan articulates a series of policies and objectives specific to development and planning for Hawai‘i County. The plan offers broad goals and policies in the fields of Economic development, Energy resources, Environmental Quality, and Flooding and Other Natural Hazards and, within each of these subject areas, provides a more detailed discussion of these goals and policies in the context of each County District. The proposed project is located in the South Kohala District and, hence, we will discuss the compatibility of the proposed project with the goals and policies proposed for that district within the plan. However, it should also be recognized that the findings from the proposed project have potential implications for other districts on the island with similar goals and policies.

Hawai‘i County's **Economic Goals**, Chapter 2, of the General Plan articulates the following:

§2.2 GOALS

(d) Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County’s cultural, natural and social environment.

(f) Strive for diversification of the economy by strengthening existing industries and attracting new endeavors.

§2.3 POLICIES

(a) Assist in the expansion of the agricultural industry through the protection of important agricultural lands, development of marketing plans and programs, capital improvements and continued cooperation with appropriate State and Federal agencies.

As noted for the State Plan goals, the development of new data regarding Hawai‘i Islands groundwater resources could have significant impacts on the development of new agricultural products on the island that are not currently thought to be feasible due to the uncertainty of the water supply in the upland areas.

Specific to the South Kohala District:

§2.4.4.2 Courses of Action:

(a) Aid in the expansion of agriculture through the protection of important agricultural lands.

(f) Support efforts to promote small business development that is consistent with the rural, agricultural, and historic character of the area.

(g) Assist the communities and residents in diversifying the economic base in ways that are consistent with the rural, agricultural, and historic character of South Kohala.
Favorable findings on the availability of potable groundwater at accessible depths in the Saddle region could be of benefit to all industries and in ways that would promote the collaborative development of access to water supplies needed at different times and in different quantities for each.

Hawai‘i County's **Energy Goals**, Chapter 3, of the General Plan recommends the following:

§3.2 GOALS

(a) Strive towards energy self-sufficiency.

(b) Establish the Big Island as a demonstration community for the development and use of natural energy resources.

§3.3 POLICIES

(a) Encourage the development of alternate energy resources.

(c) Encourage the expansion of energy research industry.

(g) Provide incentives that will encourage the use of new energy sources and promote energy conservation.

(k) Strive to diversify the energy supply and minimize the environmental impacts associated with energy usage.

Favorable findings from the proposed investigation would be supportive of these goals by enabling the development of a groundwater supply for the region that is not dependent on imported liquid/transportation fuels but could be supplied by locally-generated, curtailed geothermal/solar/wind sources of energy. As noted earlier, this would also facilitate further investigation and engineering development of load-shifting technology as well as, potentially, pumped storage technology for the island.

The County's **Public Utilities Goals**, Chapter 11, of the General Plan recommends the following:

§11.2.2 Public Utilities/Water/Policies:

(f) A coordinated effort by County, State and private interests shall be developed to identify sources of additional water supply and be implemented to ensure the development of sufficient

quantities of water for existing and future needs of high growth areas and agricultural production.
(g) The fire prevention systems shall be coordinated with water distribution systems in order to ensure water supplies for fire protection purposes.
(j) Cooperate with appropriate State and Federal agencies and the private sector to develop, improve and expand agricultural water systems in appropriate areas on the island.

The new information provided by the proposed project will enable the County to better assess the extent of water resources available within the interior sections of the island, not only in the Saddle region but also in other interior sectors of the island such as Kaʻū and South Kohala. Additional sources of water in the drier regions of the island would also support better planning and preparation for fire control.

Specific to the South Kohala District:

§11.2.4.2.2 Courses of Action

(b) Seek alternative sources of water for the Lalamilo System.
(c) Continue to seek alternative sources of water for the Waimea System.

The results of the present work will provide new data on groundwater resources in the Saddle region both toward the east and toward the west where resources are much less well understood and where accessible water supplies would serve as a new source of water for future use. With the discovery of high level water at the first drill site, a fundamentally new concept is emerging for Hawaii's groundwater system; the new well will help validate and expand on that concept.

Hawai'i County's **Land Use Goals**, Chapter 14, of the General Plan recommends the following:

§14.1.2 Land Use Goals:

(b) Protect and encourage the intensive and extensive utilization of the County's important agricultural lands.

§14.2.2 Land Use/Agriculture/Goals

(b) Preserve the agricultural character of the island.
(c) Preserve and enhance opportunities for the expansion of Hawai'i's Agricultural Industry.

§14.2.3 Land Use/Agriculture/ Policies

(b) Assist in the development of basic resources such as water, roads, transportation and distribution facilities for the agricultural industry.
(c) Assist other State agencies, such as the University of Hawai‘i, College of Tropical Agriculture and Human Resources, University of Hawai‘i at Hilo, College of Agriculture, Forestry and Natural Resources Management, Department of Business, Economic Development and Tourism, Office of Planning, Department of Land and Natural Resources and Department of Agriculture, on programs that aid agriculture.
(m) Assist in the development of water for agricultural purposes.

The proposed project is clearly in support of developing groundwater resources information that will be critical to the continued, and expanded, agricultural use of lands on the island, both in the South Kohala district as well as in the Hāmākua and North Hilo districts.

2.3.3 Hawai‘i County Water Use and Development Plan

The Hawai‘i County Water Use and Development Plan serves as a continuing long-range guide for the water resource development in the County. Its objective is “to set forth the allocation of water to land use through the development of policies and strategies which shall guide the County in its planning, management, and development of water resources to meet projected demands.” The original plan was developed in the 1980s and adopted by the Commission on Water Resources Management in 1990. The most recent update of the plan was finalized in August of 2010.

Within the Plan, the analysis of the water resources and the projected demand on those resources is based on the ground water within specified hydrologic units, termed Aquifer Sector Areas (ASEA), and references the surface water hydrologic units as applicable. There are nine Aquifer Sector Areas on the island of Hawai‘i, which are further subdivided into Aquifer System Areas. The lands on which the test wells are proposed, is located within the Northwest Mauna Loa Aquifer Sector Area, also designated as the 807 Aquifer Sector Area.

The assessment of the 807 ASEA is summarized in the update as:

§807.5.1 Water Source Adequacy

§807.5.1.1 Full Build-Out

“The full development to the maximum density of the County General Plan land use within the

Northwest Mauna Loa ASEA cannot be sustained by water sources in the sector area if agricultural demands are not included. Full build-out water demands based on LUPAG are nearly three times the sustainable yield of sector area. The existing Zoning requires approximately one third of the existing sustainable yield. If worst case agricultural demands are included, the LUPAG demand is three times the SY, and the Zoning demand is 60 percent of the SY."

It is recognized that high level water may be present in the 807 ASEA as follows:

§807.5.2.1.1.1 Ground Water

"According to the 1990 Water Resources Protection Plan, the basal lens extends at least five miles inland, and approximately 10 miles from the coast high level water may occur at great depth. Due to the remoteness and high cost of developing the high level aquifer, exploitation of this resource to supply existing developed areas and adjacent expansion areas is not likely. High level water may be utilized should localized development occur in areas over the high-level aquifer."

To a large extent, this assessment is based on the traditional view of groundwater on Hawai‘i Island. The new findings in the first test hole show that water is present at substantially higher elevations than the traditional groundwater model for Hawaii has predicted. With results from the first test hole and that proposed, the feasibility of using high level groundwater to supply the needs of this aquifer sector area become substantially less challenging. Hence, the results of the drilling, whether favorable or unfavorable, will bring ground truth data to the projections of groundwater availability in this ASEA.

2.3.4 Department of Hawaiian Home Lands

The Department of Hawaiian Home Lands maintains >13,000 hectares of land within the Saddle region that is termed their Humu‘ula tract. In their Hawai‘i Island Plan (DHHL, 2002) they identify these lands as having a high priority for development as pastoral lots with some small acreage designated for commercial uses (Figure 2-2). In their discussion of these lands they note that there are broad elevation changes across their lands as well as a very broad range of mean annual rainfall with the leeward and higher elevation lands receiving ~1000 mm per year with evaporation rates high enough to limit the carrying capacity of the land.

The geophysical data collected for the Saddle region (Pierce and Thomas, 2008) covered a significant section of the DHHL lands in the Humuʻula tract and it was in that area that geophysical anomalies were identified that were similar to those in the western Saddle region. With the confirmation of the high level water provided by the first test hole, there is a strong

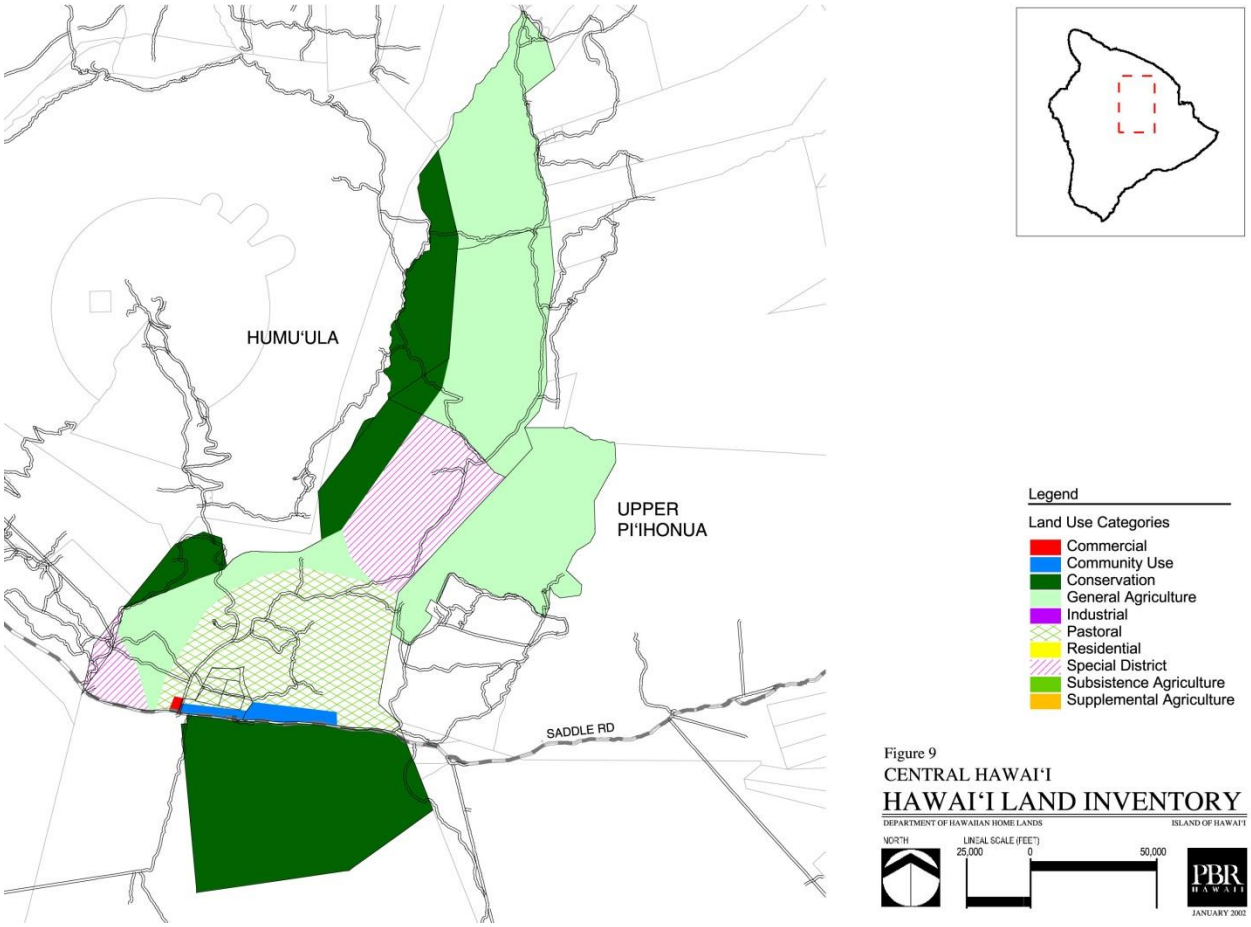


Figure 2-2. Map of DHHL Lands in Central Hawaiʻi. Those lands north of the Saddle Road are included in the ALISH category.

likelihood that water at similar elevations is present in the eastern Saddle region as well. The availability of a reliable source of accessible groundwater in the latter area would enable DHHL lessees to make more productive use of the lower rainfall pastoral leases with a significantly lower risk.

2.4 Required Permits and Approvals

Two permits and approvals will be required to implement this project. They are listed here under their granting agencies.

Hawai‘i State Commission on Water Resources Management

1. Well Construction Permit

Hawai‘i State Department of Health

1. Non-covered Source Permit

Chapter 3:
The Proposed Action and Alternatives

3.1 Description of the Proposed Action and Alternatives

Two actions are fully evaluated in this document: the Proposed Action and the No Action alternative. Two alternative technological approaches and one additional location were also considered, but did not meet the Screening Criteria and were eliminated from further consideration. These alternatives are discussed in their respective section below.

3.1.1 Selection of Technology

The objective of the present work is to develop a better understanding of the hydrology within the interior of Hawai‘i Island and to assess the geologic and hydrologic conditions at the interface of three volcanic systems: Mauna Kea, Mauna Loa, and Hualālai. In order to achieve this objective we will need to: perform a geologic analysis of the stratigraphy and structures that underlie the Saddle region; conduct a stratified fluid sampling program through the zone(s) of saturation that are hosted within the stratigraphic section; and conduct chemical and isotopic analysis of the fluid samples collected. Hence, the screening criteria for selection of the technology to be used for the planned work are as follows:

1) Develop as complete a geologic record of the stratigraphic section below the Saddle region as is possible with currently available technology;
2) Allow for the detection of fluid saturation zones while drilling;
3) Enable collection of fluid samples at frequent intervals, with minimal contamination, as the borehole progresses through the saturation zone;
4) Enable, to the extent possible, determination of which volcanic system is hosting the saturation zone;
5) Perform the investigation and analysis with minimal adverse environmental impact to the Saddle region;
6) Develop the geologic and hydrologic data in as cost effective manner as possible while ensuring that significant new information on the Saddles hydrologic system is obtained.

Three technological approaches were considered for achieving the scientific objectives outlined above: rotary drilling a conventional groundwater exploration hole; rotary drilling a small diameter test hole; drilling a small diameter test hole using wireline coring technology. Our

evaluation of these three alternatives is summarized in Table 1 below.

	Conventional Rotary	Small Diameter Rotary	Wireline Core Drilling
1. Quality of Geologic Record	3	2	9.5
2. Detection of fluid saturation	4	4	9
3. Enable frequent fluid collection	1	1	9.5
4. Identity of volcanic system	3	3	8
5. Minimal adverse impact	-4	-2	-1
6. Cost effectiveness of tech.	-8	-3	-3
Total	-1	+5	+32

Table 3-1. Screening Analysis of Drilling Technology for Emplacing Test Holes

The rating of each technology was arrived at as follows:

1. The quality of the geologic record is rated on a scale of 1 to 10 based on the geologic information that can be recovered. Both Conventional Rotary and Small Diameter Rotary drilling advance a borehole by grinding the rock into small fragments and flushing them up the wellbore using a drilling fluid or air. In this process, much of the geologic structural information is lost; although rock fragments can be harvested at the wellhead to conduct a limited analysis, Hawai‘i Island’s geology often results in loss of all the drilling fluids into the rock formation with no recoverable fragments returning to the surface for extended portions of the hole. Further, soft ash or soil formations, which are critically important to the analysis of the hydrology, are often washed completely away. Conventional Rotary drilling is ranked somewhat higher than Small Diameter Rotary only because it is more amenable to downhole geophysical logging and will allow the recovery of limited information relevant to the geologic record. With these technologies we estimate a likely loss of relevant geologic information as being 70% and 80% respectively for Conventional Rotary and Small Diameter Rotary drilling respectively.

   In core drilling technology, cylindrical samples of the formation are recovered continuously as the hole is advanced. Past core drilling programs in Hawai‘i have been able to maintain recovery rates as high as 98% over several thousand feet of hole. The soft soil and ash formations, that are vulnerable to washout in rotary drilling, have consistently been recovered using coring technology. Hence, the extent and quality of the geologic record recovered by core drilling is far better than that using rotary drilling.

2. Detection of formation saturation is rated on a 1 to 10 scale. Identification of saturation is possible, on a limited basis, using rotary drilling methods as long as air or foam is used as the drilling fluid. In such a case, the presence of saturation can be detected due to increasing hydrostatic pressure on the air injection line as the drill bit penetrates the saturation zone. However, significant back pressures are required in order to be detected during drilling and this means that several feet of penetration into the saturated zone will often be necessary before the pressure increase is detected. Rotary drilling with conventional fluids will not detect a significant change in drilling conditions and the only way to determine saturation is to halt drilling and measure water levels using a probe.

   With wireline core drilling, as each fresh core tube is inserted into the drill string, it is lowered to the bottom on a wireline cable. When water is present in the hole, it is immediately apparent by the decreased fall rate of the tube. Hence, detection of saturation is significantly better with the wireline equipment than with rotary tools.

3. Ease of sampling is rated on a 1 to 10 scale. With Conventional or Small Diameter Rotary drilling, once we have detected a saturated formation, it will be necessary to remove the entire drill string in order to collect samples of the fluids from the formation. At the depths being drilled, the time required to trip the drill string out and return it after sampling would take as much as a day. Further, with the larger volumes of foam/drilling fluid required for rotary drilling, the degree of contamination of the formation water will be higher and, hence, cleanup of the water will be more time consuming to remedy in order to allow clean samples to be collected.

   With core drilling, once a saturation zone is encountered, a fluid sampler can be lowered down the drill string and a sample can be collected with only minimal disruption of the drilling program. Even at the maximum depths anticipated, collection of a water sample might require an hour or two with the wireline.

4. Being able to identify the volcanic system hosting a given aquifer is rated on a 1 to 10 scale. With the loss of the geologic information with rotary drilling, it will be difficult-to-impossible to identify the soil and ash zones that are expected to mark the transition from

one volcanic system to another while the drilling is underway. It will only be possible to distinguish these transitions using downhole logging which is only done at the end of a drilling interval or at the end of the drilling program. During drilling of the first test hole, we were able to correlate the loss of a perched fluid level in the hole with specific formations that were, in some cases, only a few inches in thickness.

5. We have gauged the adverse impact based on the acreage of land likely to be disturbed by the drilling and testing program and assigned it a negative value. For Conventional Rotary drilling, about 4 acres are required for the drill rig, the ancillary equipment, and vehicle access and mobility around the rig. Significantly less area is required for a Small Diameter drilling rig and ancillary equipment that is estimated at about 2 acres.

   Wireline core drilling will require an area of about 1 acre for placement of the rig, supply containers and ancillary equipment.

   Although not included in the acreage value, other impacts such as air emissions, are consistent with these relative numbers: rotary drilling requires heavier equipment, and hence will have higher air emissions, than core drilling. Other potentially adverse impacts scale similarly.

6. Cost effectiveness was ranked in inverse proportion to the cost. Where a Conventional Rotary borehole to the anticipated depths would cost an estimated $8 million, small diameter rotary and core holes were estimated to both cost about $3 million.

In summary, the combined ratings for each of these technologies show that wireline core drilling is a far superior method to Conventional or Small Diameter rotary drilling largely due to the much more complete scientific information produced as well as the smaller impact on the environment. Hence, the rotary drilling methods will be dropped from further consideration of alternative actions.

3.1.2 Selection of Location

The objectives of the present investigation have guided the selection of the specific site being considered for conducting the planned action. Several of the same screening criteria applied to the selection of the technology are also applied to the selection of the location for the exploratory drilling along with several other criteria that are specific to location but not to the technology. With the demonstration of high level water present in the region from the first test hole, our criteria have been influenced by the findings from that hole.

The Screening Criteria for site selection for the current hole are as follows:

1) A site where high-level groundwater is likely to be encountered;
2) The site will provide us with information on the likely extent or magnitude, as well as the chemical characteristics, of the water in the high level groundwater aquifers in the Saddle region;
3) A site where drilling will provide new information on the geologic structure representative of Mauna Kea's subaerial stratigraphic section;
4) Existing access to the drill site is available for drilling equipment with a minimum of ground disturbance;
5) Access is available for needed operating supplies – water and fuel – with minimal road construction or disturbance of existing terrain;
6) The site will allow us to perform the investigation and analysis with minimal adverse environmental impact to the Saddle regions' environmental attributes;
7) The location will enable us to conduct the investigations where there will be least impact on existing or anticipated land uses and access.

The results of the screening analysis for selection of the most favorable site(s) to install a test bore are presented in tabular form in Table 3-2 below. The relevant analysis for each of the screening criteria is as follows:

1. For Criteria #1, our primary guidance for selection of a site derives from the identification of high level water at the first drilling site confirming the results of the magnetotelluric surveys that were conducted across the Saddle region in 2008 (Pierce and Thomas, 2009). In those surveys we were able to map resistivity of the subsurface down to a depth of more than ~2000 m (Figure 1-2.) and, because resistivity is sensitive to the degree of saturation of the rock with water, we were able to identify areas within the Saddle region where rock

resistivity matched that of water saturated basalts (about 700 ohm-meters). The locations where the saturated resistivity values reached the shallowest depth guided us in the selection

	Western Saddle Region		
	Site A	Site B	Site C
1. Probability for high-level water	9	10	10
2. Provide information on magnitude of resource	9	4	4
3. New information on geologic structures	9	6	5
4. Equipment access	10	9	8
5. Access for support supplies	8	4	3
6. Minimum impact on environmental attributes	-3	-1	-2
7. Minimum impact on future land use	-1	-1	-1
Total	41	31	27

Table 3-2. Screening Analysis for Site Selection

of the first site and the success of targeting that conductivity layer leads us to look at the western extent of the low resistivity formation beneath the Keʻāmuku parcel. There is a quite shallow region of 700 ohm meter formation at this location and we believe that we are likely to be able to access high level water at this location. The other two sites screened in the earlier EA, Sites B and C, respectively, are now considered to have an even higher likelihood of encountering high level water based on their proximity to the successful first hole. The fourth site considered in the earlier evaluation has been eliminated from the screening process for the present analysis since it fell below the Sites B and C in the former analysis.

2. Selection Criteria 2: With the successful identification of high level water present in the Saddle region, the next most critical question we need to answer is the extent of the water resources present. We have used the earlier geophysical data to guide us in the selection of Site A: it is the westernmost extent of the shallow conductive anomaly identified in those surveys and is located more than 10 km west of the first site. We believe that the presence of high level water at this distance will give us a valuable dimensional indicator of the volume of saturated rock. Currently planned geophysical surveys will be able to provide us

additional dimensional features of the groundwater resource. Sites B and C, since they are both less than 2 km and 1 km from the initial site will not be able to provide dimensional data of the same magnitude.

3. For Screening Criteria #3, our desired outcome is to develop additional, new data on the geologic structures within the flank of Mauna Kea that borders the Humu'ula Saddle. The more distant site will more likely provide us with examples of variations within the stratigraphic structure than will additional test holes in close proximity to the first hole. Hence, the western Site A is ranked significantly higher than Sites B and C.

4. Screening Criteria 4: Ease of access is a cost consideration but also one relevant to the degree of impact that the project will have on the landscape. A poor selection might adequately meet all the other criteria for the site itself, but require clearing a roadway encompassing, and impacting, several times the area that the drill site itself would require. Hence, all sites are on, or adjacent to, existing, accessible roadways within this region of the Saddle. Site A is on a short, now isolated, section of internal road on the Keʻāmuku parcel and is accessible for drilling equipment and staff without the need to construct additional access. Sites B and C are on existing roads with the quality of road being somewhat better for Site B than Site C.

5. Screening Criteria 5: Ease of access for support utilities is both a cost-related and an environmental impact item and we have graded the three tentative sites on a scale of 1 to 10. Because these sites are remote from both water supply lines as well as electric utility lines, we will need to have reliable supplies of both water for drilling and fuel for drilling and electric supply. Site A is considered a superior site since it is in closer proximity to public roads and, because the short section of road on which the site is located will be rarely used by PTA operations, there will be less opportunity for our operations to disrupt PTA activities and vice versa. The other two sites are greater or lesser distances from public roadways and may also experience periods during which PTA operations may impact access through those roads and hence are ranked significantly lower than the Keʻāmuku access.

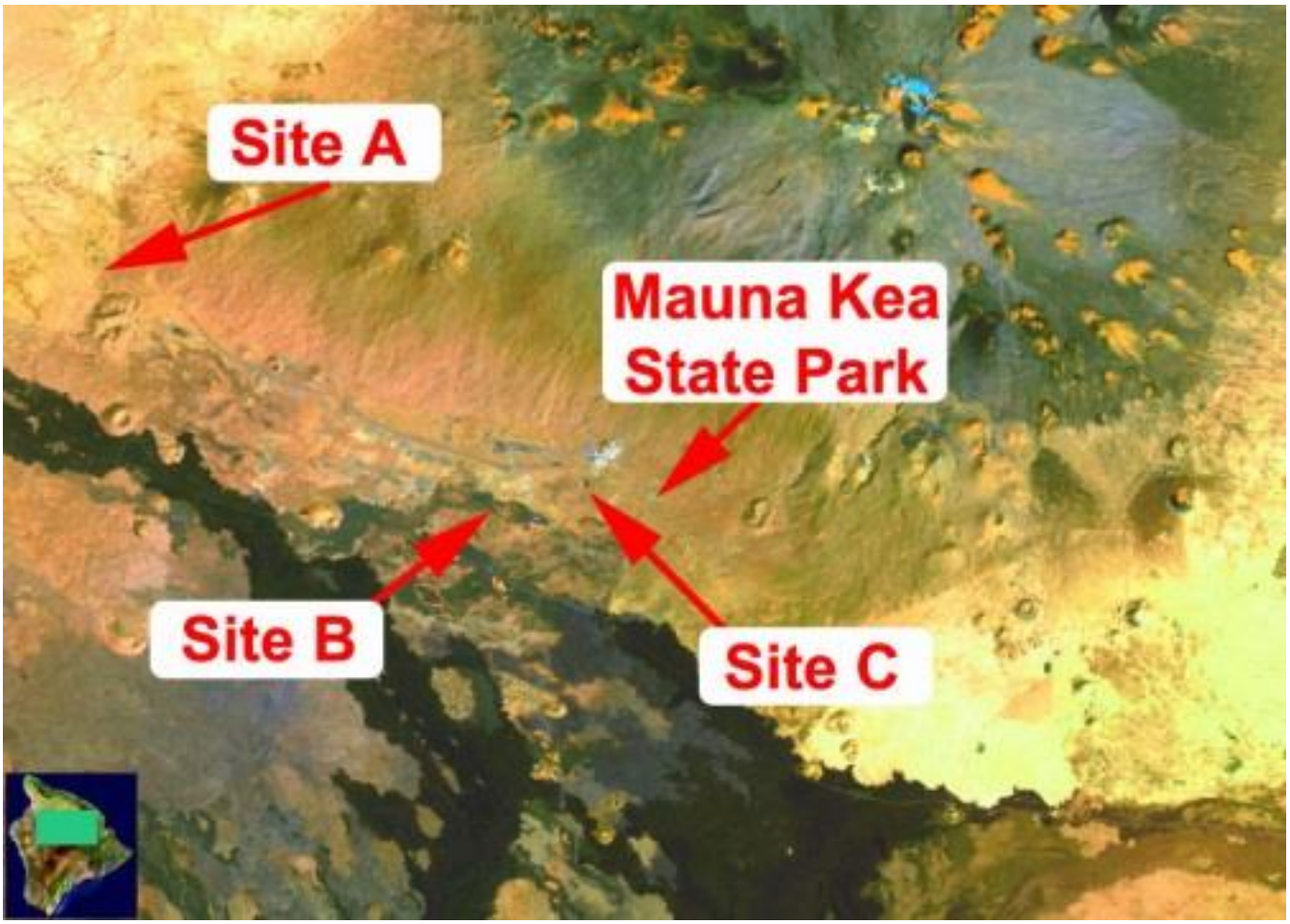


Figure 3-1. Landsat image of Saddle Region the prospective test hole sites considered in the screening analysis for this project.

6. Screening criteria 6 and 7: In prior research investigations of this nature, we have found that we can minimize the adverse impacts on the environment by selecting a drilling location that has been previously disturbed as a result of previous land uses, rather than selecting a location that has a higher density of undisturbed environmental attributes. Using this strategy, we selected three specific locations in which a 1-acre drilling site could be established with minimal impact on the environment in this portion of the Saddle region:

   Site A is located at the northeastern edge of the Keʻāmuku land parcel recently acquired by DOD and was formerly used for cattle and sheep/goat grazing. It is centered on coordinates N 19° 47′ 19.4″ & W 155° 38′ 0.1″ at an elevation of 1635 m (5364 ft.). It will, in the future, be used for maneuvers and training;

   Site B, located in a maneuvers area southwest of the PTA cantonment, is centered on

coordinates N 19° 44′ 57.7″ & W155° 33′ 07.4″ at elevation of 1873 m (6145 ft.); and **Site C** located due south of the PTA cantonment and N 19° 45′ 11.5″ & W 155° 32′ 21.6″ at elevation of 1929 m (6,330 ft.). This site was cleared and graded for an equipment staging area several years ago as part of the closing and capping of an old landfill site.

All three sites have been disturbed by prior use and have little in the way of environmental attributes that would be directly affected by planned drilling operations. None have threatened or endangered species present and all are heavily infested with non-native species. Well sites at these locations have little likelihood of impacting current and future uses of the existing landscape and were selected to avoid impacting recreational (e.g. Mauna Kea State Park) or economic uses of the lands in this region.

Table 3-2, above, summarizes the ranking of each prospective site according to the respective screening criteria and based on the sums of the ranking, **Site A** offers us the greatest likelihood of meeting the project objectives and optimizing the scientific return on the core drilling effort while minimizing the adverse impacts of the disturbances associated with establishing a drill site and executing the proposed drilling and sampling program. **Sites B** and **C** are about equivalent in the ranking and fall well below the ranking of **Site A.**

3.1.3 The Proposed Action

The proposed action will be the drilling of a borehole at **Site A**, above, as a complement to the prior drilling conducted within the cantonment at PTA. Samples of rock core will be collected continuously during drilling and will be analyzed for structural information as the core is recovered. The diameter of the boreholes may be as large as 15.3 cm (6”) at the surface, but will be reduced to 9.7 cm (3.8”) diameter at depth; depending on formation conditions, the bottomhole diameter may be as small as 6.4 cm (2.5”). During drilling, and subsequent to completion, water samples will be collected from the borehole and tested for chemical composition and other physical and chemical properties; analysis of the age of the water samples will be conducted to determine their average residence times in the aquifers within the Saddle region and isotopic analysis will enable us to determine at what altitude the recharge entered the hydrologic system. This data will complement the data acquired from the previous test hole drilled in the PTA cantonment.

The steps in conducting the drilling will consist of the following actions:

- A site having an area of ~1 hectare (2 ac.) will be prepared by leveling and clearing any debris and obstructions that may exist;
- A concrete well head slab will be installed and a drilling rig suitable for wireline coring to 1980 m (6500) or greater will be moved onto the site;
- Core drilling will commence using conventional drilling fluids composed of bentonite clay and an organic polymer solution;
- Coring is expected to continue on a 24/7 schedule with two alternating drilling crews with periodic breaks to allow for equipment maintenance and repair, downhole measurements, or borehole stabilization operations;
- Coring will continue until a pre-determined casing depth is reached (~150 m; 500') and the hole will be opened and casing will be installed;
- Core drilling will continue to a depth of ~1980 m (6500) below the wellhead with casing strings installed as required by regulatory requirements or in response to downhole conditions;
- After a water table is encountered, the drilling process will continue the use of a conventional drilling fluid but will reduce bentonite use as formation conditions allow;

After drilling is completed, a perforated liner will be lowered into the borehole to stabilize the formation and then drilling fluids will be cleared from the borehole by bailing. After the bore is cleared of drilling fluids monitoring instruments will be suspended in the hole to allow us to periodically determine formation water conditions and to sample formation fluids.

At the conclusion of the groundwater analysis process, a determination will be made as to whether one or both of these observation holes would be useful for monitoring conditions in the identified aquifers and to monitor for changes in the aquifers as a result of global climate change; should such monitoring not appear to be feasible or useful, then the holes will be plugged and abandoned according to State Water Commission and Department of Health requirements.

3.1.4 No Action Alternative

The no-action alternative does not meet the needs of the University and Stakeholders in their continued management of the Humu‘ula Saddle region lands. Without the proposed hydrologic evaluation, we will be unable to document existing conditions within the groundwater aquifers beneath the Saddle region. Stakeholders will also be deprived of ground truth data with which to develop plans for sustainable long-term utilization of these lands, and for development of a groundwater resource to alleviate the environmental and infrastructure impacts associated with continued trucking of water for use in the higher elevations of Mauna Loa and Mauna Kea. The no-action alternative would also preclude any contribution to the State Plan as it relates to management of water resources or to the Hawai‘i County Water Plan in ensuring that adequate sources are available to users in the Northwest Mauna Loa Aquifer Sector.

Chapter 4:
Affected Environment and Environmental Consequences

4.1 Introduction

This chapter will present an overview of the baseline physical, biological, social, and economic conditions of the environmental attributes that occur within the region of influence (ROI) of the Proposed Action. The potential impacts on the environment will also be presented for the Proposed Action and the No Action alternative. Only those environmental and socioeconomic conditions relevant to the Proposed Action are presented, as follows:

- Topography, Soils, and Geology
- Water Resources
- Noise
- Anthropogenic Light
- Air Quality
- Flora
- Fauna
- Cultural Resources
- Potable Water
- Wastewater Disposal
- Solid, Hazardous, and Medical Wastes
- Transportation
- Land Use
- Socioeconomic Environment
- Environmental Justice and Protection of Children

Each of the above environmental attributes will be presented in a separate section with a background and overview of existing conditions followed by a discussion of the impacts, both positive and negative, of the Proposed Action and No Action alternatives.

4.1.1 Terminology

Impacts are all described where they occur, within their Region of Influence (ROI) for each resource, including both direct and indirect impacts as well as cumulative impacts:

- The Region of Influence is that area/location that can be reasonably expected to be impacted by the proposed action and will be of a specified extent for each environmental attribute;
- Direct Impacts are caused by the Proposed Action and occur at the same time and place of the action;
- Indirect Impacts are caused by the Proposed Action but occur at a later time or at a distance from the Proposed Action;
- Cumulative Impacts are those that may occur as a result of pursuit of the Proposed Action simultaneously with other actions occurring within the ROI of either project, or as a result of accumulating impacts associated with the consecutive execution of multiple projects having overlapping ROI; Cumulative Impacts will be discussed in Chapter 5.
- Significant Impact, as defined in HRS 343-2, means the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals as established by law, or adversely affect the economic welfare, social welfare, or cultural practices of the community and State.

There may be both adverse and beneficial impacts associated within a single environmental attribute. Beneficial impacts are identified and discussed where applicable.

The following sections describe the impacts using the following levels of significance:

- Significant impact
- Significant impact but mitigatable to less than significant
- Less than Significant
- No Impact

4.1.2 Summary of Impacts

Table 4-1 presents a summary of the anticipated impacts of the Proposed Action and the No Action alternatives on the three sites under consideration. Less than Significant and No Impacts were identified for all Environmental Attributes.

Environmental Attribute	Preferred Alternative			No Action Alternative
	Site A	Site B	Site C	
Topography, Soils, and Geology	⊙	⊙	⊙	⊙
Water Resources	⊕	⊕	⊕	⊙
Noise	◎	◎	⊙	⊙
Anthropogenic Light	◎	◎	◎	⊙
Air Quality	◎	◎	◎	⊙
Flora	◎	⊙	⊙	⊙
Fauna	◎	◎	◎	⊙
Cultural Resources	⊙	⊙	⊙	⊙
Potable Water	⊙	⊙	⊙	⊙
Wastewater Disposal	⊙	⊙	⊙	⊙
Solid and Hazardous Wastes	◎	◎	◎	⊙
Transportation	◎	◎	◎	⊙
Land Use	⊙	⊙	⊙	⊙
Socioeconomic Environment	⊕	⊕	⊕	⊙
Environmental Justice and Protection of Children	⊙	⊙	⊙	⊙

Table 4-1. Summary of Impacts of Project Alternatives

LEGEND

Positive Impact ⊕

No Impact ⊙

Less than Significant Impact ◎

Significant Impact ●

4.2 Background, Location, and History

The general region considered for installation of a test hole, as discussed above in **Section 3.1.2 Selection of Location** paragraphs, are located within the Waikoloa tract of the South Kohala District and the Humuʻula tract of the Hāmākua and North Hilo Districts in central Hawaiʻi Island (Figure 4-1). These lands are under the jurisdiction of the Hawaiʻi Department of Land and Natural Resources (DLNR) and the U.S. Army Garrison Pōhakuloa (USAGP) (Figure 4-2). The DLNR lands are managed by their Land Division and Division of State Parks; and the Army-controlled lands are used as a field training site, collectively referred to as the Pōhakuloa Training Area (PTA). The prospective sites selected for further consideration are all located within the PTA lands as shown in Figure 4-3. These sites are located about 45 km (28 mi.) west of Hilo and about 61 km (38 mi.) north-east of Kailua-Kona. Within these lands are located the more densely-developed PTA Base Camp, referred to as the cantonment, that includes the operational headquarters, billeting for soldiers undergoing training exercises, shops for equipment maintenance and repair, as well as offices for base administration, environmental resources and cultural resource specialists (Figure 4-3). West of the cantonment is the Bradshaw Army Airfield and support facilities for its operation. The balance of the PTA lands are very sparsely developed and are used for a variety of training missions including artillery training, maneuvers training, live fire ranges, and aircraft training. A portion of the PTA land is owned in fee by the Army with the balance being held under a lease with the Hawaiʻi Department of Land and Natural Resources. East of the PTA cantonment is located the Mauna Kea State Park and, on the northwest border of the PTA lands is the Kaʻohe Game Management area; immediately north of the PTA border is the Mauna Kea Forest Reserve.

Prior to the Army use of the Saddle area, the region between Mauna Loa's northern flank and Mauna Kea's southern flank was largely free of modern human development. Archaeological surveys have found that aboriginal Polynesians used the Saddle region at least as early as AD 1000 (Athens and Kaschko, 1989) and the presence of bird remains suggest that the district was used extensively for harvesting of birds for food as well as feathers (Cordy, 1994). Prehistoric trails, although not well defined or documented for very early use, indicate that the Saddle region

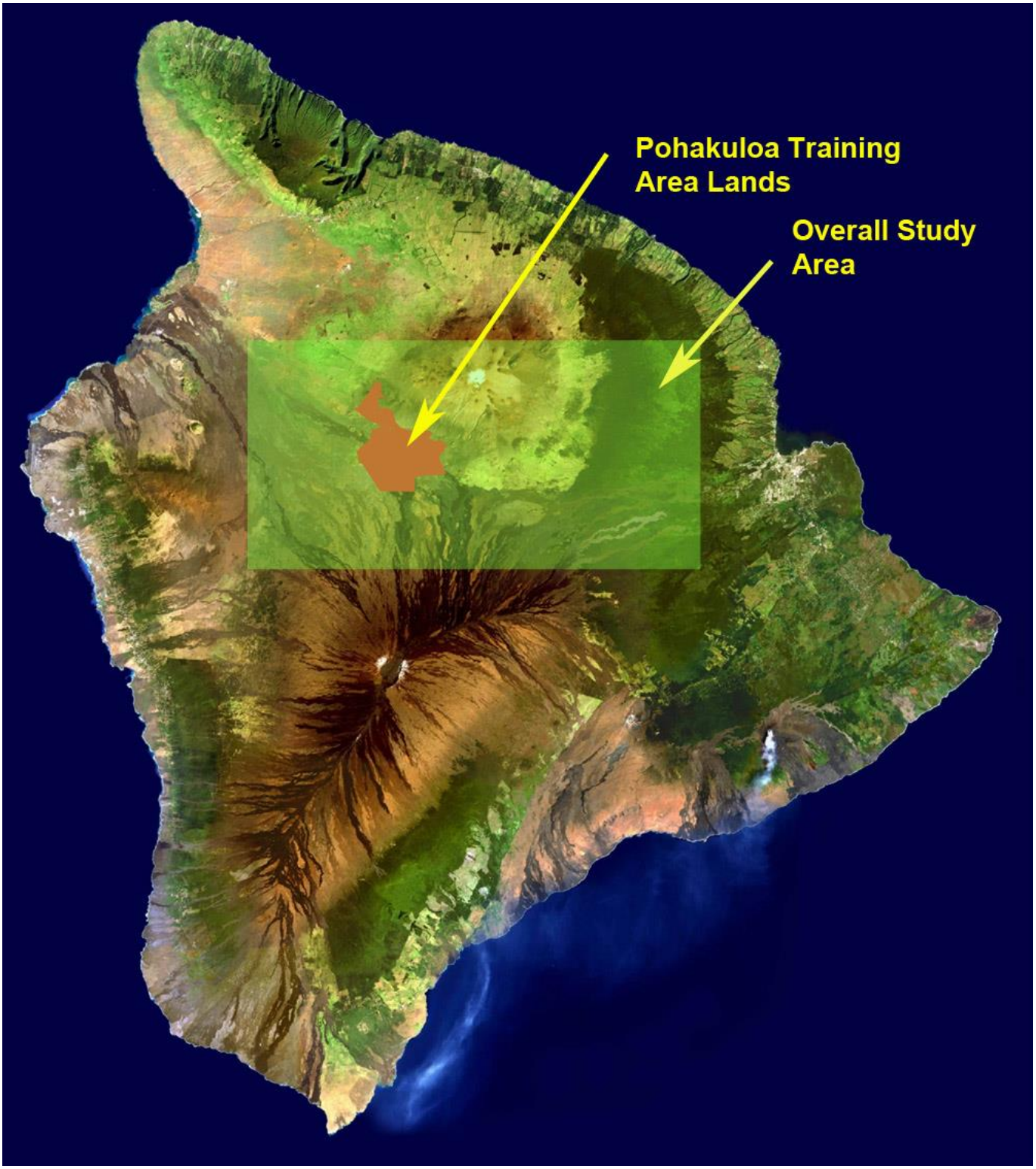


Figure 4-1. Landsat Image of Hawai‘i Island showing general study area as well as location of PTA lands within the study area.

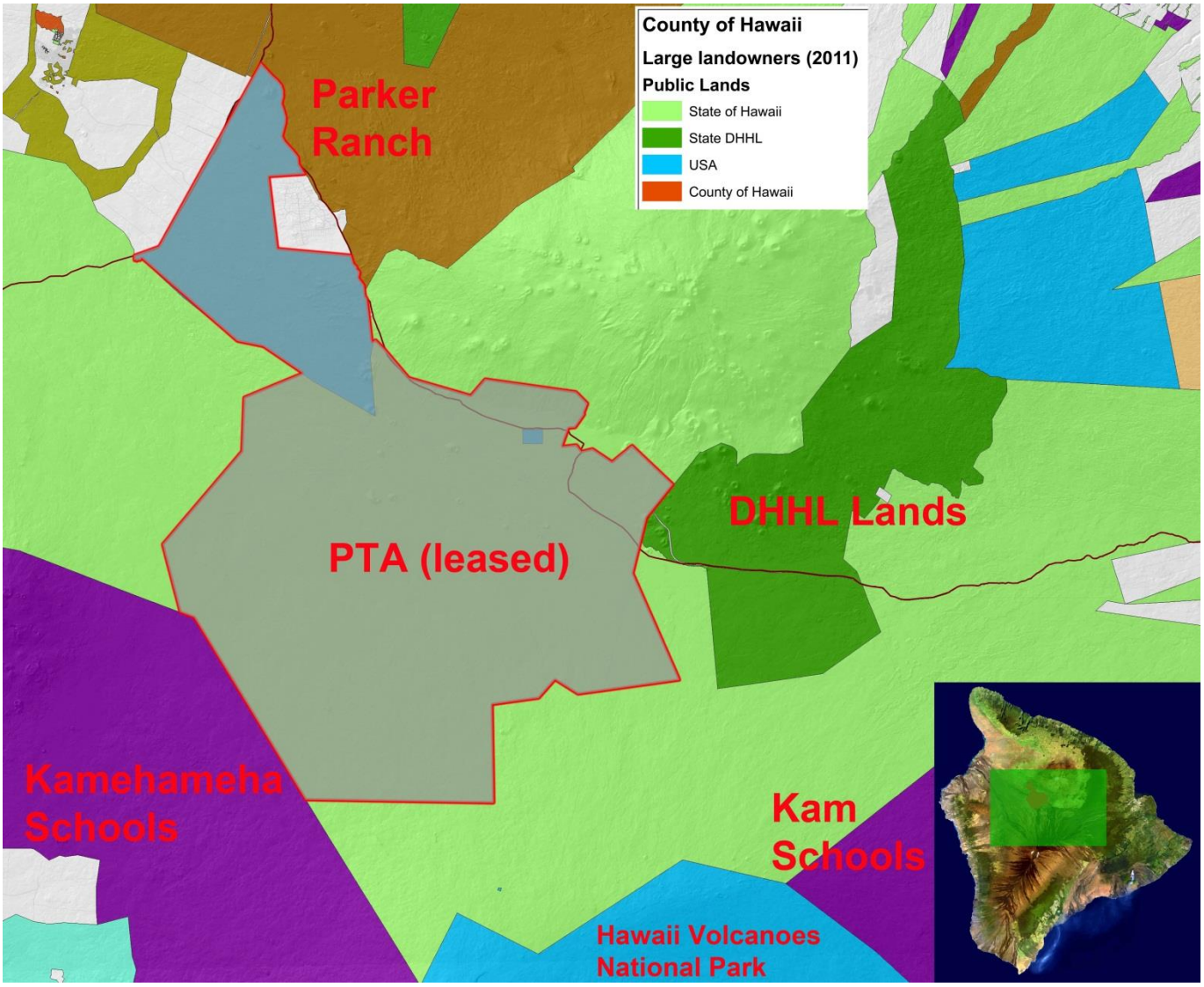


Figure 4-2. Map showing major landowners within and adjacent to the planned study area

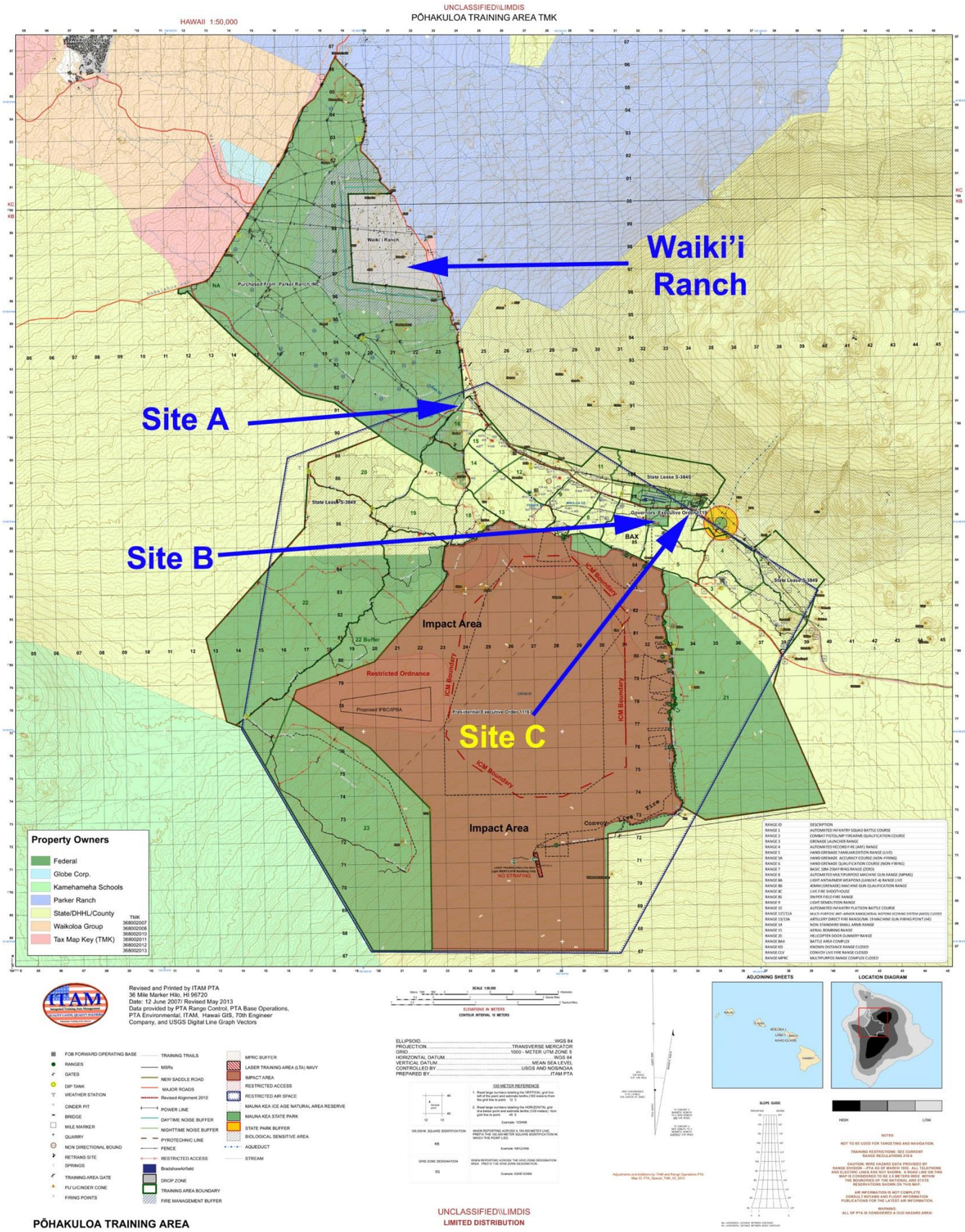


Figure 4-3. Showing land uses within the PTA area. Also shown are the locations of candidate borehole drill sites, Waikiʻi Ranch, the nearest residential area, and Mauna Kea State Park.

was used to transit across the island as well as for accessing Mauna Kea's summit to quarry stone for adze making, to perform burials, to deposit piko in safe and sacred areas, and to perform a range of other sacred rituals (Welch, 1993; Maly and Maly, 2005, 2005). The extensive lava tube system within the Saddle region hosted shelters for travelers transiting the area and numerous shallow tubes were modified by early Hawaiians for purposes that are as yet unclear: it has been suggested that the modifications were made to allow for more effective harvesting of birds and chicks for feathers and food (Langlas, 1999).

After western contact, and the introduction of cattle and sheep, these domesticated animals were released to the wild and allowed to multiply in the upland areas. As the numbers of animals increased, the Saddle region became increasingly used for hunting of free-range beef and mutton for local use as well as for trade with western ships; also harvested were large numbers of goats for their skins. As concepts of western land tenure became established, the area was used for ranching by a sequence of owners and lessees up to the present time.

Currently, the State of Hawai‘i has jurisdiction over much of the upper elevations of Mauna Kea's western flank as the Mauna Kea Forest Reserve and the Ka‘ohe Game Management Area. Owners of the lower elevation lands include the State of Hawai‘i, Parker Land Trust, Waiki‘i Ranch, and Army Garrison, Pōhakuloa.

The Army first acquired a portion of the PTA lands for military training during the early 1940s when the Saddle Road was initially cut across the center of the island when there were fears of imminent Japanese invasion. However, a permanent encampment at the present location of the PTA Cantonment was not established until the mid1950s. The overall training facility consists of 44,027 hectare (108,792 ac.) with about 9712 ha (24,000 ac.) of that leased from the State of Hawai‘i. Portions of the land are dedicated to impact areas for live fire training, maneuver training areas, and support and administrative facilities. Currently there are quarters and support infrastructure for up to ~2,000 Soldiers to participate in training exercises at PTA.

The central portion of the Saddle reaches an elevation of ~1,977 m (6,500) above mean sea level and is generally arid with annual rainfall averaging less than 510 mm (20") in the leeward portions of the Saddle. In years past, water for Mauna Kea State Park and PTA was supplied from springs on the upper slopes of Mauna Kea; the supply was shared with Mauna Kea State Park receiving

the first 10,000 gallons (37,850 l) per day of spring production and PTA receiving the balance, estimated to be on the order of 5,677,500 liters per year (water was piped down to holding tanks for the Park and PTA near the support facilities (Stout et. al, 2006). Even this source of water has shown a progressive decline during the recent past and they now produce about 100 gallons per day. The quality of even this source does not meet drinking water standards and, during the immediate past, potable water has been trucked to PTA from wells in Waimea and the outskirts of Hilo. Water use at PTA averages 227,000 liters per day (~60,000 gallons and ten truckloads per day) during training exercises and 37,850 l/d (~10,000 g/d) when PTA is staffed only by support personnel. During fire emergencies water demand can be as high as 567,750 l/d (150,000 g/d).

Development of an alternate supply of potable water at PTA, from groundwater resources, has been contemplated for at least the last 50 years. A series of early electrical soundings (Zohdy and Jackson, 1969) were performed on PTA lands in the mid-1960s and a test hole was drilled to a depth of slightly more than 305 m (~1000) (State of Hawai‘i, 1965). The geophysical surveys indicated a depth to water at a site east of the Cantonment at about 915 m (3000) below ground surface; the test hole results were consistent with this estimate as it proved to be dry. More recently, a deep production well was considered by the Army and an environmental assessment was conducted (Yuh, 1996). Due to reasons of cost or lack of priority, a drilling program was never undertaken.

The initial phase of the present project selected a site within the PTA cantonment to place a deep test hole to determine the actual depth to water in the region. The site was selected based on the recent geophysical surveys (Pierce and Thomas, 2009) that showed that high level water might be present at depths of ~900 m (3000’) below the ground surface somewhat south of the cantonment. The initial test hole encountered perched water at ~150 m (500’) and 213 m (700’) depths and a continuous aquifer that extended from ~550 m (1800’) to the total depth drilled of 1764 m (5786’). Results of recent gravity investigations, published early in 2013 (Flinders et al., 2013), have postulated the presence of a broad dike complex extending between Mauna Loa and Mauna Kea that suggest that the water encountered is a dike-impounded groundwater system of substantial extent.

4.3 Topography, Soils, and Geology

4.3.1 Affected Environment

The area of interest for the proposed drilling is located in the saddle area between the two largest volcanoes on Hawai‘i Island, Mauna Kea and Mauna Loa within the Waikoloa tract of the South Kohala land district and the Kaʻohe tract of the Hāmākua district. Over most of the area, the land slopes gently down in a south-westerly direction at less than five percent (Stout, 2006). The elevation in the area of the proposed borehole ranges from 1950 m (6,400 feet) to 1635 m (5300’) above mean sea level. Mauna Loa is still in its shield-building stage of activity whereas Mauna Kea is estimated to be about 500,000 years older than Mauna Loa and is in its late alkalic stage of growth where eruptive frequency is waning. Because Mauna Loa is growing at a much higher rate than Mauna Kea, it is encroaching onto the latter’s southern flank (Sherrod et al., 2007). As a result, the land comprising the southern portion of the Waikoloa and Kaʻohe tracts is made up of Mauna Loa lavas overlying, and interspersed with, the older Mauna Kea surface (Figure 4-4, 4-5). The Mauna Loa lava flows are dominantly of aʻa character and form an extremely rough surface whereas the Mauna Kea surface underlying the Waikoloa and Kaʻohe tracts consists of weathered lava flows, finely-divided rock fragments, derived from glacial weathering and outwash, and ash. The dominant characteristic of the surface is a dusty rocky soil of a few centimeters to more than 10 m thick.

The broad age range of the surfaces has resulted in the formation of ten soil types within the area of interest (Figure 4-6, 4-7). Approximately 80 percent of the surface area is a mixture of pāhoehoe and aʻa lava while 20 percent consists of cinder, pumice, ash, loam, sand, and soil (Stout, 2006). According to the U.S. Department of Agriculture, the project site is composed of Keʻekeʻe loamy sand with 0-6 percent slopes (Sato, et al., 1973). For this soil series, runoff is slow, permeability is rapid, and the shrink-swell potential is low.

The three locations identified as prospective drilling sites in **Section 1.6.2 Selection of Location** above, were examined in detail (Appendix A). The locations of the three candidate sites that best met our screening criteria are shown in Figure 4-8 and the conditions at the three candidate sites can be summarized as follows:

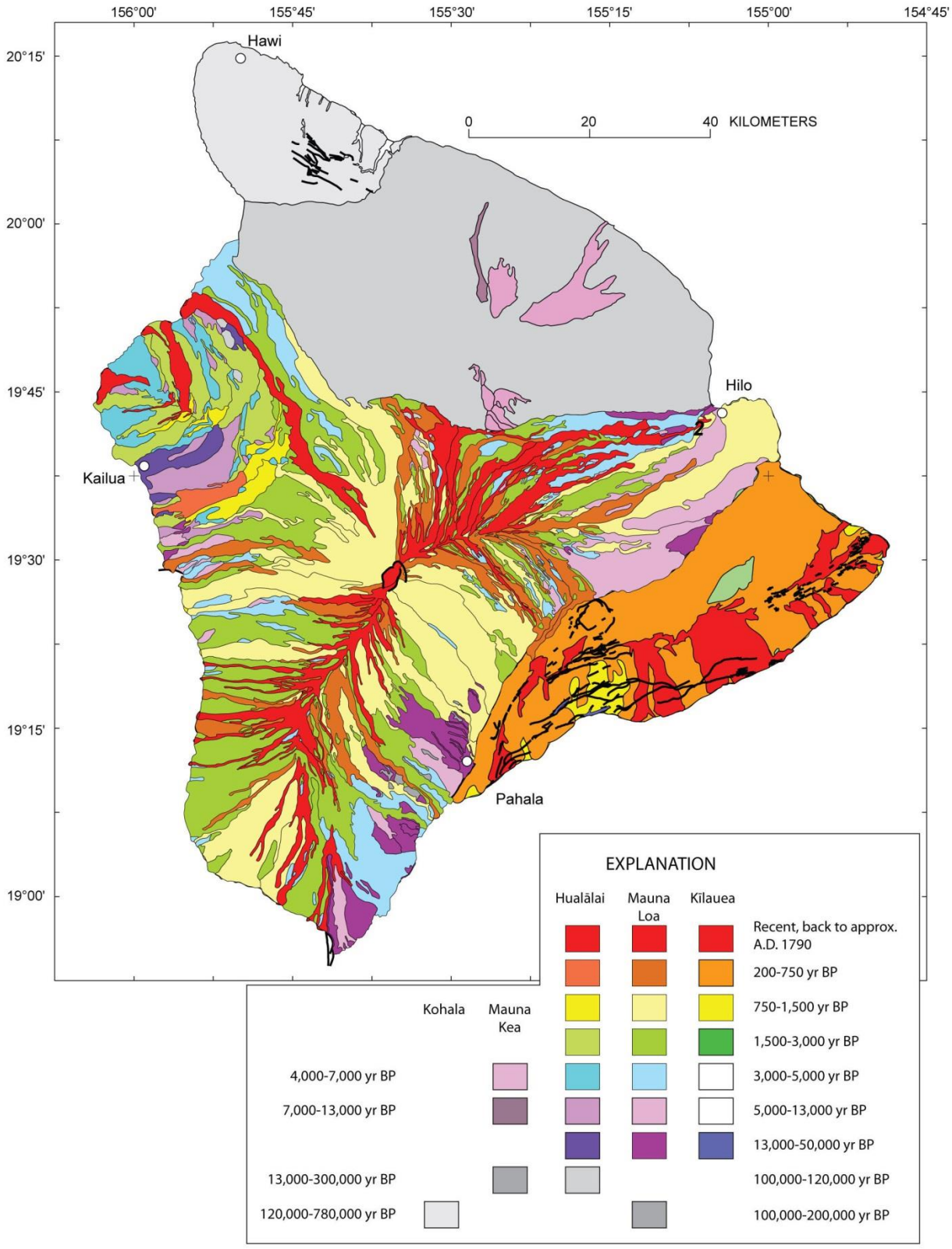


Figure 4-4: Geologic map showing age distributions of lava flows on the Island of Hawai‘i. The PTA lands straddle the transition from Mauna Kea lava flows to the younger, encroaching Mauna Loa flows to the south (Sharrod et al., 2007).

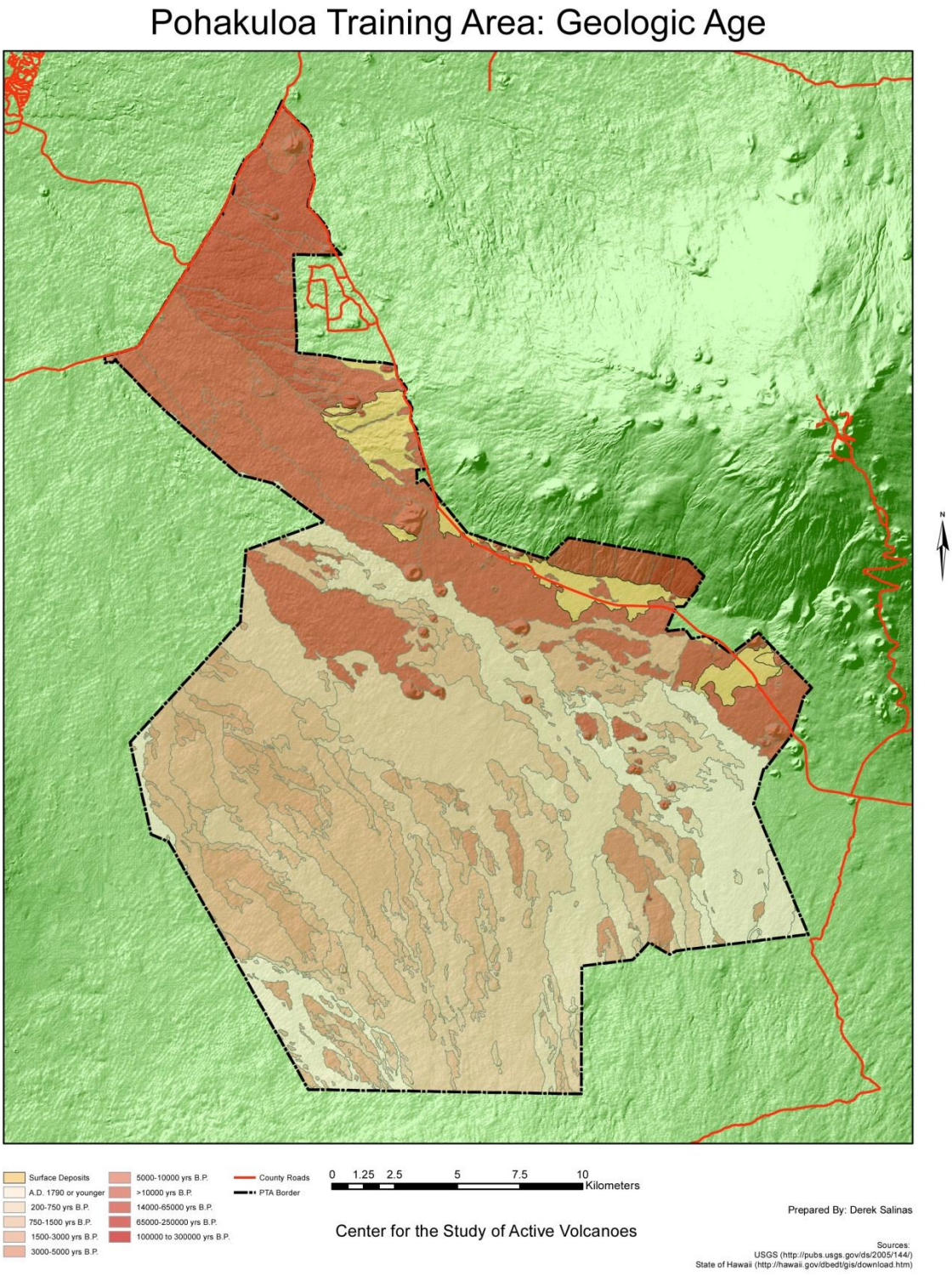


Figure 4-5. Showing younger Mauna Loa encroaching on Mauna Kea within PTA boundaries

1) **Site A Ke‘āmuku**; Figure 4-9: This site is located along the northeastern border of the Ke‘āmuku parcel and adjacent to Ke’eke’e Road, at N19° 47 50.1” & W155° 38 0.1” with an elevation of 1635 m (5,362 feet), between the former alignment of the Saddle Road at “Seven Steps” and the most recently opened section of the Saddle Road. The site consists of a mixture of Kilohana Loamy Fine Sand (KZD in Figure 4-7) and very stony land (rVS in Figure 4-7); the site is a hummocky surface covered with non-native grasses and weeds along with some native shrubs.

2) **Site B Armor Road** (Kuapa Site 2); Figure 4-10: This site is centered on coordinates N 19° 44 57.7” & W155° 33 7.4” at an elevation of 1873 m (6145 feet) and is located approximately 1.28 km (4,200 feet) south of the PTA Cantonment boundary. The immediate area is flat with a few very shallow washes and abandoned vehicle tracks across it; the soil is a dusty Mauna Kea soil and has widely scattered thin patches of vegetation.

3) **Site C Landfill** (Kuapa Site 3); Figure 4-11: This site is centered on coordinates N19° 4511.5” & W155° 32 21.6” at an elevation of 1929 m (6,330 feet), and is located near a former landfill on State-owned land that is leased by the Army for use by PTA. The site has been previously used as a staging area for heavy equipment as part of the landfill closure operation and has been graded and otherwise heavily disturbed.

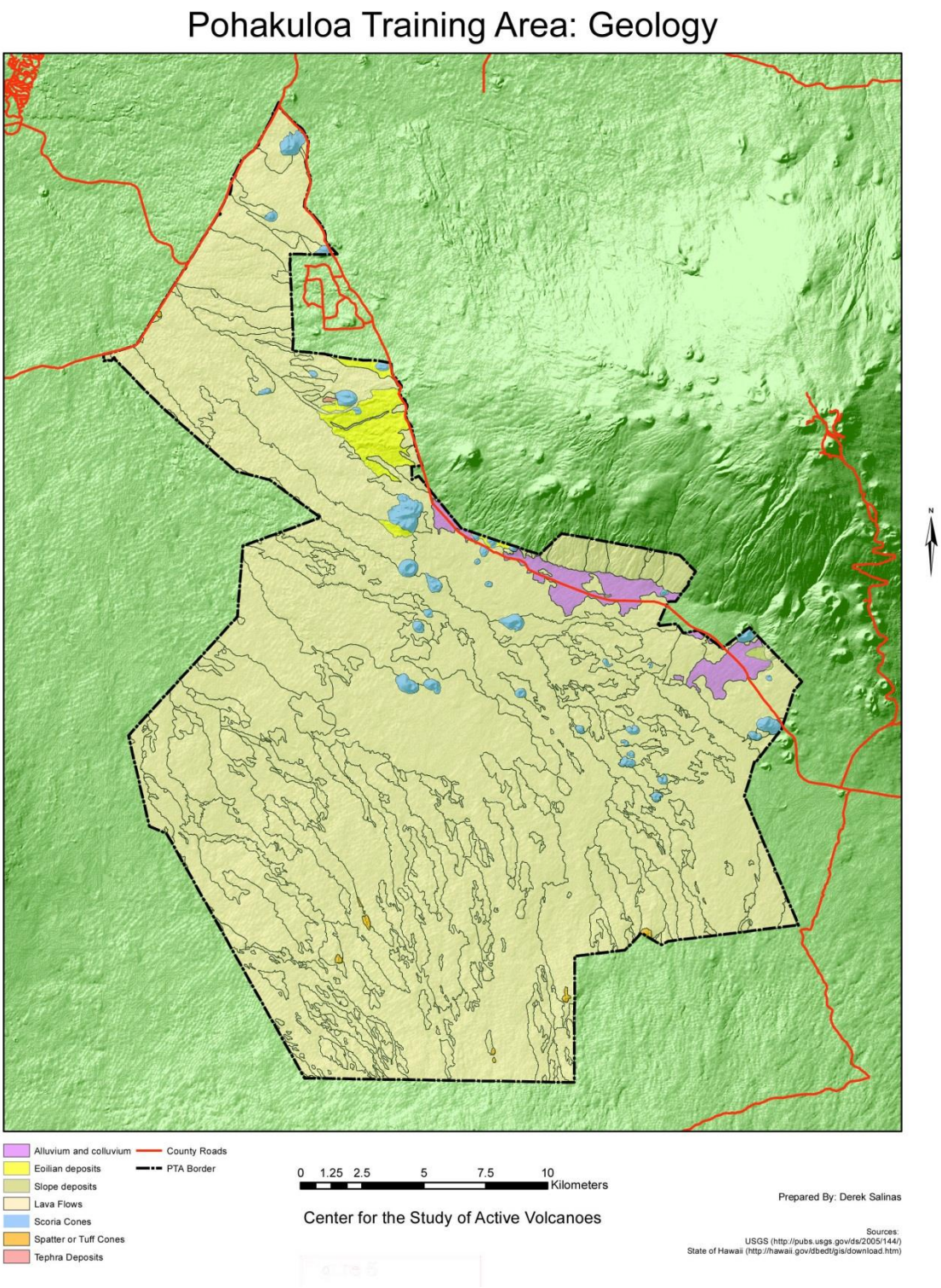
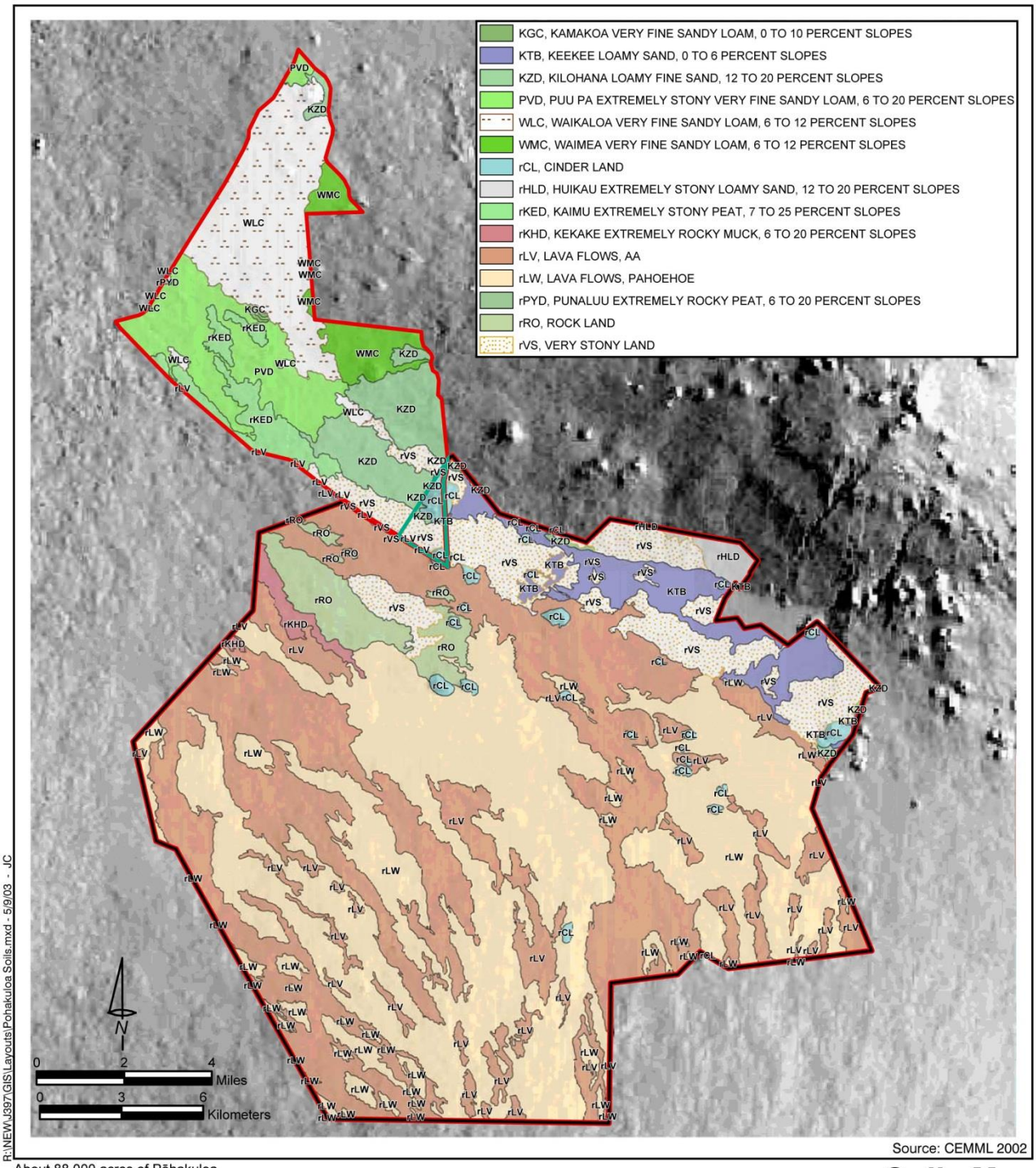


Figure 4-6. Showing the surface geology within the PTA lands.



About 88,000 acres of Pōhakuloa Training Area are classified as lava flows of which about half are ʻaʻā flows (highly fractured and blocky) and half are pāhoehoe flows (dense, smooth, or ropy).

Legend

- Pōhakuloa Training Area Boundary
- P7 West Pōhakuloa Training Area Land Acquisition Area
- 1010 Land Acquisition Area
- P3/P4 Pōhakuloa to Kawaihae Trail

Soils Map
Pōhakuloa Training Area

Island of Hawaiʻi, Hawaiʻi

Figure 4-7. Showing distribution of soil types within PTA lands (Stout, 2007).

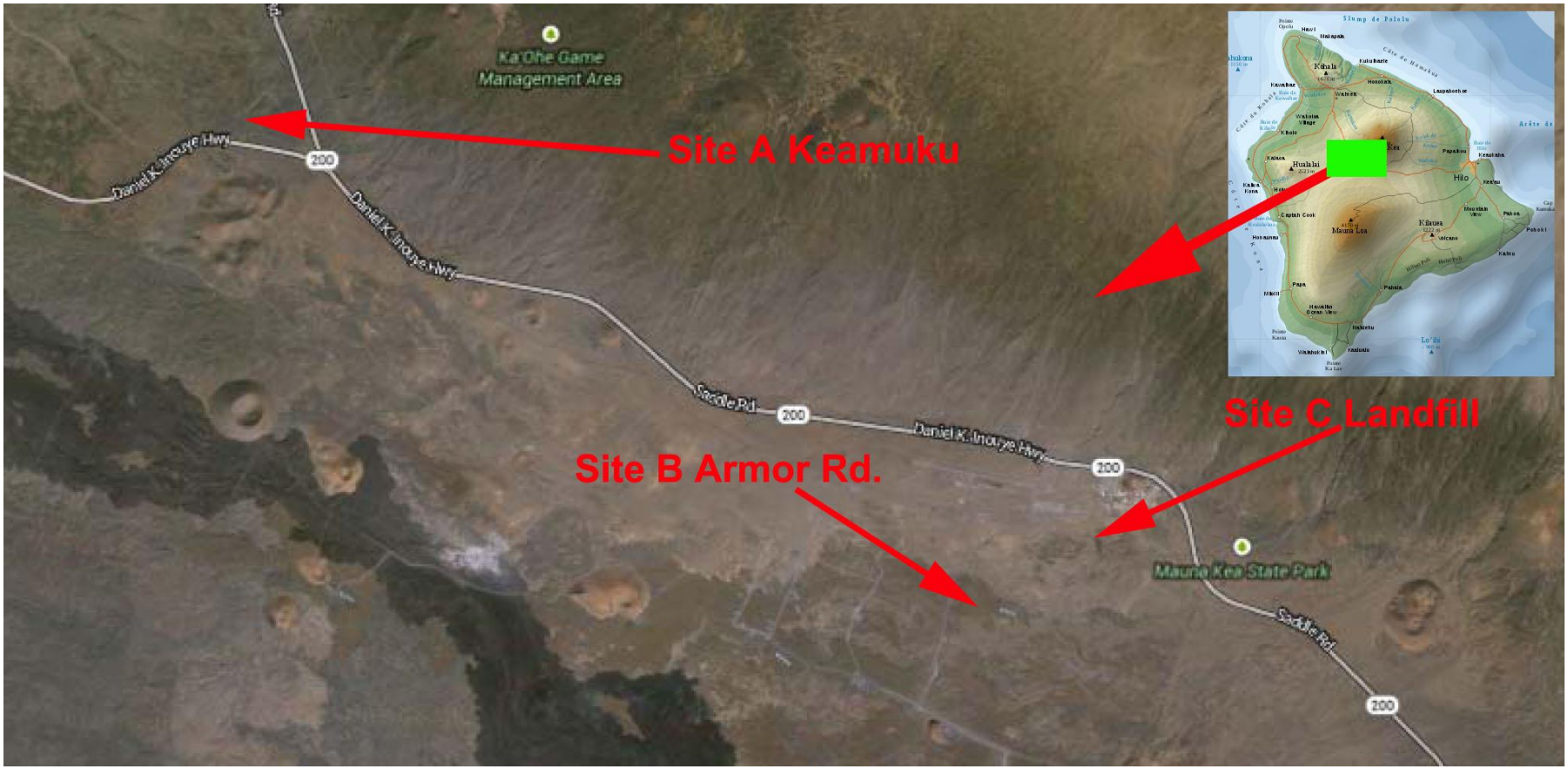


Figure 4-8: Aerial view of a portion of PTA lands with prospective drill sites shown.

Figure 4-9: Candidate **Site A Keʻāmuku**.

Figure 4-10: Candidate **Site B Armor Road**.

Figure 4-11: Candidate **Site C Landfill**.

4.3.2 Environmental Consequences

The ROI for the effects of the proposed drilling on the **Topography, Soils, and Geology** of the area is limited to the immediate vicinity of the drill site: an area of about 1 hectare. We do not anticipate any impacts on the topography beyond the boundaries of the drill site itself.

Proposed Action (Preferred Alternative): For the test drilling to be conducted, an area of approximately 1 hectare or less will need to be available for rig-up and short term storage of drilling materials at the site used. This area needs to be reasonably flat and accessible to vehicles but will not need to be paved. At prospective drill **Site A Keʻāmuku** (see Figure 4-9 above), limited grading and grubbing will have to be done over this area, as it is generally level but somewhat hummocky, to allow placement of all necessary equipment. A wellhead slab will need to be installed on the northwest corner of this site but that is the only modification to its current state that is contemplated. At **Site B Armor Road**, the existing ground is flat and featureless and would require no significant disturbance beyond installation of a concrete slab for the wellhead. Likewise, at prospective **Site C Landfill**, prior activities have already graded some of the surface contour but additional grading and

grubbing would be required in order to clear a space adequate for the rig and support equipment

The activities at the site associated with mechanical disturbance of the ground are likely to increase the possibility of dust creation and wind erosion of the finest soil components. It is not expected that the disturbance will interfere with normal water infiltration and, hence, no significant increase in water erosion is believed to be likely as a result of the drilling activities. The temporary nature of these activities at each of the prospective sites, that have been previously disturbed, will not result in a significant impact to their existing condition.

No Action Alternative: Under the no action alternative soils and topography will remain as they are.

Mitigation: Standard erosion control measures will be implemented during ground disturbing activities to minimize erosion impacts. On those sites where soil is exposed during site preparation and drilling operations, shipping containers, used for storage of materials, will be placed in a fashion to block the prevailing trade winds and shelter exposed soils to minimize wind-blown dust erosion. Where fine-grained soils are exposed, we will lay out chipped mulch or locally sourced cinder to limit wind erosion processes. This strategy was successfully applied to the initial test well site using mulch material derived from wood-chipping of fire-break brush removal. We expect to use similar, locally derived material for coverage of the second test hole site.

4.4 Water Resources

4.4.1 Affected Environment

The majority of rainfall recharge to Hawai‘i Island is orographic: moist marine air, driven by the persistent trade winds, encounter the island mass and is forced to rise in altitude as it moves across the island (Lau and Mink, 2006). As the air rises, it undergoes adiabatic expansion and cooling resulting in condensation of the moisture and formation of clouds and rainfall on the eastern flank of the island. As the air mass reaches the local crest and begins its descent back toward sea level, this process reverses with compression and adiabatic heating of the air mass as it moves toward higher barometric pressure; the heating effect will lower the relative humidity of the air mass and, hence, the frequency and rates of

rainfall decline rapidly as the air mass descends from the local crest. As a result of these processes, the Kaʻohe lands, which all fall to the west of the Saddle crest, receive modest to low rainfall over an annual cycle (Figure 4-12). The primary source of rainfall to this area is the result of infrequent synoptic scale weather systems, locally referred to as Kona storms, that can bring moist marine air from the south and west and, driven by these large disturbances, can deposit precipitation as high as the summit of Mauna Kea. The lower elevation, leeward Waikoloa lands (Keʻāmuku site) benefit from the island heating effect which can draw moist marine air upslope in the late afternoons resulting in fog-drip precipitation and occasional upslope showers. Hence, precipitation on the western flank of the Saddle region is slightly higher, at 585 mm annually, than it is in the Kaʻohe district near Sites B and C (~370 mm/yr.).

According to the "Rainfall Atlas of Hawaii" (http://rainfall.geography.Hawaii.edu, Giambelluca, et al., 2011) the average annual rainfall in the vicinity of PTA is between 370 and 762 mm (20 and 30 inches). Because of the sparse rainfall and highly porous nature of the ground surface, there are no perennial surface streams or other wetland features in the PTA area or within any part of the Saddle region (Lau and Mink, 2006; Stout, 2006). The closest natural water source is a set of springs located between the elevations of 2700 m and 3170 m (8,900 and 10,400) in the Waihū branch of the Pōhakuloa Gulch (Wentworth, C.K. and W.E. Powers 1943). Named springs within this set include Hopukani (Houpo o Kāne), Waihū (Wai hū a Kāne) and Liloe springs; an agreement with the State allows the Army to derive limited amounts of non-potable water from these springs; however, this is not considered a reliable source of water due to seasonal variations in outflow (Army Garrison, 1996). The nearest (developed) ground water source is approximately 19 km (12 miles) northwest of the PTA cantonment within the privately owned Waikiʻi Ranch community. That resource shows groundwater at an elevation of 850 m to 915 m (~2800' to 3000') above sea level but these wells may be located within the dike complex associated with Mauna Kea's west rift zone and, hence, are drawing on dike-impounded water supplies rather than the inferred basal lens within Mauna Kea. Zhody and Jackson (1969) performed a series of electrical geophysical surveys in the early 1960s and concluded that groundwater may be present at 3000' below the ground surface in the PTA area.

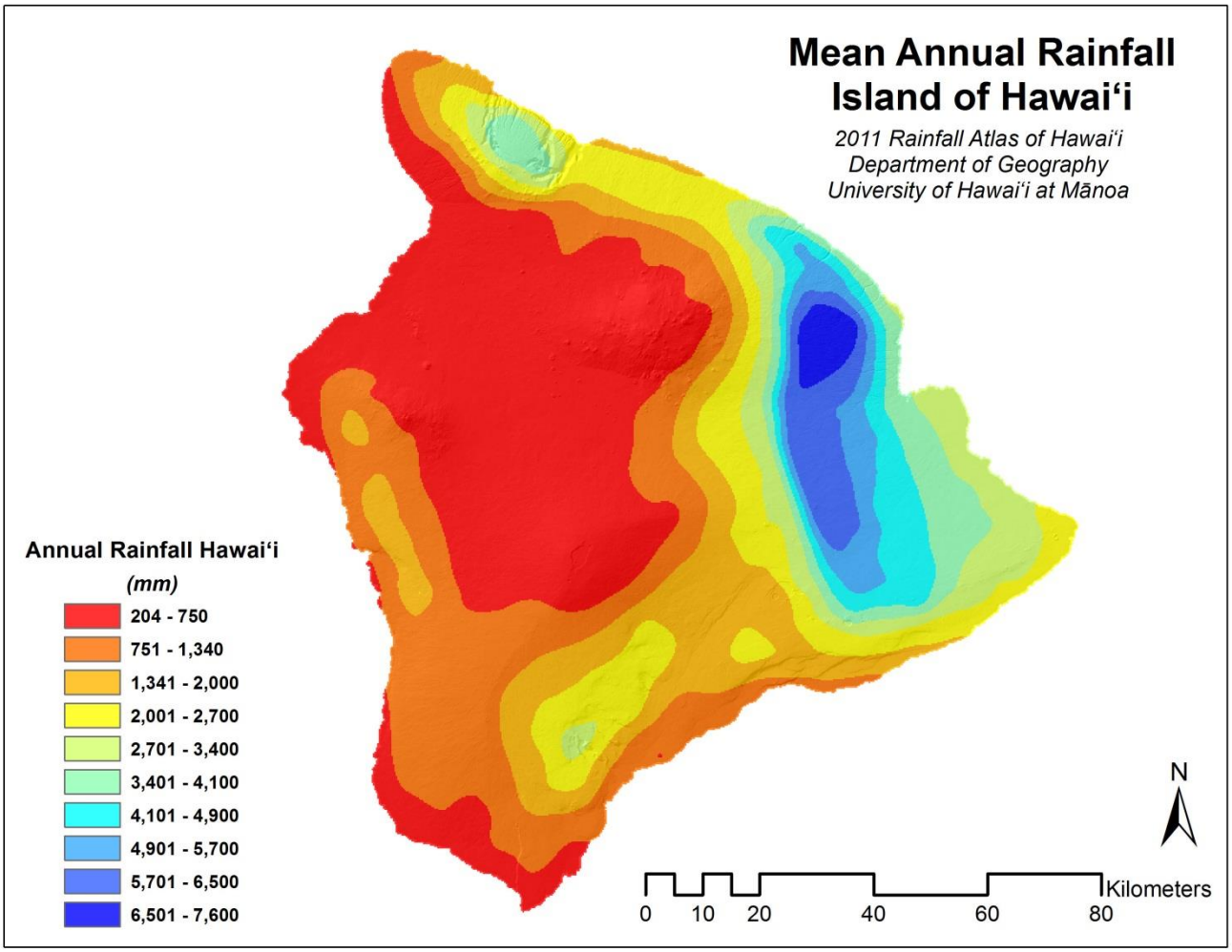


Figure 4-12. Rainfall distribution on the Island of Hawai'i. PTA lands receive among the lowest average annual rainfall rates on the island (Giambelluca, et al., 2011).

As noted above, a test well drilled on PTA land to 1001' depth was completed in January 1965, but found no groundwater (Division of Water and Land Development, 1965). The recently completed test hole in the PTA cantonment demonstrated that high elevation groundwater was present as both perched aquifers as well as what are interpreted to be dike-impounded aquifers standing at elevations of about 1400 m (4586') above sea level. These aquifers may extend across much of the northern Saddle region from near the Mauna Kea access road to at least as far west as the Ke'āmuku parcel.

According to the National Flood Insurance Boundary Maps, PTA is in an area designated "Zone X," which means "areas determined to be outside the 500-year flood plain" (National Flood Insurance Program, 2010).

4.4.2 Environmental Consequences for Water Resources

The ROI for the effects of the proposed drilling on the **Water Resources** within the Saddle region is limited to the aquifers within the PTA controlled lands. Drilling fluids will eventually make their way into the saturated aquifers that reside below the Saddle; the limited rainfall within the region will ensure that their transport toward the water table will occur slowly and allow the organic compounds to both biodegrade and become highly diluted before they are transported out of the immediate area of the Saddle region.

Proposed Action (Preferred Alternative): Site preparation at the proposed drilling locations is not expected to have any impact on ground waters underlying the prospective drill sites. The drilling itself will introduce some compounds into the water immediately around the well bore. These compounds will consist of soap (Appendix D, Airfoam), bentonite clay (Appendix D, Naturagel), and a vegetable-derived polymer (Appendix D, Alcomer 120L) that is used in formulating the drilling fluids for air drilling or gel-based drilling fluids. It is likely that most of the drilling fluids injected into the hole during drilling will, in time, enter the local water table: the soap, used during foam drilling above the water table, will likely be lost to the formation and, eventually, will biodegrade or be washed down to the basal lens by infiltrating rainfall; the conventional drilling fluid, containing bentonite and polymer, will be used after the water table is reached and these fluids will also be lost to the saturated formations during the drilling. Both the soap and the drilling polymer are biodegradable and are expected to break down over time; bentonite is a natural product, a clay, that poses no threat to the groundwater quality.

In a broader context, the new information generated by the proposed project will have a positive impact on water resources island-wide by providing new information and insights into the hydrological cycle for the island as a whole. These new insights will enable the State, the County, and the Saddle region Stakeholders to better manage the groundwater resources both specific to the Saddle area as well as for the entire island. Hence, this action will have a net positive impact on groundwater resources..

The No Action Alternative: Under the no-action alternative, there would be no impact on the groundwater supplies in the immediate vicinity of the Saddle region. However, the no-

action alternative is likely to result in a continuing burden on the Waimea and Hilo groundwater supplies that are the sources for the water trucked to the Saddle by the Stakeholders.

Mitigation: The drilling strategy will use a foam/air drilling fluid in the unsaturated zone where formation conditions allow it and will reduce the volume of drilling materials introduced into the local formation and aquifers. Conventional drilling would use a bentonite based fluid; our drilling will also use bentonite but, because we are drilling a small diameter hole, will use a far smaller volume of drilling materials than conventional rotary drilling. During drilling using conventional drilling fluids, a specialized bottom hole assembly will be used to minimize and control the rate of fluid use during the drilling process. In the prior test hole we also found that we were able to reduce the amount of bentonite used by applying somewhat larger amounts of polymer to the drilling fluids; as the latter is biodegradable, it will have little to no long-term impact on the local aquifers. Further, the selection of drilling fluid additives will be a mitigation measure as we have restricted the selection to those that are used for water well drilling and, through long use, have demonstrated their minimal toxicity.

4.5 Noise

4.5.1 Affected Environment

The Saddle region is generally quiet. Measurements of noise levels, on a one-hour average, have yielded values ranging from 42 dBA to 60 dBA. The primary sources of anthropogenic daytime noise include: vehicle, operations, and maintenance activity within the PTA Cantonment; aircraft noise associated with Bradshaw Airfield; and traffic noise from the Saddle road. Aircraft and traffic noise continue, sporadically, through the night time hours as well. With the opening of the new Saddle Road segment near prospective drill Site A, noise associated with road construction has been eliminated but replaced with higher levels of vehicle traffic noise in the vicinity of that site. During periods of live fire training, some low frequency percussive noise may be heard throughout the region (Stout and Assoc., 2006).

Because prospective **Site A Ke‘āmuku** is located within about 50 m of the new Saddle Road segment, the level and frequency of anthropogenic background noise from the

highway noise will be greatest. Prospective **Site B Armor Road** is well removed from both the highway and the PTA cantonment and will experience the lowest level of anthropogenic noise whereas prospective **Site C Landfill** will experience a background noise level intermediate between that of Sites A and B.

4.5.2 Environmental Consequences for Noise

The ROI for the effects of the proposed drilling on the ambient noise levels is estimated to be approximately 0.5 km from the drilling activity. At this distance, we believe that the noise generated by the drilling activities will be well below nuisance levels.

Proposed Action (Preferred Alternative): Noise sources associated with the drilling include increased vehicle traffic to and from the drilling sites as well as noise associated with operation of the drilling motors which will be operated on a nearly continuous basis with two shifts of twelve hours each, on a daily basis. The drill rig engines (cooling fans, exhaust, etc.) are expected to generate a noise level of about 75 dB(A) at 10 m. Although there is some variation in sound levels, the engines typically operate at a constant power level and generate a steady drone. There may also be sound emissions classified as "impact noise": hammering on drill pipe, driving pins, etc. These sound levels are likely to exceed 85 dB(A) at the site but are typically of short duration.

Noise receptors likely to be impacted by the noise will differ for each site:

At prospective Site A Keʻāmuku, human noise receptors will be staff and troop trainees conducting maneuvers and training in the Keʻāmuku parcel. Other potential human receptors for this site include campers using the Kilohana Girl Scout camp located about 1.8 km north of prospective drill Site A. Animal receptors (see below) include native and non-native avifauna (e.g. Hawaiian Hoary Bat, Nene, and Pueo) as well as non-native mammals (e.g. sheep and goats) that frequent the area.

At prospective Site II Armor Road, the nearest noise receptors will be within the Cantonment about 2 km northeast of the proposed drilling site and somewhat further than that from any Mauna Kea State Park campers as well as the avifauna and non-native mammals.

Prospective Site C Landfill is located about 1 km SE of the cantonment and about 1 km SW of the Mauna Kea State Park.

During past drilling activities in Hilo, even when drilling within a few hundred meters of residential areas in Keaukaha, the steady drone of the drill rig did not produce intrusive levels of sound for nearby residents. Over the course of the Keaukaha project, no noise complaints were made to the project principals even though all nearby residents were provided with phone numbers and invited to come by the site if they found noise levels to be intrusive. During the drilling of the recent test hole within the PTA cantonment, we found that the noise was not intrusive for occupants of the PTA billeting and were not audible from the Mauna Kea State Park. Hence, we do not anticipate that noise levels from the operating rig will be disruptive to troop trainees in Keʻāmuku nor for campers at the Kilohana Girl Scout camp. Likewise, due to the scarcity of evidence of habitat for avifauna in the considered areas, it is believed that there is little prospect for adversely impacting those receptors as well.

The No Action Alternative: Under the no-action alternative there would be no noise generated at the proposed drilling locations. However, there will be continued noise generation through the Saddle Road corridor associated with continued trucking of water to Stakeholders in the Saddle region.

Mitigation: The selection of the specific drill site that is located closest to receptors at **Site A Keʻāmuku**, was chosen in a location where there is a natural slope that will serve to deflect noise from the drilling operations away from the Kilohana camp. However, should unacceptable levels of sound be experienced, we will have the option of replacing the mufflers on the rig and associated equipment with "hospital" type mufflers that will further reduce exhaust-generated noise from the drilling operations. We will also have the option of deploying the storage containers in a way that will further deaden the sound transmission as needed. As further mitigation, the planned date of the activities at **Site A** will be outside of the normal nesting periods for birds within the region.

Noise generated by the small addition of rig traffic to existing traffic loads is believed to be insignificant and requires no additional mitigation.

4.6 Anthropogenic Light

4.6.1 Affected Environment

Because of the sparse population within the Saddle region, anthropogenic light sources are present in only limited numbers over most of the landscape. The largest contributor to nighttime light sources is from traffic that traverses the Saddle Road during nighttime hours, although this source is intermittent and mobile. Fixed sources of lights are those in the vicinity of the PTA Cantonment, at the lighted intersection at the main gate of PTA as well as area lighting within the Cantonment. The Bradshaw Air Field, adjacent to and west of the Cantonment also maintains navigation lights during most nighttime hours. Mauna Kea State Park maintains few outdoor area lights during nighttime hours and those are of relatively low output and hence don't impact the lands surrounding the park. Other stray light sources within the region include the Girl Scout Camp, northwest of PTA, and the Waikiʻi Ranch residences and roadway lighting.

4.6.2 Environmental Consequences for Anthropogenic Light

The ROI for the effects of the proposed drilling on nighttime light levels in the Saddle may extend as much as 2 to 3 km.

Proposed Action (Preferred Alternative): During drilling, the drill site and the drill rig mast will be lighted during nighttime hours for the safety of the drilling crew and others working at the site. Typically there will be area lights for navigation of the site itself, to allow use of a forklift or other heavy equipment safely, and the rig mast and rig floor will be lighted to allow crew to monitor and work on the equipment. Although none of the prospective sites are within the approach to Bradshaw Airfield, for the safety of aircraft conducting training in the area, it may be necessary to maintain a navigation light at the top of the mast.

At prospective **Site A Keʻāmuku**, the rig lights will be isolated from most anthropogenic light sources except for continuing night-time traffic traversing the new Saddle Road segment to the south as well as the former Saddle Road alignment to the north. Because of its isolation, the lighting at this site is not expected to affect uses of the surrounding lands or impact on human occupants. There is potential for the lights affecting birds or bats in their night time transit of the area and foraging activities.

At prospective **Site II Armor Road**, the rig will be isolated from any other developed areas and hence the lighting there will stand out in a broad region that is otherwise dark at night. Because of its isolation, the additional lighting will not affect existing uses of the area and will have no impact on humans. As an isolated light in an otherwise dark environment, there is the potential for the lights to affect birds or bats in their nighttime foraging or transiting the area.

Prospective **Site C Landfill** is located about 1 km SE of the cantonment and will be within the existing light dispersion from the cantonment and, hence, is expected to have a somewhat lesser impact on birds or bats transiting through this area.

The No Action Alternative: Under the no-action alternative there would be no additional lighting within the cantonment or at the other prospective drilling locations that are further removed from the cantonment.

Mitigation: In order to minimize the likelihood of disorienting nocturnal bird navigation, the lights will be directed downward and shielded so that there is a minimum of stray light given off by the site. Area lights will be designed to minimize upward escape of light and will be maintained, to the extent possible, below the elevation of the top of the containers to further minimize unnecessary light leakage off site. When and where possible, motion sensor lights will be used so that, if a work area is not in active use, lights will be automatically shut off. Finally, the drill crew will be educated to watch for birdlife that may be attracted to the nighttime lighting and one of the management staff will monitor the site for incidents of bird disorientation or bird strikes and adjust lighting deployment to minimize these effects. We believe that these measures will also address the concerns expressed by OHA regarding impacts to fauna resident in the Mauna Kea Forest Reserve.

Because of the relative scarcity of native birds and bird nesting habitat in the areas of the prospective drill sites, the impact on native birds due to the temporary increase in anthropogenic light is expected to be less than significant.

4.7 Air Quality

4.7.1 Affected Environment

Under the Federal Clean Air Act (42 USC 85 § 7401 et seq.) each state is required to identify areas that have ambient air quality in violation of federal standards. All of Hawai‘i is categorized as attainment, meaning that federal ambient air standards are being met, or unclassifiable if data are not available to support such a determination.

Ambient air monitoring is currently underway to document air quality for the PTA region (Morrow, 2010), however, the data are not currently available for our use. Nonetheless, the air quality in the general area is typically very good. The primary anthropogenic sources of air pollutants include vehicular traffic over the Saddle road, vehicular traffic within the cantonment and overland travel during maneuver training. An additional source of ambient air pollution is volcanic smog (vog) produced by Kilauea volcano. Many of the anthropogenic sources are variable and intermittent, and produce a negligible impact on the overall air quality within the Saddle region. However, air particulate loading generated by overland travel can become significant during training but is generally localized (U.S. Army Environmental Command, 2008). The source of the vog is well removed from the Saddle region but two erupting vents on Kilauea produces sulfur dioxide at rates ranging from 1000 tonnes per day to as much as 1800 tonnes per day during recent years (HVO, 2011). Under typical trade-wind conditions, the vog has relatively little impact on the Saddle region: onshore winds during the day can draw vog derived particulates from the leeward (Kona) side of the island up into the Saddle area (Hollingshead et al., 2003; Porter, 2009). During relatively rare periods of southerly winds on the island, significant levels of vog can blanket the island and will produce a visible haze throughout the Saddle region. The dominant compounds contributing to the haze are sulfuric acid and ammonium sulfate aerosols with lesser amounts of ammonium chloride and hydrochloric acid aerosols (Thomas and Macomber, 2010).

4.7.2 Environmental Consequences for Air Quality

The ROI for the effects of the proposed drilling on the air quality of the Saddle region will be within ~2 km of the drilling activities. Beyond this radius, the emissions from the drill rig or from dust producing activities will be diluted or settled out of the air column.

Proposed Action (Preferred Alternative): Short-term impacts on air quality would occur during site preparation and drilling. Site preparation impacts would include dust generated by rig up and installation of containers as well as diesel exhaust from the equipment being used. During drilling, the primary impact on air quality would be from diesel exhaust produced by the drilling, compressor, and generator engines. Data sheets on the emissions of the drilling equipment and compressor engines are listed in Appendix E. In both cases, these engines will be of similar or smaller capacity than truck engines routinely used in transiting across the Saddle Road. They will be evaluated for their ability to meet air quality standards during the permitting process under a Non-Covered Source Permit issued by the Hawai‘i State Department of Health. Any fuel use or emission requirements imposed by that permit will be met by the project.

Lands outside of the PTA include Mauna Kea State Park, Kilohana Girl Scout camp, and Ka‘ohe Game Management area to the north, which are under the jurisdiction of the State Department of Land and Natural Resources. Privately held lands are to the west of PTA-held parcels and includes the Waiki‘i Ranch as well as smaller private holdings. All the prospective sites are sufficiently isolated from actively occupied lands that air quality impacts from those sites would be insignificant.

The No Action Alternative: Under the no-action alternative there will be no additional emissions of diesel exhaust nor of dust beyond the existing loading associated with typical vehicle traffic across the Saddle or activities underway at PTA.

Mitigation: As noted above, we will configure the drill site to minimize the impacts of wind on cleared portions of the drill site and, hence, also mitigate the impacts of dust generation. Fugitive dust control measures will be implemented as necessary and as was done for the initial drilling site by covering much of the exposed area with cinder or mulch as needed to minimize mobilization of dust. At the conclusion of project activities, we will work with the PTA Environmental Office and grounds staff to restore natural vegetation to our drill site as recommended by them to help further minimize any longer term impacts from the drill site activities.

4.8 Flora

4.8.1 Affected Environment

The regional land cover is presented in Figure 5-11 showing that the area is sparsely vegetated due to low rainfall and geologically recent flows covering significant portions of the region. The flora within the areas specific to the present project have been detailed in Effects to Biological Resources from Exploratory Well Hole No.2, Keʻamuku Maneuver Area, Island of Hawaii (PTA Natural Resources Office, 2013) and Pōhakuloa Deep Well Test Candidate Sites Descriptions and Natural/Cultural Resources Evaluations (Kuapa Services, 2010) as attached. The findings from that analysis are as follows:

Site A Keʻāmuku: This site is moderately vegetated with a broad variety of plants having been identified (Table 4-2) at the site. The plant species identified were dominantly non-native flora with only eight species of native plants present and more than 25 non-natives inhabiting the site some of the latter are considered target weeds for removal from the PTA lands. None of the identified native plants are listed as threatened or endangered.

Site B Armor Road: This site is more sparsely vegetated and contains far fewer plant species. Plants within this prospective location include telegraph weed, lovegrass and kikuyu grass that are sparsely distributed over the area; less commonly, fountain grass and three weed species are scattered over the location.

Site C Landfill: This site, also sparsely vegetated, was found to have widely scattered patches of telegraph weed and fountain grass with a less common occurrence of Kikuyu grass. Bordering the site are a few naio and māmane trees. Several small herds of goats were observed nearby during the survey and the fountain grass is heavily grazed.

4.8.2 Environmental Consequences for Flora

The ROI for the effects of the proposed drilling on the flora at the prospective drilling sites will be the drill sites themselves.

Proposed Action (Preferred Alternative): As noted above, each of the prospective sites have been surveyed for sensitive and native plants and have been found to be generally devoid of sensitive plant species. The overall impacts to the flora will be from work activities at the drill site that would potentially trample or abrade the plants as well as introduction of new non-native/invasive species that could affect native plants. Given the already disturbed nature of prospective sites **B** and **C** and the near absence of sensitive or

Scientific Name	Common Name	Origin	Federal Status	PTA NRO Target Weed
Anagallis arvensis	Scarlet pimpernel	Non-native	None	No
Avena fatua	Wild oats	Non-native	None	No
Bidens pilosa	Spanish needle	Non-native	None	No
Brassica nigra	Black mustard	Non-native	None	No
Bromus diandrus	Ripgut grass	Non-native	None	No
Carex wahuensis	Not known	Native	None	No
Cenchrus setaceus	Fountain grass	Non-native	None	No
Centaurea melitensis	Yellow star thistle	Non-native	None	Yes
Chamaesyce olowaluana	Akoko	Native	None	No
Chenopodium oahuense	Aweoweo	Native	None	No
Dactylis glomerata	Cocksfoot	Non-native	None	No
Dodonaea viscosa	Aalii	Native	None	No
Eragrostis atropioides	Hardstem lovegrass	Native	None	No
Erodium cicutarium	Red stem filaree	Non-native	None	No
Galinsoga parviflora	Gallant soldier	Non-native	None	No
Heterotheca grandiflora	Telegraph weed	Non-native	None	No
Lepidium africanum	African pepperwort	Non-native	None	No
Malva parviflora	Cheeseweed	Non-native	None	No
Medicago lupulina	Black medic	Non-native	None	No
Melilotus alba	White sweet clover	Non-native	None	No
Melilotus indica	Sweet clover	Non-native	None	No
Melinis repens	Natal redtop	Non-native	None	No
Osteomeles anthyllidifolia	Ulei	Native	None	No
Pellaea ternifolia	Kalamoho	Native	None	No
Petrorhagia velutina	Childing pink	Non-native	None	No
Salsola tragus	Russian thistle	Non-native	None	Yes
Senecio madagascariensis	Fireweed	Non-native	None	No
Silene gallica	Small-flowered catchfly	Non-native	None	No
Sisymbrium irio	London rocket	Non-native	None	No
Solanum americanum	Glossy nightshade	Native	None	No
Sonchus oleraceus	Common sowthistle	Non-native	None	No
Tagetes minuta	Stinkweed	Non-native	None	No
Verbascum thapsus	Woolly mullein	Non-native	None	No
Verbesina encelioides	Golden crown-beard	Non-native	None	No
Vicia villosa	Hairy vetch	Non-native	None	No

Table 4-2 List of plants identified at Site A Keʻāmuku

native plants at those sites, the impacts of the project due to direct destruction of native and sensitive plants will be negligible. **Site A**, the preferred site, does have native species and the activities at that site will likely impact those plants; however, the impacts are considered to be less than significant. There will be no anticipated impacts on threatened or endangered plants due to their absence from all three sites considered.

The No Action Alternative: Under the no-action alternative there would be no impact on the existing flora located at the individual prospective drill sites.

Mitigation: To the extent possible, the site preparations will minimize the number of native plants that will be impacted or removed. At the conclusion of the project at a given site, we will confer with the PTA Environmental Office regarding revegetation or other remediation that may be needed. During site preparation and drilling activities all vehicles and equipment brought to the site will be cleaned prior to transport from low elevations and will be inspected for evidence of soil, plant material, or invasive invertibrates prior to accessing the site. Any evidence of introduction of non-native species will trigger control measures as appropriate and approved by the PTA Natural Resources Office.

A less than significant impact on native flora is anticipated from the proposed activities.

4.9 Fauna

4.9.1 Affected Environment

Existing bird and mammal resources within the region included native birds Hawai‘i Amakihi (*Hemignathus virens*), the Palila (*Loxioides bailleui*), Akiapōlāau (*Hemignathus munroi*), Nene (*Branta sandvicensis*), Pueo *(Asio flammeus sandwichensis)*, and Hawaiian Hawk (*Buteo solitarius*). Eleven species of introduced birds are known to frequent the region as well with the most common of these being the House Sparrow (*Passer domesticus*) and common Myna (*Acridotheres tristis*).

Surveys were conducted at **Site A** to determine ground-nesting avifauna presence and habitat use within the action area using the same transects as the botanical surveys. Survey efforts were focused on the Hawaiian Goose (*Branta sandvicensis*) and the Hawaiian Short-Eared Owl (*Asio flammeus sandwichensis*), because the action area contains potential nesting habitat for both these species. No evidence of ground nesting avifauna were identified at **Site A** within the ROI of the drilling effort.

Feral goats (*Capra hircus*) and pigs (*Sus Scrofa*) were observed, and are common, within the Saddle region as are mice and rats. The endangered Hoary Bat (*Lasiurus cinereus semotus*) has been sighted in the past and may use PTA for foraging but was not observed during site surveys nor is there evidence of appropriate habitat for these animals on the sites being considered.

4.9.2 Environmental Consequences for Fauna

The ROI for the effects of the proposed drilling on the indigenous fauna is estimated to be no more than 2 km.

Proposed Action (Preferred Alternative): Planned activities at the prospective drill sites are expected to have minimal impacts on the native fauna of the region. The limited size of the area impacted by drilling activities is expected to be too small to deprive the fauna of habitat and site surveys did not identify nesting or occupancy of the sites by any native animals. However, as noted in **4.6 Anthropogenic Light**, drilling activities are planned to continue through the nighttime hours. For the safety of the site workers, the rig mast and work areas around the rig will need to be lighted during those hours and these fixed lights may have the potential to cause disorientation for night birds or serve to attract foraging bats.

The No Action Alternative: Under the no-action alternative there would be no additional impacts on the fauna resources within the ROI of the drilling.

Mitigation: To minimize the impacts of nighttime activities, lights will be shielded and, where possible, directed downward. Further, work area lights that can safely be equipped with motion-sensor activation will be fitted with sensors. Shift supervisors and staff will also be directed to be alert to evidence of bird or bat activity, or losses, associated with nighttime work; if evidence of significant losses is found, we will work with PTA biologists to implement further strategies in an effort to limit these losses.

4.10 Cultural Resources

4.10.1 Affected Environment

Hawaiian culture, prior to western contact, was acutely sensitive to, and aware of, the natural environment. Their interaction with the environment was both spiritual and utilitarian. Within this system Mauna Kea and the upland slopes held a special place in the culture. The island of Hawaiʻi was considered to be the first offspring of Wākea, in western parlance the "Sky Father", and Papa, the Earth Mother, from whom all Hawaiians are descended. Mauna Kea was considered the piko, or center and beginning, of the island and is considered to be the provider of physical and spiritual resources on which the island's inhabitants rely. This hierarchical view of the natural world extended to concepts about occupancy and utilization of the land: the highest elevations, at the mountain summits, were named Kuahiwi, and were considered to be spiritually the most important lands and were not appropriate for casual use. The next lower elevations were the Kualono, and were less revered, but still not suitable for occupancy, and were the source of valued hardwoods (e.g. naio, māmane, sandalwood) as well as birds, feathers, and flowers reserved for the Aliʻi. The high rainfall, lower elevation regions of the mountain Waomaʻukele and Waoakua were valued as sources for large trees used for canoe construction but were also occupied by spirits of the forest and, again, to be entered only of necessity. The Waokanaka and Kahakai regions were the more makai portions of the island and were sources for everyday use, agriculture, and harvest. On the upper leeward flanks of the mountain were the Kula regions, or grasslands that provided pili, aʻaliʻi and ʻilima.

Although not within the above land classification system, much of the area in the Saddle was referred to as Kaʻohe. In traditional usage, this is translated from the Hawaiian language as "the bamboo", but in its use as a place name here, it is taken to mean "that which holds water" (Kanahele, 2012). Whether this is a reference to the springs in the region, or the tendency of this location to attract the clouds and fog is not known; however, this area was also considered to be the domain of Lilinoe, the spiritual embodiment of the fog and mists. Site A is located within the land section known as Waikoloa, likely derived from Wai-kō-loa, literally translated as "water pulling far". This term is also applied to a cold north wind and, hence, whether the name is associated with the windy conditions that occur within this region or, as in the reference to Kaʻohe, it relates to the frequent accumulation of clouds and fog within this region cannot be determined.

Archeological surveys of the Army lands within the Saddle are consistent with these land divisions: sites within the western and southwestern flanks of Mauna Kea have indicated sporadic occupancy (rather than continuous) of the Saddle since at least 1000 AD with evidence of frequent encampment through the pre-contact era. Sites were rich with bird remains, suggesting usage of the area for harvesting of birds for food or for their feathers. Oral histories indicate that the young ʻuaʻu (petrel) chicks were a prized delicacy reserved for the Aliʻi although the mamo, ʻōʻō, and ʻiʻiwi birds were also harvested for their feathers. In later years, after western contact, bird numbers in this region were greatly reduced by both the introduction of the mongoose, as well as the mosquito and avian malaria. Loss of the upland forests began as early as the first decades of the 1800's due to foraging by cattle, sheep, and goats, that were provided to Kamehameha I by western traders and released to the wild; the degradation of the upland forests by the ungulates also contributed to the loss of bird habitat that continues to the present time and has resulted in a decline of traditional harvest of native birds and associated feather work.

The presence of a number of trails through the Saddle region were taken to indicate that the area was also used by early Hawaiians for transiting across the island, for harvesting of hardwoods from the naio/māmane forest, as well as for accessing the higher elevations for recovery of adze-making materials from the extensive quarries near the Mauna Kea summit although this practice apparently had died out by the mid-1800's (Maly and Maly, 2005) with the introduction of malleable metals by western traders.

The upper elevations of Mauna Kea were also accessed for religious purposes. Among the better known practices was placement of the umbilical cords of newborns at Mauna Kea's summit or in Lake Waiau; a practice that continues to be practiced to the present date. Water from Lake Waiau was also considered to have special healing or medicinal properties by virtue of having been collected in this most important spiritual district at Mauna Kea's summit. Unfortunately, much, if not most, of the traditional and spiritual practices observed in the higher elevations of Mauna Kea have left no record. An oral history, recorded as part of Saddle Road research, indicated that sites for religious and cultural rituals extended down to the lower elevations and included: Papa Hemolele, on the south side of Waikiʻi Gulch, as a site for resting and prayer during a transit from the Kona lands into and through the

Saddle. Further to the east, additional sites were identified, some of which have since been covered by recent lava flows. Written accounts of western visits to the upland areas, compiled by Maly and Maly (2005), also refer to a more widely practiced construction of rock cairns, or ahu, along trail sides at which native travelers offered tokens or devotional gestures of respect. With progressive westernization these practices have fallen into disuse and these more modest ahu have been lost due to neglect and more recent disturbance of the lands.

During our selection of sites, we included avoidance of natural and cultural resources as one of the criteria for selection and have chosen sites that show evidence of recent use and avoided sites where natural contours of the ground surface remain. In addition, we researched whether prior site-specific surveys conducted on PTA lands identified resources of cultural significance and conducted our own surveys (Appendix A Natural and Cultural Resources Evaluation) and likewise found none at the site within the cantonment nor were any archeological artifacts identified at the other alternate sites under consideration for this project.

We have engaged in face-to-face consultation with the PTA Cultural Advisory Committee and the group Kahu Ku Mauna, a cultural advisory group to the Office of Mauna Kea Management, on multiple occasions to determine whether the proposed activity would infringe on current or likely future cultural practices within the Saddle or summit areas of Mauna Loa or Mauna Kea; none were identified by those groups. Likewise, we consulted with fourteen individuals and representatives of agencies and Hawaiian cultural groups on the proposed drilling program (see Appendix B, Section 106 Consultation Letters); the Office of Hawaiian Affairs concurred that no historic or culturally significant resources were likely to be impacted (Appendix C). For the recent consultation for the Draft EA, comments were received only from the State Historic Preservation Office of the Department of Land and Natural Resources which encouraged the project to make more aggressive efforts to engage with the Hawaiian community to solicit further commentary regarding potential cultural concerns with the project; we expect to continue interacting with any cultural groups who have expressed interest in the project and will, on the release of the Draft Environmental Assessment, also publish notices in the local newspapers inviting individuals with cultural interests in this region to review and comment on the project.

Discussions with all interested groups will be continuing as many who have been consulted have expressed support for the project and interest in the findings.

4.10.2 Environmental Consequences for Cultural Resources

The ROI for the effects of the proposed drilling activities on the Cultural Resources within the Saddle region is within the confines of the prospective drill sites themselves. No impacts were identified that extend outside of prospective sites.

Proposed Action (Preferred Alternative): No archaeological sites were recorded and none are believed to exist in the immediate vicinity of any of the prospective drill sites. No evidence was found that any of the three prospective sites are currently used, or have been used in the past, for cultural practices of any form. Due to the age of the flows in the prospective areas being considered for use, there is no potential that subsurface (e.g. lava tube burials), or pre-contact, cultural resources could be affected by the proposed drilling.

The No Action Alternative: Under the no-action alternative, there would be no impacts on cultural resources within any of the prospective drill sites.

Mitigation: We will be publishing public notices in the news media to continue to solicit input or concerns with the planned activities and respond appropriately to those concerns during and after the environmental review process. Should evidence of archeological or cultural resources be encountered during site preparation work or during drilling, then activities at the site will be suspended and the PTA Cultural Resources Section and the DLNR State Historic Preservation Division will be contacted immediately for review, evaluation, and recommendations on how to preserve or avoid damage to those resources.

No impacts are anticipated on the cultural resources within PTA lands.

4.11 Potable Water

4.11.1 Affected Environment

The PTA Base Camp is serviced by three 2.54 million liter (670,000-gallon) storage tanks constructed in 1997 and a water distribution system that was upgraded in 1999. The stored water is treated and chlorinated prior to distribution.

Potable water wells also exist near the Waikiʻi ranch that extend more than 1219 m (4,000

feet) below the ground surface; the next nearest wells are located in Waimea where a large volume of high level water exists within the Kohala-Mauna Kea saddle region (Lau and Mink, 2006; Bowles, 2005). High elevation water is also found at the Kaʻūmana well located at an elevation of ~610 m (2000 feet) just west of Hilo and, during the most recent work conducted on the present project, a test borehole was drilled near Mile Marker 36 on the Saddle Road that encountered perched aquifers at elevations of 1790 (5873') and 1730 (5675') mamsl and what is believed to be a dike-impounded aquifer at an elevation of 1398 mamsl (4583'). The extent of these aquifers is presently unknown but ongoing work, including the test hole, which is the subject of this SEA, will be working to better define the characteristics of these resources.

Potable water is trucked to PTA from County wells, primarily from the Waimea well approximately 40 km (25 miles) from the Base Camp. Water is also available, depending on seasonal conditions, from a water line running from Mauna Kea Spring north and east of the Base Camp. This water source is shared with Mauna Kea State Park, which has rights to the first 37850 liter (10,000 gallons) per day. PTA annual usage of water from Mauna Kea Spring varies depending on availability; an approximate average is 5.7 M liter (1,500,000 gallons) per year. The total potable water usage at PTA is estimated at 44.55 M liter (11,770,000 gallons) per year. Annual costs for trucking water from County wells to PTA are approximately $1.2M (2011 dollars).

4.11.2 Environmental Consequences for Water Resources

The ROI for the effects of the proposed drilling on the potable water resources within the Saddle region are not expected to extend more than 1 km from the site of the drilling.

Proposed Action (Preferred Alternative): As noted in the previous discussion, there are no shallow sources of potable drinking water within the Saddle region. The nearest recognized water source, at Waikiʻi Ranch is believed to be drawing water from a dike system more than 8.5 km away from the proposed well; at this distance, it is extremely unlikely that there will be any communication possible between these water sources.

The present drilling will attempt to verify the existence of potable water at depths of about 1 km or less below the ground surface. Some drilling materials will be lost to the formation during the drilling process and will include soap, or foaming agent, as well as bentonite clay

and polymer. All the materials that will be used during the drilling are typically used for potable water well drilling and are considered to pose a minimal risk of degrading the water quality in the formations being drilled.

The No Action Alternative: Under the no-action alternative, there would be no impact on potable water resources within the Saddle region.

Mitigation: The use of foam for drilling the shallow portion of the hole is a mitigation strategy as this drilling technique significantly reduces the volume of materials that are lost to the formation in Hawai‘i’s highly permeable lava flow stratigraphy. Secondly, the drilling materials have been selected to be minimally damaging to the water quality of any aquifer that they may migrate into. Finally, as part of the completion work on the well, we will use a deep hole pump to remove as much of the drilling fluid from the hole as possible while we are sampling for chemical and isotopic analysis of the formation fluids.

With these mitigation measures, we believe that the impact of the drilling activity on the groundwater resources below the PTA lands will be temporary and insignificant.

4.12 Wastewater Disposal

4.12.1 Affected Environment

Wastewater at PTA Base Camp is directed to septic systems located throughout the Camp. All enlisted billeting rely on three latrine/shower points, which utilize a gray-water system whereby gray-water from the showers and sinks is filtered and then re-used in the latrines. The remainder of the Base Camp buildings are serviced by a series of septic systems. Officer billets have a single latrine and shower facility in each building. The Base Camp administrative office and shop buildings also have their own latrine facilities. Portable toilets are used in the training areas.

4.12.2 Environmental Consequences for Wastewater Disposal

The ROI for the effects of the proposed drilling on wastewater disposal is expected to be restricted to the drill site area only.

Proposed Action (Preferred Alternative): The project will maintain portable toilets at any

drill site that is in use. Any wastewater generated will be disposed of by a licensed contractor from whom these units will be leased. We do not anticipate any further impact on wastewater disposal within the Saddle region.

The No Action Alternative: Under the no-action alternative there would be no impact on the wastewater processes that are currently employed at PTA.

4.13 Solid and Hazardous Wastes

4.13.1 Affected Environment

Solid waste generated at PTA is hauled to the West Hawai‘i landfill operated by the County of Hawai‘i. Waste oil and contaminated soils or hazardous wastes are managed by a commercial hazardous waste contractor who removes them from the site and transports them to Oahu for processing and disposal.

4.13.2 Environmental Consequences for Solid and Hazardous Wastes

The ROI for the effects of the proposed drilling on solid and hazardous wastes will be restricted to the drill site alone.

Proposed Action (Preferred Alternative): The proposed activities are not expected to generate any solid or hazardous wastes that will require special treatment. Any waste products generated at the drilling sites will be consolidated into waste containers and trucked to the Hilo or Kona landfills. Similarly, any waste oil generated by equipment maintenance will be consolidated and a contractor will be secured to transport that waste oil to a recycling or disposal facility offsite.

The No Action Alternative: Under the no-action alternative there will be no effects on the disposal of solid or hazardous wastes.

Mitigation: Proper waste management protocols will be implemented and maintained at the drill site at all times.

The drilling activities are not anticipated to have any impact on solid or hazardous wastes on the island.

4.14 Transportation

4.14.1 Affected Environment

Land based access to the PTA lands is via the Saddle Road, however, with the ongoing upgrading of this artery, transport across the Saddle no longer requires transiting through a major portion of the PTA training area. Now abandoned sections of Highway 200, that formerly were part of the Saddle Road, are still accessible but are now reserved for PTA use only. Within the PTA lands, there is a network of gravel/cinder roads that are used by troops during training exercises. These roads are also open to hunters on a limited access basis when troop training is not underway at PTA. With the improvements in the Saddle road, the volume of traffic using this highway has increased dramatically. Whereas traffic prior to the Saddle Road was estimated to average about 900 vehicles per day, with the improvements that have been made to date, that number has increased to an estimated 10,000 per day (Okahara and Assoc. 2010) and is likely higher than that currently due to the recent opening of the latest segment of the improved highway.

Bradshaw Army Airfield, adjacent to the PTA Base Camp, provides air transportation for military personnel on training missions to PTA.

4.14.2 Environmental Consequences for Transportation

The ROI for the effects of the proposed drilling on transportation is expected to extend to Hilo and Kona due to project staff and supplies transiting from these population centers to the drilling sites.

Proposed Action (Preferred Alternative): The proposed drilling activities will generate between four and eight vehicle trips per day for crew changes and securing supplies required for the drilling. This is expected to have minimal impact on the existing traffic load currently using the Saddle road for transport of goods and services between East and West Hawai‘i.

The No Action Alternative: Under the no-action alternative, existing traffic levels would remain.

Mitigation: We will minimize vehicle traffic by having crew carpool for shift changes and

work to coordinate supply runs with shift changes and other required trips to Hilo or Kona.

4.15 Land Use Classification and Land Uses

4.15.1 Affected Environment

The lands occupied by PTA are dominantly classified under Hawai‘i’s Land Use Planning Allocation Guidelines (LUPAG) as Conservation lands (Figure 4-12); the recently acquired Ke‘āmuku parcel is classified as Agricultural land. The Conservation lands, either owned or leased by PTA, have been designated by DLNR as General, Resource, and Limited Conservation Subzones (Figure 4-13). The lands bordering PTA are a mix of Conservation and Agricultural lands with the latter comprised of a mix of small privately held rural lots as well as a few larger acreages used for ranching.

Land uses in the parcels surrounding PTA span a broad range of applications. The Mauna Kea Forest Reserve abuts PTA’s northern boundary and encompasses 212 km^2 (52,500). Within these lands, and covering a portion of the north and west lands held by PTA, are designated critical habitat for the endangered Palila bird. Northwest of PTA are game management lands and privately held small agricultural parcels at Waiki‘i Ranch used for grazing sheep. North and east of PTA, are lands that are considered critical habitat for the endangered Palila bird. Also east of PTA is the Mauna Kea State Park, a recreational and camping area, that is used by hunters and family groups. A large parcel of land that formerly was owned by Parker Ranch and used for cattle grazing, the Ke‘āmuku parcel, was, in the past, leased by the Army from Parker Ranch, but has recently been acquired by the Army in fee and is now designated for maneuvers training.

Site A Ke‘āmuku is located within the recently acquired parcel of land by Army Garrison PTA. The Land Use Commission (LUC) Land Classification is Agricultural. It is located in an isolated triangle of land that sits between the old Saddle Road and the new Daniel K. Inouye highway.

Site B Armor Road is located south west of the PTA Cantonment and has a Land Classification of Conservation and a Resource subzone, the next least restrictive of the Conservation classifications. The parcel of land on which the site is located is owned in fee by the Army Garrison Hawai‘i and its use during the recent past has been for troop training

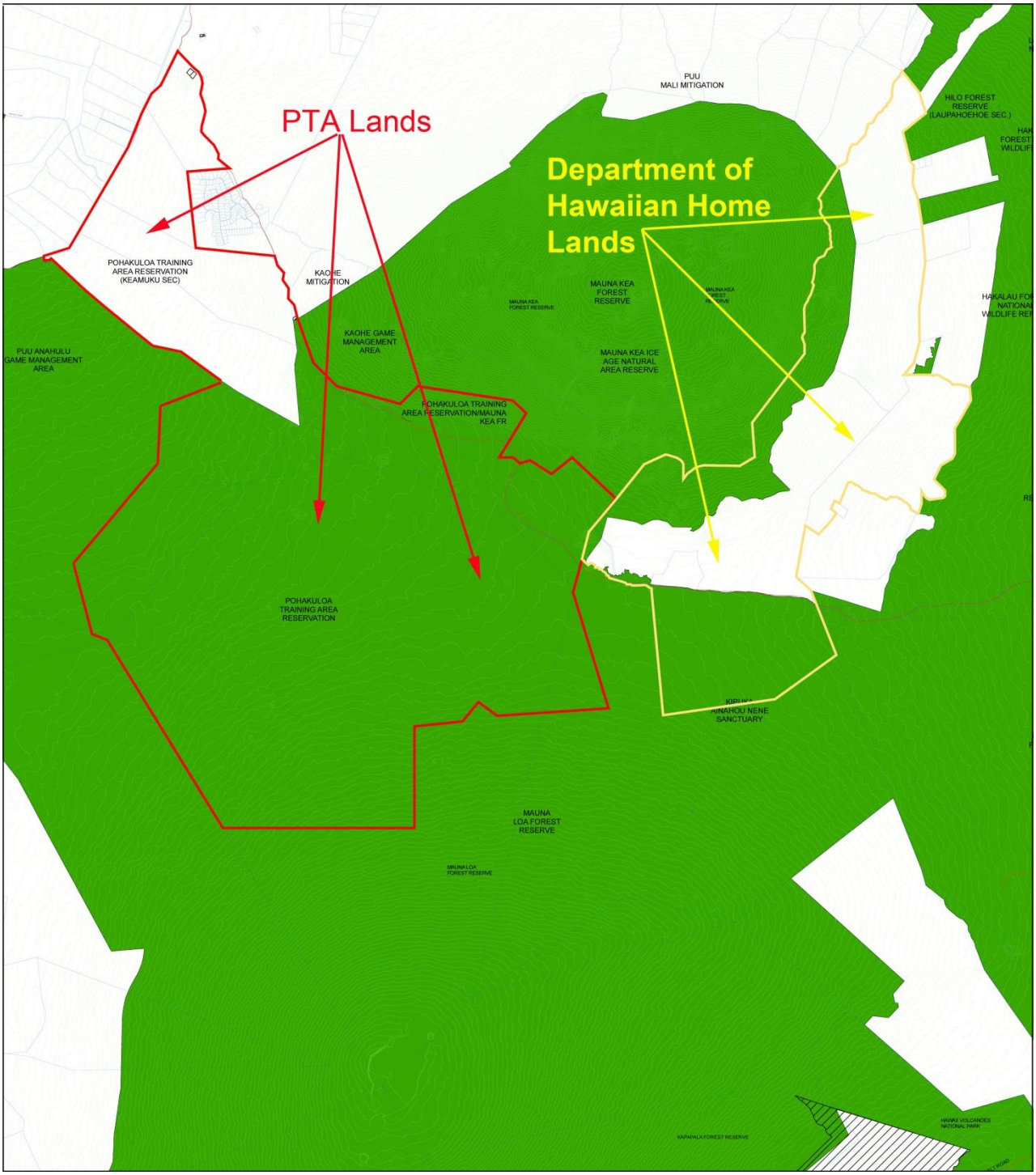


Figure 4-12. Showing Land Use Classification of Humu'ula Saddle lands.

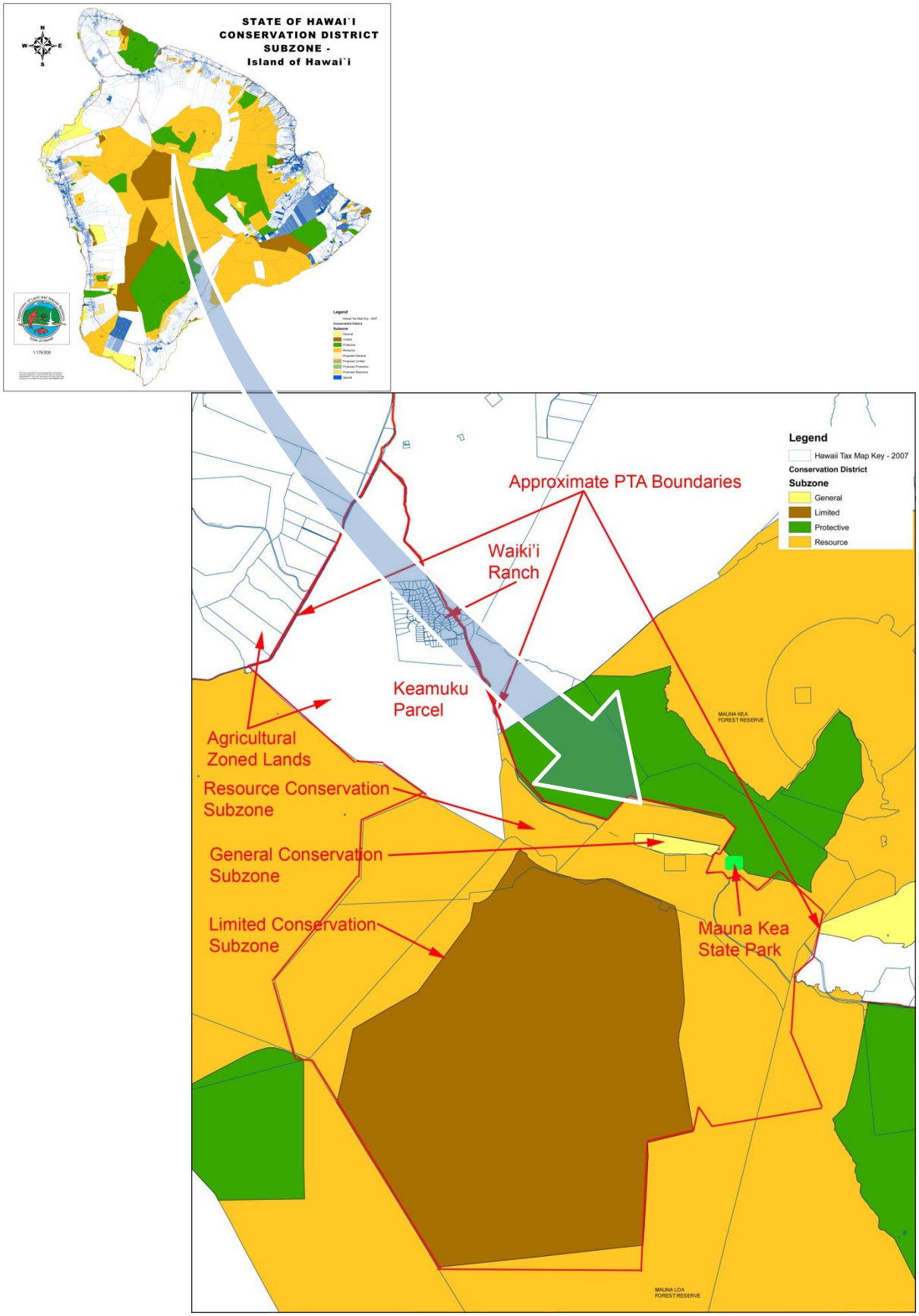


Figure 4-13. Conservation Subzones for Conservation Lands at and around PTA

and maneuvers. Much of this parcel sits within the safety zone of the recently developed battle area complex (BAX) impact zone; should this site be used, it will be located adjacent to that safety zone.

Site C Landfill is located south of the PTA Cantonment and has a LUC classification of Conservation/Resource. The parcel, on which the site is located, is owned by the State of Hawai‘i but is held under lease by the Army Garrison, Pōhakuloa. Its recent use has been for training purposes but has also been cleared as a staging area for heavy equipment during the closure of a refuse site that had been used by PTA for solid waste disposal.

4.15.2 Environmental Consequences for Land Use Classification and Land Use

The ROI for the effects of the proposed drilling on Land Use within the Saddle region extends over the drill site itself.

Proposed Action (Preferred Alternative): The proposed drilling activities will not directly affect existing land uses in the area. The exploratory drilling activities will last for several months and will leave behind minimal changes to the existing landscape. An indirect effect of the project may be that it will demonstrate significant water resources within this region of the island that may make existing agricultural activities more economically viable and, hence, allow these lands to remain in their existing classifications.

The No Action Alternative: Under the no-action alternative, there will be no impact on regional land uses.

Mitigation: Mitigation is not required.

4.16 Socioeconomic Environment

4.16.1 Affected Environment

The PTA training area spans the Waikoloa, Hāmākua, South Kohala, North Kona and North Hilo districts of the Big Island. According to the Federal Census results for 2010, State of Hawai‘i data book "Resident Population by County: 1990 to 2009", Hawai‘i State Department of Business, Economic Development and Tourism) the 2010 resident population

of Hawai‘i Island was ~185,000. The 2009 census estimates for the above districts, respectively, are: 9540, 7313, 15,721, 34,172, and 2060. Population projections prepared by the State Department of Business, Economic Development, and Tourism indicated that by 2020, the Hawai‘i County population will approach 205,400 people. In 2010 there were about 84,000 individuals in the civilian labor force with about 76,000 of those employed (U.S. Census Bureau, Longitudinal Employer-Household Dynamics, 2010). However, the 2010 status was during a period of shrinking labor force and shrinking numbers of employees and net out-migration from the island due to the ongoing recession in the US economy and the developed world in general. The average annual income for Hawai‘i Island wage earners (2009 data) was ~$38,000, the lowest of Hawai‘i’s county income levels, and is about 15% below that of Honolulu (State of Hawai‘i, Hawai‘i Workforce Infonet).

In 2000, the County of Hawai‘i had the third highest number of visitors among the counties of approximately 1,267,966 people. Oahu had the highest visitor count of about 4,719,244 people. It is estimated that in 2011, visitor expenditures for the island of Hawai‘i were $1.43 billion (HVB, 2012).

At the PTA Base Camp, the total permanent staff consists of 125 personnel. During training missions, military personnel at PTA can total as many as 2,000 Soldiers.

4.16.2 Environmental Consequences for Socioeconomic Environment

The ROI for the effects of the proposed drilling on the regional Socioeconomics will extend to the population centers of Kona and Hilo.

Proposed Action (Preferred Alternative): The proposed exploratory drilling is expected to have minimal direct impacts on Hawai‘i Islands socioeconomic environmental conditions. What effects it will bring will mostly be short term employment opportunities for a small number of island workers. Although this type of drilling is highly specialized, and will require trained drillers, we have, in past drilling projects on the island, provided employment to unskilled or minimally trained laborers as drill hands. In some cases, these opportunities have led to longer term employment for some of the incumbents at the end of the project.

Although it is more speculative, if the exploratory drilling is successful, then there is an increased likelihood that newly demonstrated water supplies could support an expansion of agricultural activities in areas of the Big Island where it is not now economically feasible; in particular, availability of a reliable source of water in the Saddle area would make it more feasible for the Department of Hawaiian Home Lands to lease more than 8,100 hectares (20,000 acres) of land under their jurisdiction for use in farming and ranching. Native Hawaiians are most often within the lower economic percentiles and, hence, availability of more land for economically productive uses will enable more residents of Hawaiian ancestry to participate in Hawai‘i’s economy. Likewise, other lands on the flanks of Mauna Kea that have limited productivity due to lack of water could be made more productive and contribute to the local economy in terms of locally produced food as well as employment.

The No Action Alternative: Under the no-action alternative the socioeconomic environment will remain as it is.

Mitigation: Mitigation is not required.

4.17 Environmental Justice and Protection of Children

4.17.1 Affected Environment

Title VI of the 1964 Civil Rights Act and Executive Order 12898 on Environmental Justice mandates that each Federal agency identify and address, to the extent possible, disproportionately high and adverse human health or environmental effects of policies, programs, or activities on low-income and minority populations. In terms of major categories recognized by the U.S. Census (2010), most residents of the state of Hawai‘i are Asians (38.8 percent) with the remainder mostly white (30.2 percent). African Americans comprise 3.2 percent and Native Hawaiian and Pacific Islanders comprise 9.2 percent of the population. The most economically disadvantaged of the recognized ethnic groups in Hawai‘i are generally considered to be those of Native Hawaiian ancestry, having the lowest average family income and showing disproportionately high incidences of adverse health conditions, incarceration rates, and chemical dependencies (U.S. Department of Health and Human Services, Office of Minority Health).

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety

Risks (April 21, 1997), recognizes a growing body of scientific knowledge demonstrating that children may suffer disproportionately from environmental health risks and safety risks. The Executive Order directed each Federal agency to identify and assess environmental health and safety risks that may disproportionately affect children and ensure that each agency's policies, programs, activities, and standards address any of these risks.

The nearest residential area to the proposed work is the Waikiʻi Ranch; residents of this community are generally in higher income brackets with residential lot prices in excess of $300,000 and home prices as high as $3 million. More distant communities include Waimea and Waikoloa, both communities that are marketed to higher income individuals.

The nearest community with a significant disadvantaged population is Hilo, the county seat, and home of more than 40,000 of the Big Island's residents.

4.17.2 Environmental Consequences for Environmental Justice and Protection of Children

The ROI for the effects of the proposed drilling on the Environmental Justice and Protection of Children may extend to the Hilo and Kona population centers on the island.

Proposed Action (Preferred Alternative): There are currently no communities near PTA that have significant populations of minorities or that could be adversely impacted by the proposed exploratory drilling activities. As noted above, the project will generate increased temporary employment opportunities for lesser skilled laborers and, hence, those opportunities would accrue to the benefit of the more vulnerable population of economically disadvantaged individuals on the island.

It is also noted that one of the larger land owners, and one of the Stakeholders considered in this project, in the Saddle Region is the Hawaiʻi State Department of Hawaiian Homelands. Prior discussions with DHHL officials have indicated strong interest in the results of the test drilling and its implications for their being able to provide a reliable water supply to their future lessees that they place on agricultural lands in the eastern section of the Saddle area. Hence, there is potential for benefits to accrue to that, commonly disadvantaged, population from the outcome of the present project.

The No Action Alternative: Under the no action environmental justice will remain as existing conditions.

Mitigation: Mitigation is not required.

Chapter 5:
Cumulative Impacts

Current and proposed projects within the vicinity of PTA Base Camp that could possibly contribute to cumulative impacts are identified in this section.

5.1 Saddle Road Realignment – Island of Hawai‘i

This long-term project is upgrading and realigning sections of the Saddle Road between Hilo and Kona on the island of Hawai‘i and will allow this corridor to better meet the American Association of State Highway and Transportation Officials (AASHTO) Standards. Work is complete as of the present date on portions of the road between mile marker 10 and the Māmalahoa Highway intersection west of PTA. Future work on the road, recently re-named the Daniel K. Inouye Highway, is intended to connect the eastern end of the improved highway to the Puainako Extension in Hilo and a follow-on effort is planned to continue the western terminus from the Māmalahoa Highway intersection to the Queen Kaahumanu Highway on the western shoreline of the island. Funding for those segments has not yet been identified and further work on the highway is unlikely to be underway before the proposed drilling project is complete. An Environmental Impact Statement (EIS) was prepared for the construction and operation of the Saddle Road realignment project, which included evaluation of environmental consequences. A Final EIS was completed in 1999 and a Supplemental EIS was completed in 2010.

5.2 Battle Area Complex

The Battle Area Complex will consist of a modern training range wherein both mounted tactical exercises as well dis-mounted live fire practice will be conducted. The complex will encompass ~1,100 m^2 of training structures and 840 ha of land area. The planned location for this facility is immediately adjacent to prospective drill Site B and well removed from the preferred Site A and alternate Site C.

5.3 Proposed Modernization of Pōhakuloa Training Area – USARPAC

The U.S. Army has proposed to modernize training ranges and training support infrastructure within PTA and to construct and operate an Infantry Platoon Battle Area (IPBA) at PTA. The USARPAC is proposing to upgrade PTA constructing new replacement facilities in the Cantonment area, upgrading access roads, and constructing integrated training facilities known as the Infantry Platoon Battle Area consisting of an Infantry Platoon Battle Course (IPBC), Live-fire Shoothouse, and Military Operations on Urban Terrain (MOUT) that would be built on land within the artillery impact area. Existing

Project	Location	Sponsor	Project Description	Projected Completion Date
Saddle Road Realignment	Across island of Hawai‘i, near PTA	Federal Highways Administration & State of Hawai‘i	Improving and modifying (realignment of) Saddle Road from Hilo to Kona.	2010−2015 (Phased in over many years)
Battle Area Complex	PTA	U.S. Army	Proposal to construct the Battle Area Complex at existing Range 12 for company gunnery training and qualification requirements of selected weapons systems and to support mounted and dismounted infantry platoon tactical live-fire operations.	2013
Infantry Platoon Battle Area and PTA Modernization	PTA	USAG-HI and U.S. Army Pacific	Construct and use an infantry platoon battle course and a military operations-in-urban terrain and shoot house, and modernize range and cantonment facilities.	2014−2022
U.S. Marine Corps MV-22 and Cobra Attack Squadron Training at PTA	PTA	U.S. Marine Corps	Conduct periodic U.S. Marine Corps training requirements.	Ongoing from 2013
Range Maintenance Facility	PTA	U.S. Army	Proposed construction of a 15,145-ft2 (1,407-m2) consolidated range maintenance complex on a previously developed site in a PTA cantonment.	2015
25th CAB Landing Zones	PTA	U.S. Army and Army National Guard	Proposed construction of four helicopter landing zones on southern perimeter of PTA	2015

Table 5-1. Summary of Projects that May Occur Concurrently With the Proposed Project (or that can be reasonably expected to occur immediately after the proposed project)

facilities no longer meet military standards and are unable to support efficient and effective training. Upgrades could include replacement of the helicopter aprons and hangar, control tower, troop billets, tactical equipment maintenance shop, military police station, fire station, and facility and range maintenance shops.

5.4 U.S. Marine Corps MV-22 and Cobra Attack Squadron Training at PTA

The U.S. Marine Corps has proposed stationing the MV-22 and Cobra Attack Squadron at Kāneʻohe Marine Corps Air Station on Oahu. A component of that proposal is to conduct a portion of the training

for these aircraft at Pōhakuloa Training Area. The proposed action will increase flight operations at and around the Bradshaw Army Airfield and over PTA lands in the Saddle region. Physical changes to PTA in support of this proposal are restricted to an expansion and reinforcement of an estimated 12,500 m^2 helicopter aprons at the BAAF.

5.5 Range Maintenance Facility

The Army would construct a consolidated Range Maintenance Facility at PTA on a previously developed site within the Cantonment Area. The project will encompass ~1400 m^2 of floor area and will include administrative space for range maintenance, a carpentry shop, a welding shop, target and raw material storage, and parking for personally operated vehicles and other vehicles and equipment. Presently, all of these services exist at PTA but are in scattered, obsolete, and inadequate facilities resulting in inefficient operations and maintenance. Supporting facilities include potable water system, septic system, electric service and 150-kVA, three-phase transformer, paving, walks, parking, security fencing, information systems, and site improvements. Existing structures would be demolished and replaced by the proposed facility.

5.6 Construction of Additional Landing Zones for Helicopter Training

The Army plans to construct four additional landing zones (LZ) for the 25th Combat Aviation Brigade and Army National Guard along the southern boundary of the PTA lands in the Saddle; the LZs will be linked by newly constructed vehicle trails that will also connect to the existing Pioneer Trail and the former Hilo-Kona Road, an unimproved cinder road that parallels the Saddle Road south of the PTA lands. The LZs would be leveled by bulldozer and would encompass areas of 35 m x 35 m for two landing zones and one LZ each encompassing areas of 90 m x 90 m and 160 m x 160 m.

5.7 Analysis of Cumulative Impacts

In our consideration of cumulative impacts, we will consider only those impact areas that have some adverse impact from the proposed project. These include: Noise, Anthropogenic Light, Air Quality, Solid and Hazardous Waste, and Transportation which all have less than significant impacts; the other impact areas were considered to incur either no impact or a positive impact.

5.7.1 Noise Impacts

Due to the relatively high traffic use of the Saddle road, the noise impacts were expected to be noticeable only during night time hours and only to those within close proximity to the prospective

drilling sites. The planned construction projects will occur during normal working hours and will not contribute to any nighttime noise generated by the proposed drilling. Two of the sites are located in areas well removed from the Saddle Road and there should be no cumulative impacts from the two noise sources; the third site, Site A, is located near the road but more than 1 km away from any possible human receptors that would be impacted by cumulative noise from traffic and drilling.

The Battle Area Complex construction is now complete and hence, there can now be no cumulative impact from noise generated by that construction. The other projects listed are months to years from being implemented and are unlikely to be initiated before drilling activities are complete.

5.7.2 Anthropogenic Light

Light emission at all of the prospective drill sites will be well isolated from any new or ongoing construction projects in the above list; the only possible exception would be the construction of the Battle Area Complex that may be located within 1 km of the prospective Drill Site B. Construction of that site is complete and hence no cumulative impacts will occur in association with drilling. Prospective Drill Site A and C are well removed from any of the planned construction activities in the above table.

5.7.3 Air Quality Impacts

The air quality impacts from the drilling activities will be associated with the drilling and support equipment which are stationary emission sources. Activities associated with construction of the new PTA facilities will involve mobile emission sources that, for the most part, are at a substantial distance from the proposed drilling locations. Their combined emissions are unlikely to have a detectable combined impact on any downwind site for more than short periods, if at all. The relatively short duration of the respective activities will also limit the adverse effects of the combined actions.

5.7.4 Flora Impacts

The impacts on flora for the proposed project will be confined to those associated with site clearing for installation of a drilling work area; all the other activities that may occur contemporaneously with our proposed project are in locations well removed from our site and the likelihood that our clearing will have a cumulative effect with the other projects is remote.

5.7.5 Fauna Impacts

The impacts on fauna are associated with the potential effects of nighttime lighting on bird or bat flight paths. As noted above, daytime construction activities will not have a cumulative effect on the nighttime light emissions generated by the proposed drilling. In the unlikely event that night time training operations occur within the new facilities proximal to the proposed drilling sites, the drilling operations will be suspended for safety reasons.

5.7.6 Solid Hazardous or Medical Wastes

Any solid wastes generated by the proposed drilling activities will be managed by qualified contractors separate from those contracted by the Army Garrison, Pōhakuloa, or by the contractors conducting the construction activities listed above. The combined solid wastes are not expected to exceed the waste management capacity available on the island. We do not anticipate generating any hazardous or medical waste during the drilling program.

5.7.7 Transportation Impacts

Impacts on transportation arising from the proposed drilling will be for work crews commuting to and from PTA for their respective drilling shifts and for project scientists and managers to make periodic visits to the site to review the core and drilling progress. The crew shift change will be at 07:00 and at 19:00 each day and will avoid the peak use times typically used by most of the cross-island traffic. Hence, the contribution of the drilling staff to the peak traffic loads experienced by the Saddle Road will be the exception rather than a typical occurrence.

5.8 Follow-on or secondary impacts

The completion of an additional test bore in the Saddle region near PTA could potentially document the extent of recoverable quantities of water beneath this region. The follow-on impacts of that new information could lead to development of production wells to supply potable drinking water to PTA or to, for example, Mauna Kea State Park. While that outcome could lead to higher levels of use of PTA and Mauna Kea State Park, analysis of impacts associated with those activities would be entirely dependent on speculative findings that we have no way to constrain using data or other investigations that are currently available to us.

Chapter 6:
Determination of Significance and Findings

6.1 Criteria

"Significant effect" is defined in HRS 343 as: "the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the States environmental policies or long-term environmental goals as established by law, or adversely affect the economic welfare, social welfare, or cultural practices of the community and State. Based on this definition, the anticipated determination for the proposed project is a Finding of No Significant Impact (FONSI). A discussion of this finding and reasons supporting it is provided below; a summary of these findings are presented in Table 6-1.

6.1.1 Involves an irrevocable commitment to loss or destruction of any natural or cultural resource

The proposed project will not result in a loss of natural or cultural resources because the majority of the planned project area has been previously graded or developed. No threatened or endangered plant species are located within the ROI of the prospective project sites. The proposed activity is not expected to have a detectable impact on the population of native and alien birds on the island of Hawai‘i. No threatened or endangered avifaunal or mammal species were identified at the prospective drilling locations.

No archaeological sites were recorded and none are believed to exist within the ROI of the prospective drill sites. No further archaeological work is recommended in the project area but, if cultural features are encountered during the site preparation and drilling activities, cultural resource personnel will be notified and drilling activities will be suspended until the University has consulted with DLNR State Historic Preservation Division, the Office of Hawaiian Affairs, and others having an interest in the disposition of cultural finds.

6.1.2 Curtails the range of beneficial uses of the environment

The majority of the project area has been previously graded or developed or been used for agricultural activities; therefore, the proposed activity does not curtail beneficial uses of the environment. The only lasting impact to a site will be the installation of a small concrete slab and well head that can be used to monitor groundwater resources. When or if this activity is no longer needed, the bore can be plugged, as mandated by DLNR, and the site restored.

Impacts	Site A Keʻāmuku	Site B Armor Road	Site C Landfill	No Action
Involves an irrevocable commitment to loss or destruction of any natural or cultural resource	⊙	⊙	⊙	⊙
Curtails the range of beneficial uses of the environment	⊙	⊙	⊙	⊙
Conflicts with the States long-term environmental policies or goals and guidelines	⊙	⊙	⊙	⊙
Substantially affects the economic and social welfare of the community or State	⊙	⊙	⊙	⊙
Substantially affects public health	⊙	⊙	⊙	⊙
Involves substantial secondary impact, such as population changes or effects on public facilities	⊙	⊙	⊙	⊙
Involves a substantial degradation of environmental quality	◎	◎	◎	⊙
Is individually limited but cumulatively has considerable effect upon the environment	◎	◎	◎	⊙
Substantially affects a rare, threatened, or endangered species	◎	◎	◎	⊙
Detrimentally affects air or water quality or ambient noise levels	◎	◎	◎	⊙
Affects, or is likely to suffer damage, by being located in an environmentally sensitive area	◎	◎	◎	⊙
Substantially affects scenic vistas and view planes identified in County or State plans or studies	◎	◎	◎	⊙
Requires substantial energy consumption	◎	◎	◎	⊙

Table 6-1. Summary of Potential Impacts and Level of Significance

◎ = less than significant impact ⊙ = no impact

6.1.3 Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 343, Hawai'i Revised Statutes (HRS), and any revisions thereof and amendments thereto; court decisions; or executive orders

The proposed action is in accordance with guidelines and regulations established in Chapter 343, HRS; the National Environmental Policy Act (NEPA); Council on Environmental Quality (CEQ).

6.1.4 Adversely affects the economic and social welfare of the community or State

The proposed activities would not adversely affect social or economic conditions of the surrounding area. If new water resources are identified, they could potentially have positive economic impacts on the island but that, and other long-range impacts of this borehole, is speculative without the data sought by the present project.

6.1.5 Substantially affects public health

Factors related to public health, including air, noise, and water quality, are expected to be temporary and minimally affected or unaffected by the drilling activities. Department of Health and County of Hawai'i regulations will be followed to mitigate any potential public health impacts.

6.1.6 Involves substantial secondary impact, such as population changes or effects on public facilities

The proposed project will not in itself generate new population growth. The proposed activities will generate new information that, in and of itself, will not have a broad impact on the island. Public facilities will not be adversely affected by the planned activities.

6.1.7 Involves a substantial degradation of environmental quality

The proposed impacts of the planned drilling on air and water quality, noise levels, natural resources, and land use associated with these activities are anticipated to be minimal. Mitigation measures will be employed as practicable to further minimize potentially detrimental effects to the environment associated with the proposed activities.

6.1.8 Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions

The proposed activities were not found to significantly impact, or interact with, other proposed and ongoing activities within the Saddle region in a way that would result in significant cumulative

impacts. Follow-on impacts that may result from future decisions that may be made based on the results of the present action are so speculative that no credible analysis can be made of those impacts.

6.1.9 Substantially affects a rare, threatened, or endangered species

No rare, threatened, or endangered species are known to exist in the immediate vicinity of the prospective drilling sites.

6.1.10 Detrimentally affects air or water quality or ambient noise levels

During drilling there will be a slight impact on the groundwater in the immediate vicinity of the wellbores being drilled due to loss of drilling fluids into the formation. These impacts will be minimized through the use of specific drilling technology that will minimize the volume of materials deposited in the formation and those materials used will be selected to be non-toxic and non-threatening to the long term water quality around the test wells. Air quality will temporarily decrease during drilling and on-site activities but this impact will be minimized and temporary. Ambient noise levels will increase during drilling but measures are available to ensure that these impacts are minimal and they will be temporary.

6.1.11 Affects, or is likely to suffer damage, by being located in an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water or coastal waters

The proposed activity will not affect, nor is it located in, any environmentally sensitive areas such as those listed; the volcanic hazards and earthquake hazards for this area of Hawaii Island is substantially lower than that for the southern half of the island and is not expected to experience significant seismic shaking or lava flow inundation in the foreseeable future.

6.1.12 Substantially affects scenic vistas and view planes identified in County or State plans or studies

The proposed project will not substantially alter view planes within the PTA lands and what effects do occur will be temporary in nature.

6.1.13 Requires substantial energy consumption

Drilling activities are not expected to require a substantial amount of electrical energy.

6.2 Findings

Based on the analysis of environmental consequences of the proposed action in Sections 6.1.1 through 6.1.13 above, the absence of significant impacts, and the absence of adverse comments on the project from agencies or individuals, the University of Hawaii anticipates making a Finding of No Significant Impact for the proposed project. The University of Hawai‘i will implement the proposed action for the following reasons:

1) In order to define the characteristics of the groundwater resources within the Humu‘ula Saddle region, the proposed test bore will determine a range of critical parameters for those resources that may currently underlie the Saddle region including: depth to the water; formation characteristics; quality of the water; and estimates of the rates of recharge to the aquifers identified; extent of the dike complex responsible for impounding water within the Saddle. With that information, the Stakeholders in the Saddle region will be able to make a reasoned analysis of the resources available, their suitability for use, and make informed estimates of the likely impacts of development of those water resources.
2) There would not be any significant adverse impacts from the proposed drilling activities. All anticipated impacts will be mitigated.
3) The no-action alternative does not meet the purpose and need of the Saddle Stakeholders and will likely result in greater, long-term, cumulative impacts on the environment than are necessary.
4) If the project is not undertaken, the Stakeholders will be deprived of critical information with which to manage the resources under their care.

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10.0 Comment Communications Received on the Draft Environmental Assessment and Anticipated Finding of No Significant Impact

10.1 Agencies

10.1 Individuals

APPENDIX A

Natural and Cultural Resource Evaluations

POHAKULOA DEEP WELL TEST CANDIDATE SITES DESCRIPTIONS and NATURAL/CULTURAL RESOURCES EVALUATIONS

Scott Henderson, Kuapa Services
May 2010

GENERAL BACKGROUND

The Deep Well Test project will drill a 2.5- to 7-inch diameter hole 5,000 to 10,000 feet deep at a site near or at the Pohakuloa Training Area (PTA) base camp. Primary objective of the effort will to explore a potential groundwater source identified previously by geophysical (resistivity) measurements. The most prominent anomaly, indicative of a possible water presence, is centered southeast of the PTA base camp near coordinates N 19 44 24.8 W 155 31 49.5.

The Deep Well Test bore will take about six months to drill. The project will require an area of about one acre to accommodate drilling equipment and supplies. The drill rig will be about 60 feet tall and will be situated over a well-head concrete slab measuring about 10 feet by 10 feet. Drilling operations will typically run continuously (24 hours a day, seven days a week).

Drilling fluid compounds will be injected into the bore hole for purposes of lubrication, cooling and to carry cuttings away from the drill head. All of the compound products are expected to percolate into the permeable substrates. There will be no expected discharge of water, hydrocarbons, chemical substances or particulate debris at the drilling site.

DEEP WELL TEST CANDIDATE SITES SELECTION CRITERIA

Four sites were selected as candidates for the drilling operation (Figure 1). Primary criteria considered in initial selection of candidate sites were:

1. To be located within boundary of the Pohakuloa Training Area.
2. To be located less than 1.9 miles (3 km) from the prominent resistivity anomaly center.
3. To have minimal effect on human health and activities. To have road access for work and
4. personal vehicles. To have relatively level area of about one acre.
5. To have minimal to nil presence of significant natural and cultural resources.

The approximate center of the resistivity anomaly and relative positions of the candidate sites are shown in Figure 2.

CANDIDATE SITE DESCRIPTIONS

The four candidate sites were field-surveyed by Scott Henderson, Kuapa Services for a total of 5.5 hours on March 26 and May 12, 2010. One site was eliminated from further consideration due to the presence of undisturbed natural features that project principals were reluctant to impact. Perimeters of the remaining sites were delineated with GPS, and multiple transects with about 20-foot separation were walked across the sites to document presence and relative abundance of flora and fauna, and to search for possible occurrence of historical/cultural artifacts and features.

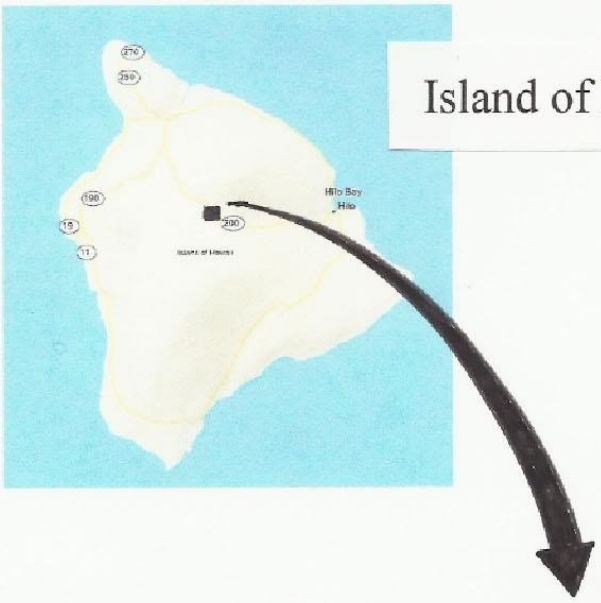
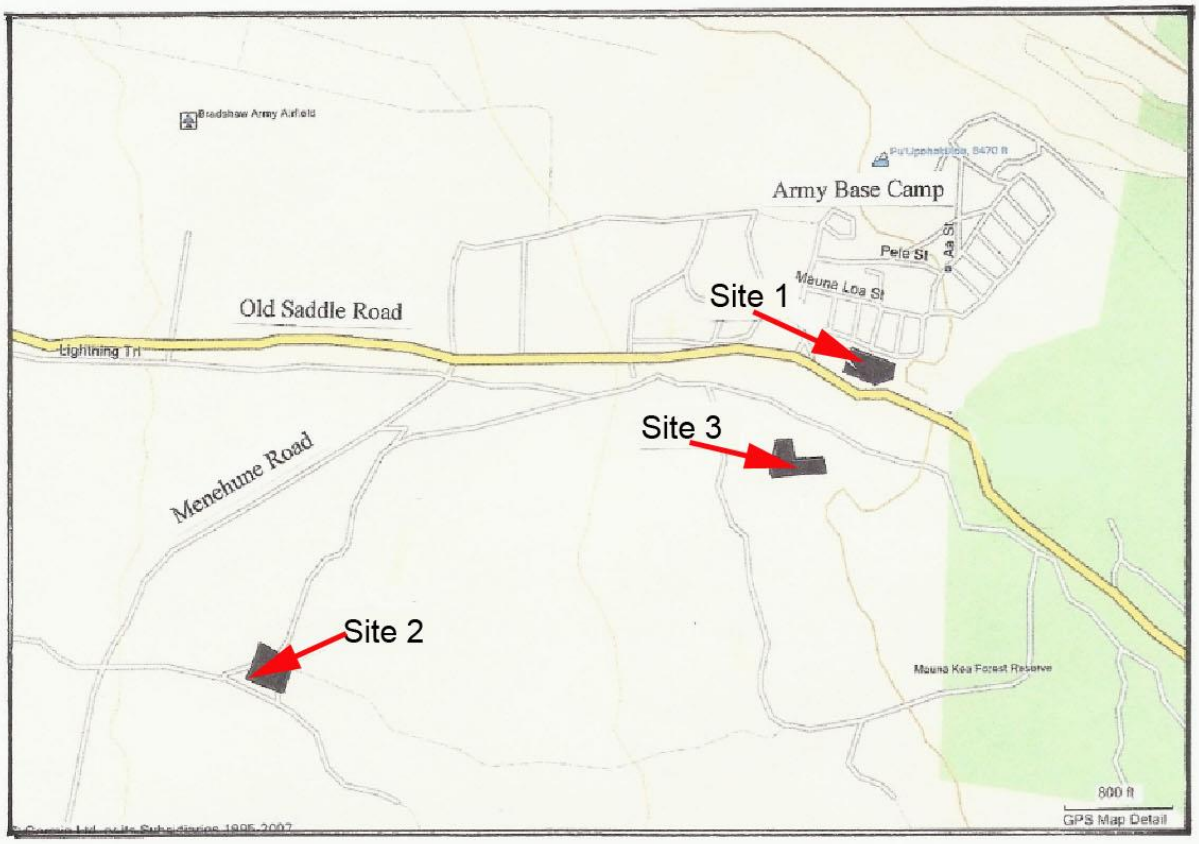


Figure 1. Three candidate sites for Pohakuloa Training Area Deep Test Well



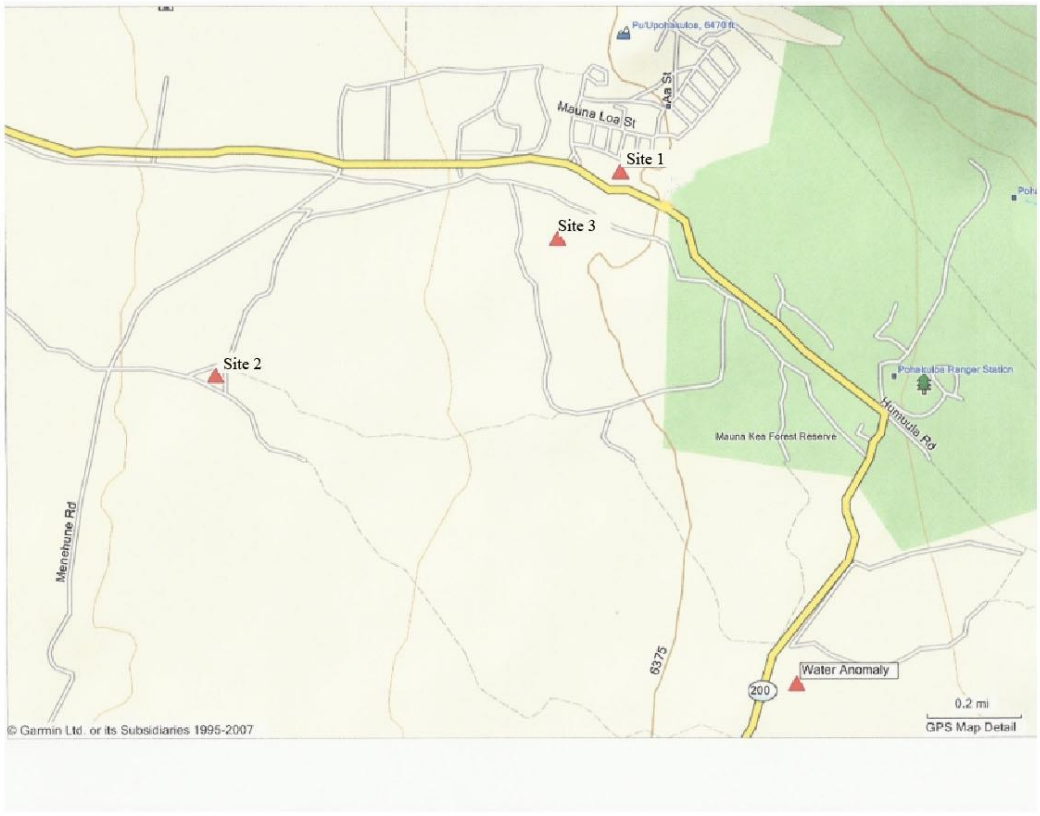


Figure 2. Locations of PTA Deep Well Test Hole candidate sites and center of resistivity anomaly (at lower right).

Site 1. The site is centered on coordinates N 19 45 19.4 & W 155 32 11.7 at elevation of 6,362 feet. This site (Figure 3) is located along the southern margin of the PTA base camp area. It occupies about 1.4 acres of a larger flat area that has been used for a least two decades as a parade ground and recreational field. The area consists of dusty Mauna Kea-type soil with patchy coverage of kikuyu grass (*Pennisetum clandestinum*). Clusters of geraniums (*Pelargonium* sp.) a few māmane and naio trees occur on higher relief near the east side of the site. Several pine trees (*Pinus* spp.) are found on west side of the parade field.

The southern edge of the site is bordered by the PTA base camp security fence. No grubbing or grading of this site would be necessary as it is flat and vehicular access is very good.

No apparent items or structures of historical/cultural significance were seen on or near Site 2.

Figure 3. **Candidate Site 1** at PTA Parade Ground, looking east.

Site 2. The site is centered on coordinates N 19 44 57.7 & W155 33 07.4 at elevation of 6145 feet. It is located about 4,200 feet from the PTA base camp area and 1,000 feet east of intersection of Menehune and Armor Roads. The 2.4 acre site surveyed (Figure 4) consists of relatively flat terrain with a few very shallow washes. Ground surface consists of fine, dusty Mauna Kea-type soil with scattered basaltic pebbles and cobbles. South margin of the site is bordered by Armor Road, and a narrow gravel road passes west-east through the northern sector. Debris from repeated cycles of tactical and bivouac training is scattered over much of the terrain. Telegraph weed, lovegrass and kikuyu grass are common. Uncommon plants include fountain grass and three weed species.

No heavy equipment or grading operations would be required at this site due to its flat relief.

There are no apparent items or structures of historical/cultural significance on or near Site 2. On a PTA ITAM map dated Sept 30, 2009, an historic ranch fence is shown extending into an area near the southeastern corner of Site 2. Inspection of the area, however, found no sign of the fence feature within 500 feet of the site.

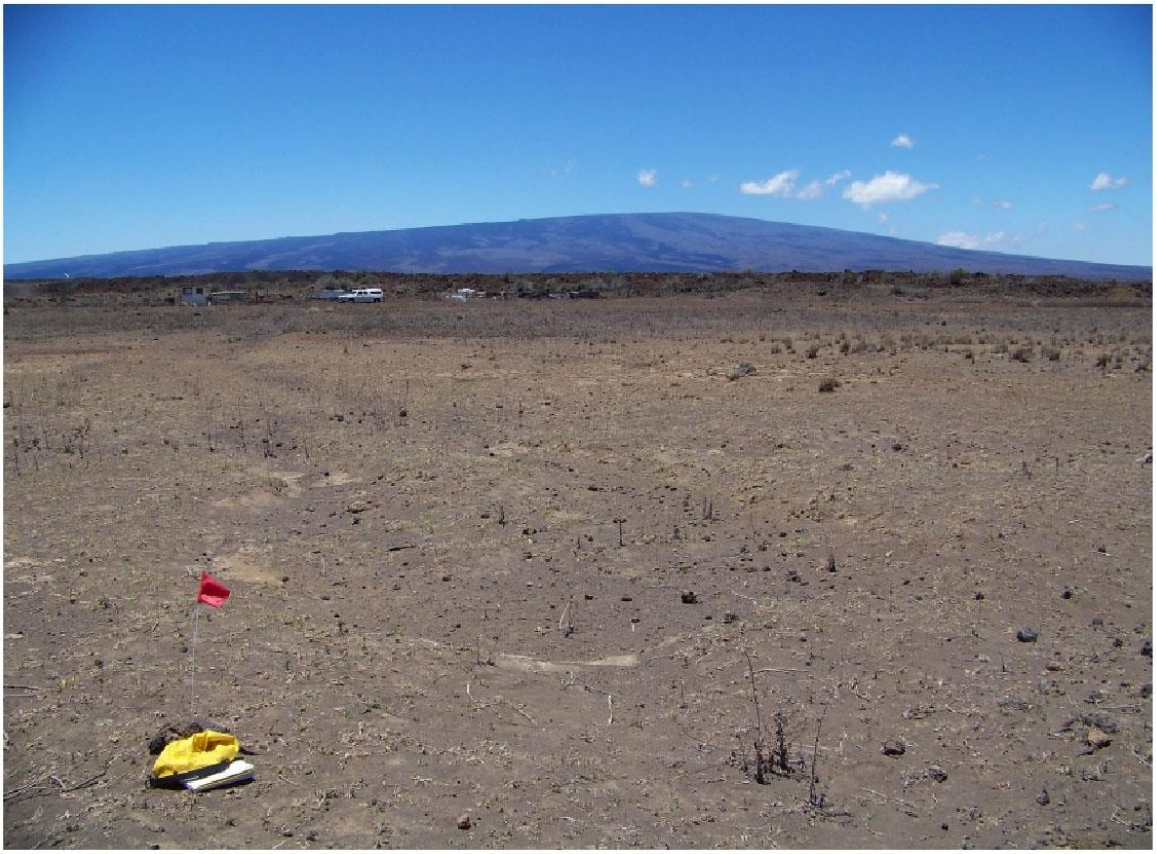


Figure 4. **Candidate Site 2** near Menehune and Armor Roads intersection, looking south.

Site 3. The site is centered on coordinates N 19 45 11.5 & W 155 32 21.6 at elevation of 6,330 feet. It is located about 600 feet south of the PTA base camp and is immediately north of an abandoned (capped) landfill. This 1.1 acre area (Figure 5) is an irregular-shaped parcel of heavily-disturbed land that had been bulldozed during operation and capping of the adjacent landfill. A gravel road used for access to the abandoned landfill passes through the western side of the site. About 12,000 square feet of the site would need to be prepared by heavy equipment to push larger rocks to the side and for leveling. This site preparation would only occur on previously disturbed substrates.

Common plants include telegraph weed and fountain grass. Kikuyu grass is present in low abundance. A few naio and māmane trees are found around the outer perimeter of the site. Several small herds of goats were seen nearby and the fountain grass is heavily grazed.

No apparent items or structures of historical/cultural significance were seen on or near Site 3.

Figure 5. **Candidate Site 3** near abandoned landfill, looking north toward PTA base camp.

PERSONAL CONSULTATIONS AND PAST SURVEY RESULTS

In a meeting with PTA Environmental Office staff on May 12, 2010, there were no significant concerns voiced regarding sensitive biological resources at the four candidate sites. The biological staff noted that there have been no reports of rare or listed species at or near any of the candidate sites. Lena Schnell (Natural Resource Manager) noted that there is slight possibility that bats could be attracted to lights at the operational drilling site at night. It was agreed that the project work crew should be able to identify bats and should have appropriate contact information to report downed bats.

Lena Schnell also noted that although nene geese and Hawaiian hawks have been seen flying over some areas of PTA, that those birds have not been seen in the immediate areas of the candidate sites. And, although shearwater birds have not been sighted on PTA proper, past studies have shown that those seabirds do use the saddle area between Mauna Kea and Mauna Loa as a flyway. Fixed lighting associated with the test well project will be shielded to direct lighting downward to minimize potential navigation/orientation effects on transient shearwaters.

Past studies of natural resources at PTA (Refs. 1 - 6) have revealed no sensitive or federally-listed plant or animal species occurring on or near the four candidate sites.

At the meeting with PTA Environmental Office staff on May 12, 2010, Dr. Julie Taomia (PTA Archaeologist) stated that there are no known sites of historical significance on any of the candidate sites. She noted that the most recent archaeological surveys in the area of Site 3 were accomplished by GANDA in 2003 and PTA archaeological staff in 2005.

Archaeological survey of the PTA cantonment area in 2001 (Ref. 7) found that no archaeological sites were recorded and none are believed to exist in the immediate vicinity of PTA base camp.

On April 16, 2010, Dr. Don Thomas (Center for Study of Active Volcanoes) gave a presentation on the proposed PTA Deep Well Test Hole project to the PTA Cultural Advisory Committee (CAC). Attendees were Lt. Col. Warline Richardson (PTA Commander), Dr. Julie Taomia, Leilani Hino (Maunalani Hotel Cultural Program) and Curtis Tyler. Dr. Frank Trusdell (Volcanologist, Hawaii Volcano Observatory & member of the CAC) had been previously briefed on the project by Dr. Thomas. Drs. Thomas and Taomia noted that there were no significant concerns expressed by CAC members regarding the effects or purpose of the proposed project.

ENVIRONMENTAL EFFECTS

Nearly all of the areas surveyed at the candidate sites have been previously heavily disturbed by human activity. And, there is no known past or present occurrence of sensitive or listed biota, or historic properties. Thus, it is expected that the project will have no significant effect on natural or cultural/historic resources.

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1. Shaw, Robert B. 1997. *Rare Plants of Pohakuloa Training Area, Hawaii*. Center for Ecological Management of Military lands. Fort Collins, Colorado.
2. Hawaii Natural Heritage Program. 1998. *Arthropod Survey at Pohakuloa Training Area, Island of Hawaii*. Contract DAHC77-960C-004. Prepared by The Nature Conservancy of Hawaii, Honolulu in cooperation with Peter Oboyski, Entomological Consultant, for US Army Garrison, Hawaii.
3. Hawaii Natural Heritage Program. 2002. *Database of Rare and Endangered Plants, Animals, and Natural Communities of the Island of Hawaii and Island of Oahu.* Unpublished.
4. US Army Hawaii and 25th Infantry Division (Light). 2001. *Integrated Natural Resources Management Plan and Environmental Assessment/Finding of No Significant impact 2002-2006 Pohakuloa Training Area.* August 2001.
5. US Fish and Wildlife Service, Pacific Islands Ecoregion Office. 2002. *Notice of Proposed Critical Habitat for Plant Species from the Island of Hawaii.* June 2002.
6. US Army Hawaii and 25th Infantry Division (Light) 2004. *Final Environmental Impact Statement for Transformation of US Army Hawaii.* April 2004.
7. US Army Hawaii and 25th Infantry Division (Light) 2003. *Final Environmental Assessment for Pohakuloa Training Area 2010 Master Plan for Base Camp Facilities.* December 2003.

Evaluation of Resources
Site A
Natural Resources Office
Pohakuloa Training Area

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IMHW-PTA-PWE 20 November 2013

MEMORANDUM FOR RECORD

SUBJECT: Effects to Biological Resources from Exploratory Well Hole No.2, Keamuku Maneuver Area, Island of Hawaii

1.0 INTRODUCTION

The Pohakuloa Training Area Natural Resources Office (PTA NRO) assessed direct and indirect effects to biological resources protected under the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA) to support the proposed drilling of Exploratory Well Hole No.2, located on Army-owned land of the Keamuku Maneuver Area (KMA). Direct effects evaluated include mortality of federally-listed plants and ground-nesting avifauna, noise, and anthropogenic source light. Indirect effects considered include the spread of invasive plants and invasive invertebrates, habitat disturbance for wildlife, wildland fire, and generation of fugitive dust. To aid in the assessment of these effects, the PTA NRO conducted 3 types of biological surveys:

1) Botanical;
2) Ground-Nesting Avifauna;
3) Invasive Ants.

These biological surveys were conducted on 17 October 2013 to document native and non-native plants, determine the presence of ground-nesting avifauna, and establish a baseline for the presence or absence of invasive ants in the action area. This memorandum presents technical findings for each survey and provides an overall assessment of potential effects to biological resources as a result of the proposed action.

The action area as defined in the US Fish and Wildlife Service (US FWS) Section 7(c) Consultation Handbook should consider all direct and indirect effects of the proposed agency action (US FWS and NMFS 1998). The proposed project will disturb a maximum of 2.7 ac (1.1 ha), including impacts from the well drilling operations. The drilling operations are estimated to last approximately 6 months. Due to the small footprint of the action, the project's short duration, and based on conservation measures implemented by the Army, potential direct and indirect effects to biological

resources are not expected to exceed the 2.7-ac project footprint. Therefore, for the purpose of this assessment the action area is defined as the 2.7-ac Exploratory Well Hole No.2 footprint. According to the Consultation Handbook, the action description should include all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by a Federal agency (US FWS and NMFS 1998). For the purpose of this assessment, the proposed action includes all activities associated with drilling Exploratory Well Hole No.2 at PTA.

2.0 PROJECT DESCRIPTION

The sampling and monitoring results from Exploratory Well Hole No.1, located on the PTA Cantonment Parade Ground (drilled 2013) to explore a potential groundwater source, indicate that a second exploratory well is necessary in order to adequately describe the ground water resources extent and aquifer attributes (RCUH 2011). Refer to the *Environmental Assessment, Sustainable Water for the Humuula Saddle Region of Hawaii Island: A Detailed Hydrologic Evaluation and Exploratory Drilling Program* for details regarding the purpose and need for the project and a description of well construction and operations (RCUH 2011).

According to the Environmental Assessment (RCUH 2011), drilling the second exploratory well (Hole No.2) will involve:

- Drilling a borehole to a depth near sea level from the elevation of the drilling site;
- Collecting samples of all stratigraphic formations that influence the transport or sequestering of groundwater within the saddle region around the PTA lands;
- Collecting and analyzing groundwater samples from all important aquifers within the stratigraphic section for chemical and isotopic compositions;
- Installing instrumentation to monitor water levels and temperatures to document the effects of changes in seasonal or synoptic rainfall on the subsurface aquifers.

Drilling operations at Hole No.2 will be 24 hours per day, 7 days per week for approximately 6 consecutive months. Drilling is expected to begin in the January-March 2014 timeframe. The disturbed footprint for Hole No. 2 drilling operations will be a maximum of 2.7 ac. Final delineation of the disturbed area will depend on site preparation needs, but will in no case extend beyond the designated area.

The drilling operations for Hole No.2 will be identical to the operations for Hole No.1, except that water will be delivered to the Hole No.2 site daily via 5000-gal water tanker. Similar to drilling Hole No.1, drilling for Hole No.2 will be via a truck-mounted drill rig. A concrete pad approximately 15 x 30 ft (5 x 9 m) will be constructed on prepared sub-

grade to provide a stable platform for the drill rig. Moderate grading, leveling, and compaction will be required on up to 2.7 ac surrounding the drill site to accommodate delivery vehicles, ocean freight containers to be used as storage, and various drilling equipment.

Subsurface work for site preparation will extend to no greater than 3 ft (1 m) below grade. Other than site preparation, subsurface disturbance will consist solely of the bore hole. The bore hole will have a 7-12 in (18-30 cm) diameter to a depth of approximately 20 to 50 ft (6 to 15 m). Beyond the first casing, the bore hole will have a ~3 in (~8 cm) diameter down to 3000 ft (915 m) below grade. From 3000 to 6500 ft (915 to 1980 m) below grade, the bore hole will have a diameter of ~2 in (~5 cm). Maximum depth of Hole No.2 will be approximately 6500 ft (1980 m) below grade.

White lights will be used at night due to life/health/safety issues for drilling operations. Lights will be oriented downward and shielded to the extent that life/health/safety are not compromised.

3.0 PROJECT LOCATION

3.1 POHAKULOA TRAINING AREA

PTA is located in the saddle region of Hawaii Island between Mauna Kea, Mauna Loa, and Hualalai volcanoes. At 132,800 ac (53,750 ha), it is the largest single US Army holding in the State of Hawaii. The United States first used this area in 1942 for military maneuvers during World War II and PTA was formally established as an Army installation in 1956. The installation is bordered on the north by Mauna Kea State Park, Mauna Kea Forest Reserve, and Parker Ranch, to the east and south by Hawaii State lands, and to the west by Kamehameha School lands and State lands. PTA comprises 3 main areas: Cantonment, Bradshaw Army Airfield, and training areas including the KMA and an Impact Area.

PTA is classified as subalpine, tropical, dryland forest, one of the rarest ecosystems in the world. The installation contains 20 federally-listed threatened and endangered plant and animal species. Average annual rainfall at Bradshaw Army Airfield is approximately 15 in (37 cm) (Shaw and Castillo 1997). Typically, most precipitation falls during the winter months (November - February) in conjunction with Kona storms. During other months, there can be prolonged periods of little or no rainfall. The average annual temperature is 55° F (12.8° C) with little monthly fluctuation (Shaw and Castillo 1997). The growing season at PTA is essentially year-round.

PTA varies in elevation from approximately 2400 to 8700 ft (730 to 2650 m). The installation has 10 soil types reflecting the volcanic geology of the area. Approximately

80% of the installation is covered by young volcanic substrates with the greatest soil development in the northern portion of the installation (Shaw and Castillo 1997). Soils are typically thin and poorly developed, which is characteristic of extremely young volcanic substrate. There are no surface streams, lakes, or other bodies of water at PTA due to low rainfall, porous soils, and lava substrates. Sparse rainfall, fog drip, and occasional frost are the main sources of moisture that sustain plants and animals in the dryland habitat of Pohakuloa.

3.2 EXPLORATORY WELL

The proposed site for the exploratory well (Hole No.2) encompasses 2.7 ac on Army fee-simple land in the Keamuku Maneuver Area (Figure 1). The site is along Keekee Road approximately 500 ft (150 m) north of the new Saddle Road (D.K. Inouye Highway).

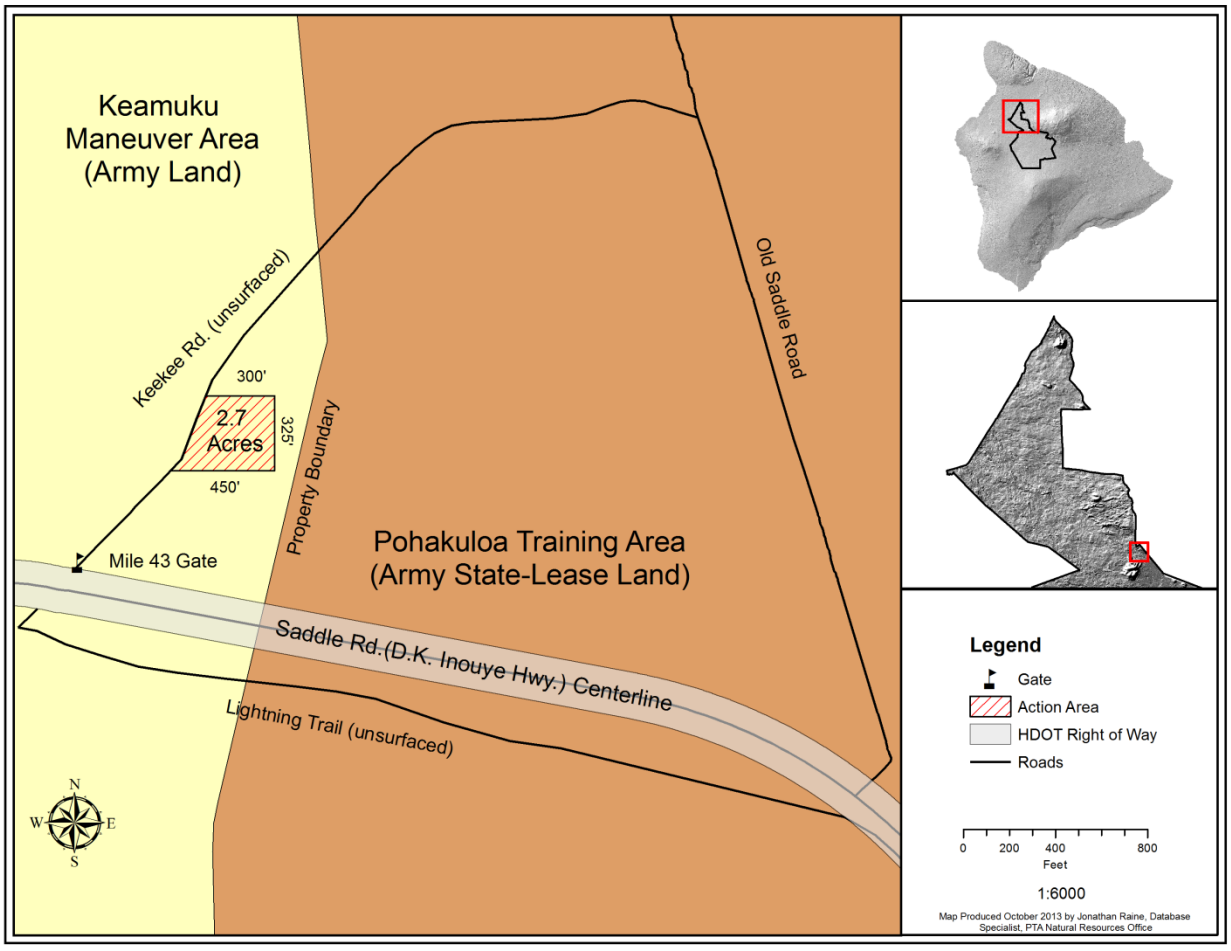

Figure 1. Location of the Exploratory Well

The gate for access to this site is located outside the Hawaii Department of Transportation (HDOT) right-of-way for the new Saddle Road alignment. The HDOT right-of-way extends 100 ft (30 m) on either side of the roadway centerline. This gate is located 110 ft (34 m) off the roadway centerline (north side). Therefore, this gate is Army owned and controlled, and is not part of the HDOT maintenance requirement. The gate is located at about the 42.5 mile post, but since there is no other gate within several miles of this gate, this gate is given the nominal designation of "Mile 43 Gate".

4.0 EFFECTS TO BIOLOGICAL RESOURCES

Direct effects are those caused by the action that occur at the same time and place that the action occurs. An example of this is a person stepping on an endangered plant or disturbing an endangered animal while roosting. Indirect effects are caused by the action but occur later in time and are not immediately visible. An example of this is the spread of invasive weeds that could impact listed species through increased competition, or persistent human presence that may eventually cause an endangered animal to roost and feed elsewhere.

4.1 DIRECT EFFECTS

4.1.1 Mortality of Federally-Listed Plants and Ground-Nesting Avifauna

Federally-Listed Plants

Potential direct impacts to federally-listed plants from Exploratory Well Hole No.2 include mortality during site preparation, and trampling from foot traffic and/or vehicle traffic during drilling operations. These potential impacts were evaluated based on the presence of plants within the action area that are listed as threatened or endangered under the ESA.

The PTA NRO conducted botanical surveys on 17 October 2013 to determine the presence of federally-listed plant species and to assess overall vegetation in the vicinity of the exploratory well. The botanical survey team consisted of Kip Cline, BSc, Heraldo Farrington, BSc, Rob Yagi, BSc, and Paul Martin. Transects ranged from 300 - 446 ft (91 - 136 m) in length and were spaced 33 ft (10 m) apart (Figure 2). This spacing is standard and has been determined to yield the optimum balance between coverage and rare plant detection probability. A total of 11 transects were surveyed, covering the entire action area of 2.7 ac. Weather conditions were favorable and visibility was good for conducting the surveys. All locations of federally-listed threatened and endangered plant species and/or species of concern were required to

be recorded. Lists of common native and introduced plant species were also recorded on 3 transects (Figure 2).

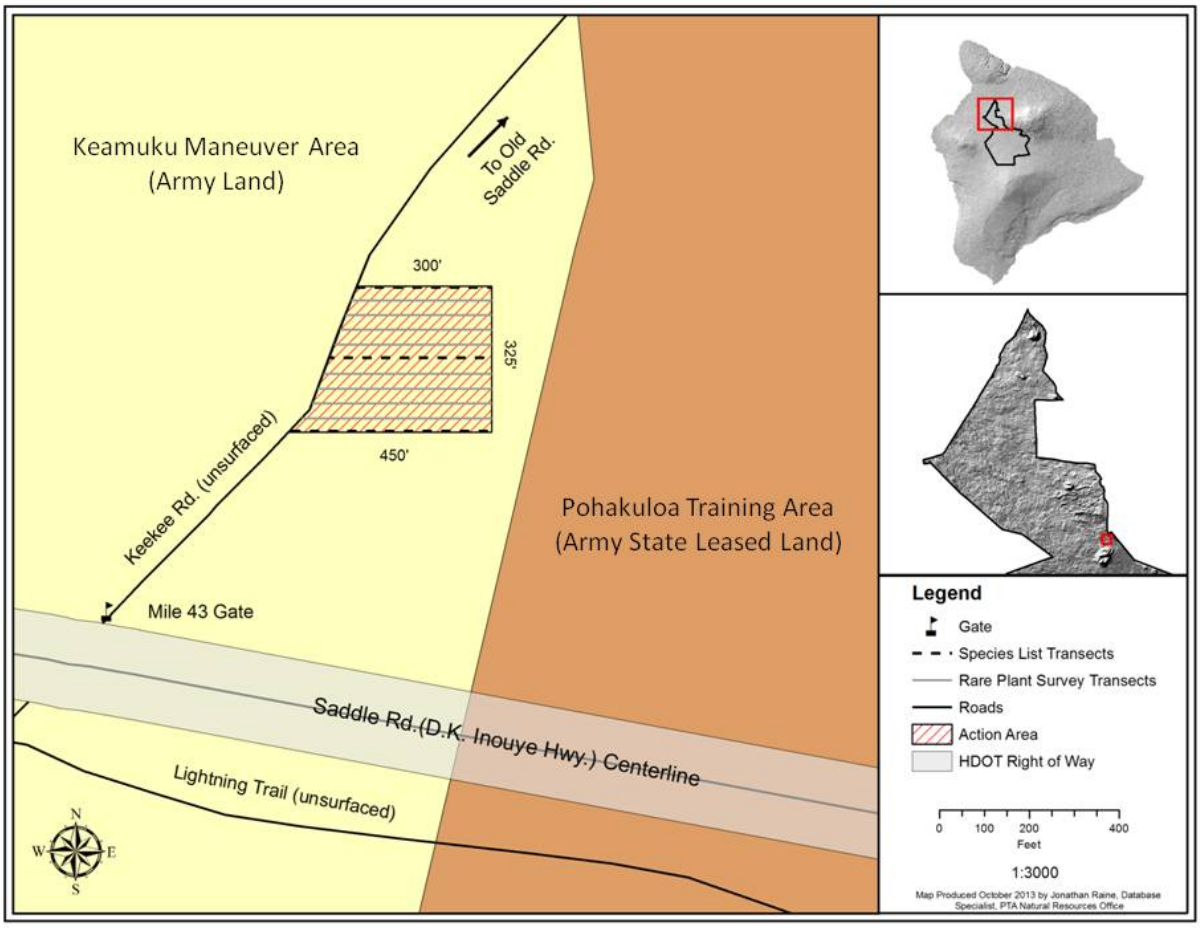

Figure 2. Botanical Survey Area

No federally-listed plant species were found within the action area. Therefore, drilling operations for Exploratory Well Hole No.2 will have no impact to federally-listed plant species. It was further determined that the action will result in minimal impact to common native vegetation.

Common native and non-native plant species present within the action area are listed in Table 1.

Table 1. Botanical Survey Results

Scientific Name	Common Name	Origin	Federal Status	PTA NRO Target Weed
Anagallis arvensis	Scarlet pimpernel	Non-native	None	No
Avena fatua	Wild oats	Non-native	None	No
Bidens pilosa	Spanish needle	Non-native	None	No
Brassica nigra	Black mustard	Non-native	None	No
Bromus diandrus	Ripgut grass	Non-native	None	No
Carex wahuensis	Not known	Native	None	No
Cenchrus setaceus	Fountain grass	Non-native	None	No
Centaurea melitensis	Yellow star thistle	Non-native	None	Yes
Chamaesyce olowaluana	Akoko	Native	None	No
Chenopodium oahuense	Aweoweo	Native	None	No
Dactylis glomerata	Cocksfoot	Non-native	None	No
Dodonaea viscosa	Aalii	Native	None	No
Eragrostis atropioides	Hardstem lovegrass	Native	None	No
Erodium cicutarium	Red stem filaree	Non-native	None	No
Galinsoga parviflora	Gallant soldier	Non-native	None	No
Heterotheca grandiflora	Telegraph weed	Non-native	None	No
Lepidium africanum	African pepperwort	Non-native	None	No
Malva parviflora	Cheeseweed	Non-native	None	No
Medicago lupulina	Black medic	Non-native	None	No
Melilotus alba	White sweet clover	Non-native	None	No
Melilotus indica	Sweet clover	Non-native	None	No
Melinis repens	Natal redtop	Non-native	None	No
Osteomeles anthyllidifolia	Ulei	Native	None	No
Pellaea ternifolia	Kalamoho	Native	None	No
Petrorhagia velutina	Childing pink	Non-native	None	No
Salsola tragus	Russian thistle	Non-native	None	Yes
Senecio madagascariensis	Fireweed	Non-native	None	No
Silene gallica	Small-flowered catchfly	Non-native	None	No
Sisymbrium irio	London rocket	Non-native	None	No
Solanum americanum	Glossy nightshade	Native	None	No
Sonchus oleraceus	Common sowthistle	Non-native	None	No
Tagetes minuta	Stinkweed	Non-native	None	No
Verbascum thapsus	Woolly mullein	Non-native	None	No
Verbesina encelioides	Golden crown-beard	Non-native	None	No
Vicia villosa	Hairy vetch	Non-native	None	No

Ground-Nesting Avifauna

Potential direct impacts to ground-nesting avifauna (birds) from Exploratory Well Hole No.2 include injuring or killing birds (including eggs and goslings) during site preparation, and disturbing existing nests or incubating adults during drilling operations. These potential impacts were evaluated based on the presence of ESA or MBTA protected ground-nesting avifauna within the action area.

Surveys were conducted to determine ground-nesting avifauna presence and habitat use within the action area on 17 October 2013, using the same transects as the botanical surveys. Survey efforts were focused on the Hawaiian Goose (*Branta sandvicensis*) and the Hawaiian Short-Eared Owl (*Asio flammeus sandwichensis*), because the action area contains potential nesting habitat for both these species. The wildlife survey team consisted of Rogelio Doratt, MSc, Bea Vizcarra, MSc, and Rachel Moseley, BSc. Transects ranged from 300 ft - 446 ft (91 m - 136 m) in length and were spaced 33 ft (10 m) apart (Figure 3). A total of 11 transects were surveyed, covering the entire action area of 2.7 ac. Observers were instructed to look for ground nest sign such as feathers, feces, vegetation bundles, and nesting bird activity such as brooding females or aggressive and/or protective males.

No indicators of ground-nesting avifauna presence (e.g., nests, feathers, feces, brooding females, protective males) were detected during surveys within the action area. Therefore, no effects from the construction and operation of the exploratory well are expected. It should be noted, however, that Hawaiian Goose nesting generally occurs between November and January with a peak in December (Banko et al. 1999), and the nesting season for the Hawaiian Short-Eared Owl is unknown. Therefore, the PTA NRO will re-survey the well site immediately before site preparation begins to confirm that no ground-nesting avifauna are present within the action area. Additionally, all Hawaiian Goose sightings in the action area during the project will be reported to the PTA NRO.

Recent studies show that petrel colonial activity on Hawaii Island occurs in relatively high elevation (6500 - 8500 ft) lava tubes and blisters where there is a low density of predators (Banko 1980). The action area is at a ~5400 ft with a high predator density and is therefore not considered to be suitable habitat for the endangered Hawaiian Petrel (*Pterodroma sandwichensis*) or candidate Band-Rumped Storm Petrel (*Oceanodroma castro*). No mortality and/or disturbance to petrels or petrel nests is expected from drilling operations for the exploratory well.

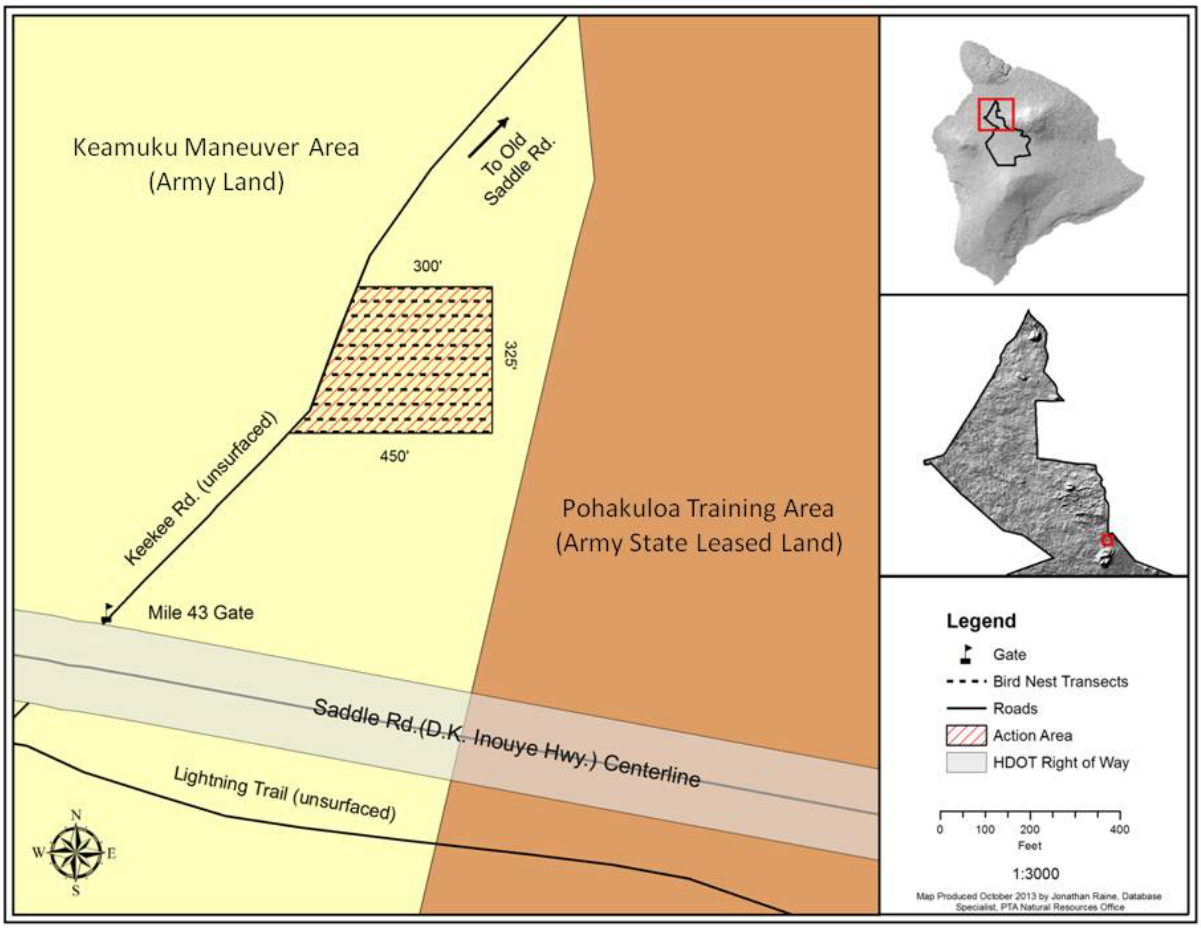

Figure 3. Ground-Nesting Avifauna Survey Area

4.1.2 Noise

Wildlife species potentially affected by noise from Exploratory Well Hole No.2 include the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) and avifauna protected under the ESA and MBTA, such as the Hawaiian Goose and Hawaiian Short-Eared Owl. Noise impacts were evaluated based on the expected presence of these species within the action area during well construction and operation.

Hawaiian Hoary Bat

Potential direct effects to the Hawaiian Hoary Bat from elevated noise levels near the exploratory well include potential hearing damage, collision with equipment, and/or startling of individuals from roosts, which may disrupt sleep patterns or torpor.

Based on vegetation species composition and structure in the vicinity of the exploratory well, it is unlikely that bats roost in the action area; however, the area does contain potential available foraging habitat for bats. While it is unclear how anthropogenic

noise will affect Hawaiian Hoary Bat foraging ability, laboratory data suggests foraging bats avoid noise (Schaub et al. 2008). Species such as the Pallid Bat (*Antrozous pallidus*), Long-Eared Bat (*Myotis evotis*), Northern Long-Eared Bat (*Myotis septentrionalis*) as well as the Spotted Bat (*Euderma maculatum*) avoid foraging in noisy areas (Faure and Barclay 1992, Fullard and Dawson 1997, Lacki and Ladeur 2001, Leslie and Clark 2002, Ratcliffe and Dawson 2003). Direct effects to foraging bats from noise generated by the exploratory well drilling are therefore unlikely.

Effects of military training to the Hawaiian Hoary Bat at PTA were analyzed by the US FWS in 2003. US FWS (2003) considered habitat loss, not noise or other disturbance, to be the major factor affecting the abundance and distribution of bats across PTA. The noise associated with drilling operations for the exploratory well will likely cause little interference with the bat's echolocation (Larkin et al 1996). Therefore, collisions with equipment are not considered to be a concern for the Hawaiian Hoary Bat. While it is unknown how noise associated with the exploratory well will affect this species, it is assumed that if noise levels are intolerable bats will avoid or vacate the area.

Avifauna

Potential direct effects to avifauna from noise generated by the exploratory well operations include increases in startle, alarm, and alert behavior, taking flight to avoid noise disturbance, increased energetic demands from flying, and hearing damage.

Numerous studies on noise impacts to avifauna, including studies of over flights from military aircraft such as helicopters, have been conducted. Although results cannot generally be applied across species, studies demonstrate that a variety of species, from wading birds to raptors, co-exist with loud noises (USAG-HI 2010; Peshut and Schnell 2011). Although there is debate in the literature as to the effects from noise on the fitness of birds, many studies focus only on behavioral responses, which may not indicate physiological responses or animal fitness. The literature supports that many bird species live, breed, and raise young in areas with sound levels well over 80 dBA. Birds may flush from nests when sound levels are high (generally >80-100 dBA), but generally return to their nests within minutes after the disturbance abates (USAG-HI 2010). Also, many studies indicate that birds habituate (display decreasing responses) to loud noises (Peshut and Schnell 2011).

The exploratory well is not expected to adversely affect wildlife within the action area. Wildlife in the action area is already exposed to noise from the new Saddle Road, commercial helicopter overflights, and routine military training exercises. Existing noise levels in the action area are relatively constant and are not expected to

substantially change due to noise generated from the exploratory well drilling. Noise levels are expected to remain below 75 dB within the action area during well operations (RCUH 2011), below the threshold of concern for wildlife species. Furthermore, noise effects from the exploratory well will be temporary, lasting only the duration of drilling operations (approximately 6 months).

The Hawaiian Goose is routinely found during flocking season in noisy habitats such as edges of highways (Saddle Road, Hawaii), airport runways (Kauai), and live-fire ranges (PTA). Additionally, studies have suggested that owl species may not be as sensitive to loud, low frequency noise, as once believed (Delaney et al. 1999).

If present in the action area during drilling operations for the exploratory well, wildlife is expected to temporarily vacate the area during high levels of noise and return after the disturbance (US FWS 2008).

4.1.3 Anthropogenic Light

Wildlife species potentially affected by anthropogenic light from Exploratory Well Hole No.2 include the endangered Hawaiian Hoary Bat, Hawaiian Petrel, and Band-Rumped Storm Petrel. Impacts from anthropogenic lights were evaluated based on the expected presence of these species within the action area during drilling operations.

Hawaiian Petrel and Band-Rumped Storm Petrel

Anthropogenic light sources are known to be hazardous to fledging petrels because they disrupt navigation (Simons and Hodges 1988). Therefore, the rare petrel that traverses the action area may become disoriented and grounded from the lights.

In a radar survey of seabirds at PTA, Cooper et al. (1996) detected 5 seabirds (0.05 birds/hr), including 3 Hawaiian Petrels, on the eastern portion of the installation. This movement rate is 6-fold lower than the lowest seabird movement rate found in a similar study by Day et al. (2003) at coastal sites (0.3 birds/hr). In 9 of the 14 sites sampled by Day et al. (2003), seabird movement rates were greater than 1.0 bird/hr, with a maximum rate of 25.8 birds/hr at Waipio Valley (northeast of PTA). Between 2008 and 2012, the PTA NRO recorded the Hawaiian Petrel and the Band-Rumped Storm Petrel in Training Areas 21 and 23 at the installation. Call recording characteristics suggest the individuals were transiting the installation.

As previously noted, the action area is not considered to be suitable habitat for the Hawaiian Petrel or Band-Rumped Storm Petrel due to its lower elevation (5400 ft) and high predator density. The exploratory well site is located approximately 23 mi (37 km) from known petrel colonies in Hawaii Volcanoes National Park. Limited investigations

suggest that the Hawaiian Petrel and Band-Rumped Storm Petrel use the saddle region as a flyway from the west coast to the colonies along the Mauna Loa northeast rift zone in the park (Cooper et al. 1996). Petrels that are transiting the saddle region are not expected to be in the vicinity of the exploratory well site during daylight hours. It is expected that very few petrels will transit near the action area during nighttime operations because petrel density in the flyway is estimated to be very low (Cooper et al. 1996). Therefore, very few petrels are likely to encounter effects from anthropogenic lights at the Hole No.2 site.

There will be minimal exterior lighting associated with the exploratory well. Lighting will be restricted to areas that require illumination for human life, health, and safety such as the drill rig, entryways, interiors of storage containers, and yard lighting. To reduce impacts from anthropogenic lights in the action area, lights will be shielded and directed downward wherever possible. When and where possible, motion sensors will be used so that lights will automatically shut off if a work area is not in active use (RCUH 2011). Additionally, the well crew will be educated to watch for avifauna that may be attracted to nighttime lighting and one of the management staff will monitor the site for incidents of bird disorientation or bird strikes and adjust lighting deployment to minimize these effects (RCUH 2011).

Hawaiian Hoary Bat

A potential direct effect to the Hawaiian Hoary Bat from anthropogenic light at the exploratory well site is collision with equipment and temporary structures.

While lights may attract the Hawaiian Hoary Bat due to increased insect presence, based on findings from a literature review (see Section 4.1.2) it is likely that bats will avoid the action area due to the low frequency noise emitted from the drilling operations. Due to the disinclination of some species of bats to forage in noisy areas, no adverse effects to the Hawaiian Hoary Bat are expected in the action area despite the increased insect presence associated with anthropogenic lights. Additionally, no bat collisions were reported to the PTA NRO from the first well site (Hole No. 1).

4.2 INDIRECT EFFECTS

4.2.1 Invasive Plants

A non-native plant is considered invasive if it is likely to, or known to, cause harm either economically or environmentally. Invasive plants pose a significant threat to biological resources at PTA by altering the structure and function of native ecosystems and competing with native plants for resources such as space, sunlight, water, and

nutrients. Invasive plants also tend to increase the frequency and intensity of wildland fires, to which native species may be poorly adapted.

At PTA, over 150 non-native plant species have been documented (Shaw and Castillo 1997), the majority of which are considered to be invasive. The introduction and spread of invasive plant species at PTA may be attributable to the following human, vehicle, and equipment vectors:

- Military training activities;
- Construction of buildings and roads (civilian traffic);
- Ground softening associated with construction activities;
- Movement of vehicles, equipment and troops;
- Routine maintenance on infrastructure, including roads, training areas, and buildings.

A list of non-native plant species found within the action area is included in Table 1. Most of the 27 non-native plants found within the action area are considered to be invasive, and 2 species (*Centaurea melitensis* and *Salsola tragus*) are listed as target weeds by the PTA NRO Invasive Plants Program due to their level of invasiveness, effects on the ecosystem, and distribution at PTA. In order to prevent the spread of invasive plants to and from the action area, standard operating procedures (SOPs) require that all vehicles and equipment be inspected and cleaned prior to entering and before leaving the project site (USAG-HI 2008). In addition, construction Best Management Practices (BMPs) outlined in the US FWS's 2003 Biological Opinion for PTA (US FWS 2003) help to reduce the risk associated with introducing invasive species.

The PTA NRO will survey the exploratory well site for invasive plants, including incipient species, quarterly from initiation of drilling operations through 6 months after project completion, and then once more 12 months later as part of its Invasive Plant Survey and Monitoring effort. Invasive plant control will be conducted as necessary. Due to the fact that no threatened and endangered species were recorded within the action area, no additional management is needed at this time.

4.2.2 Invasive Invertebrates

The introduction and establishment of invasive ants poses a threat to Hawaii's native biota through competition and predation. Ants disrupt native ecosystem function and are recognized as a major cause of species extinctions world-wide. This is especially important for Hawaii, where native species are particularly vulnerable because they evolved in the absence of native ant species (Cole et al. 1992, Gillespie and Reimer

1993, Krushelnycky and Gillespie 2008). For example, on Haleakala, Maui, the Argentine ant (*Linepithema humile*) has nearly reached the ~10,000 ft (3050 m) summit and has drastically altered species assemblages of insect fauna there (Krushelnycky and Gillespie 2008). At PTA, predator ants could potentially decimate native invertebrate populations through direct predation or indirectly through competition for wind-borne detritus (Cole et al. 1992).

Invasive ants may also potentially impact native plant populations at PTA. Ants are known to tend or "farm" alien pests such as aphids and scale insects, which impact plant vigor and may serve as a vector for further spread of plant disease (Messing et al. 2007). Foraging ants may impact fruit development and seed set of rare and native plants. Additionally, ants indirectly affect plant pollination by attacking native arthropods. For example, the Argentine ant has been shown to reduce populations of important native pollinators such as *Hylaeus* spp., a ground nesting native bee (Cole et al. 1992).

Several invasive ant species have been documented at PTA, including: Argentine ant (*Linepithema humile*), big-headed ant (*Pheidole megacephala*), Cardiocondyla ant (*Cardiocondyla venustula*), Hypoponera ant (*Hypoponera opaciceps*), pharaoh ant (*Monomorium pharaonis*), Singapore ant (*Monomorium latinode*), tiny yellow house ant (*Tapinoma melanocephalum*), and white-footed ant (*Technomyrmex albipes*) (HNHP 1998, Oboyski et al. 2001).

Invasive ant surveys were conducted on 17 October 2013 to determine invasive ant presence in the vicinity of the exploratory well. The PTA NRO survey team consisted of Rogelio Doratt, MSc, Martha Kawasaki, BSc, and Bea Vizcarra, MSc. Ant bait stations were placed in a 100 x 100 ft (30 x 30 m) grid throughout the action area (Figure 4). A total of 16 ant bait stations were deployed throughout the survey area of 2.7 ac. Bait stations were inspected and collected 1 hour after deployment to allow adequate time to attract ants. On all survey days, ant baiting began when ants were expected to have predictable foraging behavior; i.e., when the temperature was at least 50° F (10° C).

Ants were identified to species using the Pacific Invasive Ant Key website (http://itp.lucidcentral.org/id/ ant/pia) and the Ants of Hawaii Key website (http://pick4.pick.uga.edu/mp/20q?guide=Ants_Hawaii). A total of 838 ants of a single species (Argentine ant) were found at 15 of the 16 bait stations during the survey period. Findings are consistent with known distribution; Argentine ants are established throughout most of PTA. The Hole No.2 site is also located within the known distribution of another invasive invertebrate, naio thrips (*Klambothrips myopori*). To

prevent the spread of invasive ants and thrips to and from the action area, SOPs require that all vehicles and equipment be inspected and cleaned prior to entering and before leaving the well site (USAG-HI 2008). In addition, construction BMPs outlined in the US FWS's 2003 Biological Opinion for PTA (US FWS 2003) help to reduce the risk associated with introducing invasive species.

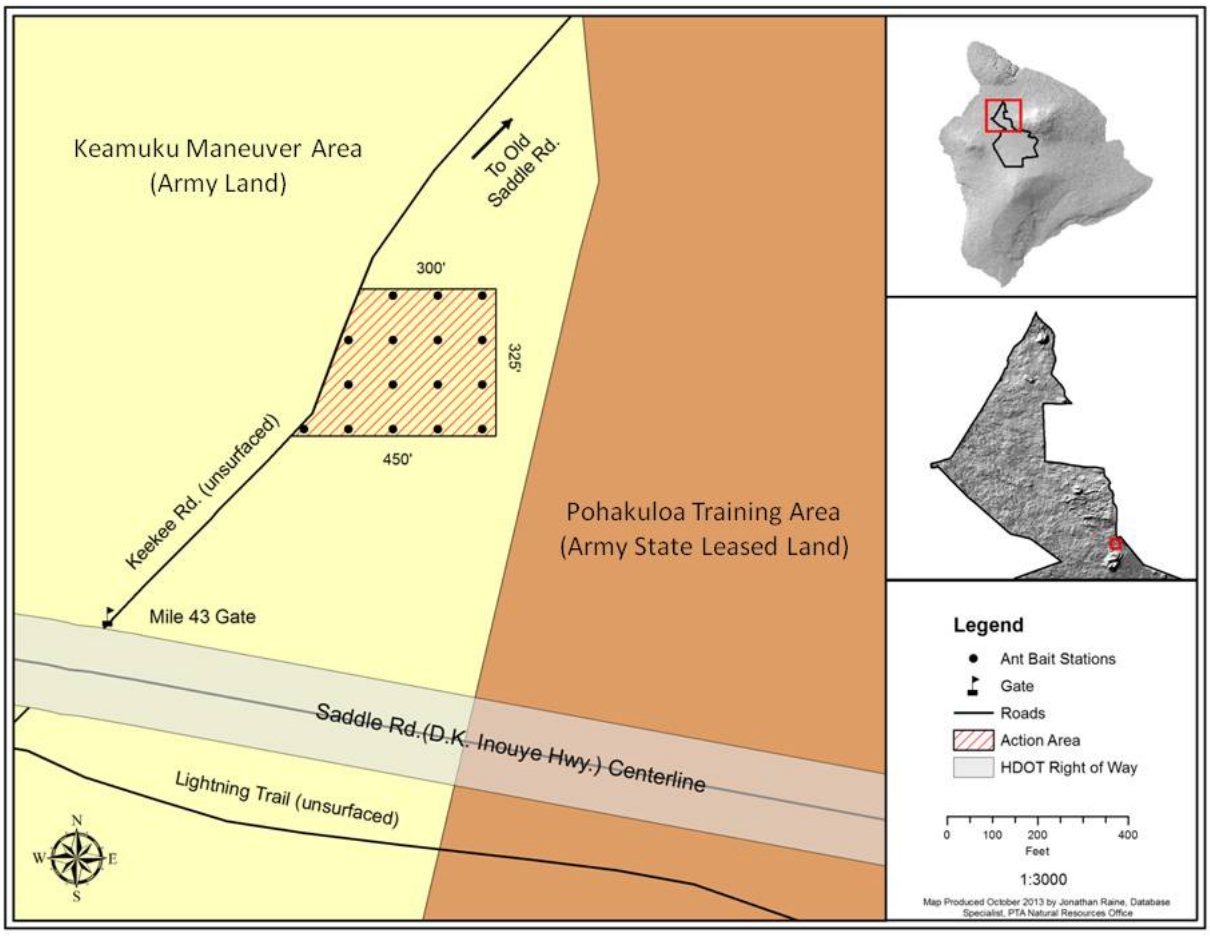

Figure 4. Invasive Ant Survey Area

4.2.3 Habitat Disturbance for Wildlife

Exploratory Well Hole No.2 could indirectly affect the Hawaiian Hoary Bat and ground-nesting avifauna by disturbing potential habitat for foraging and nesting. Impacts were evaluated based on the expected presence of bats and ground-nesting avifauna within the action area.

An assessment of potential available treeland roosting and foraging habitat for the Hawaiian Hoary Bat was conducted concurrently with the botanical surveys described above. Based on species composition determined by botanical surveys, it is unlikely that the area provides potential roosting habitat; however, there is potential foraging

habitat within the action area. Given the lack of preferred roosting habitat in the action area, daytime presence of roosting bats is considered to be improbable, but it is possible that foraging bats transit across the action area during nighttime hours. Based on the US FWS Biological Opinion (2003), the loss of roosting habitat is considered to be the major limiting factor for the Hawaiian Hoary Bat at PTA. Additionally, the action area (2.7 ac) constitutes an insignificant percentage of the total available foraging habitat at PTA and the Keamuku Maneuver Area. Therefore, effects to Hawaiian Hoary Bat foraging habitat from the exploratory well are considered negligible.

The exploratory well is not expected to affect future nesting sites for ground-nesting avifauna. No indicators of ground-nesting avifauna presence (e.g., nests, feathers, feces, brooding females, protective males) were detected during surveys within the action area. The PTA NRO will re-survey the well site immediately before mobilization begins to confirm that no ground-nesting avifauna are present within the action area. Additionally, the footprint of the action area is relatively small (2.7 ac) and duration of the project is temporary, lasting only 6 months, so the occupation of the site by ground-nesting avifauna during drilling operations is unlikely.

4.2.4 Wildland Fire

Wildland fires have a range of effects on biological resources in Hawaii, including:

- Destruction of native plants and animals and/or the alteration of the many components, structures, and processes of Hawaiian ecosystems;
- Acceleration or retardation of seral stage succession and an increase or reduction in nutrient availability;
- Opportunities for competitive advantage of fire-adapted non-native plant species (especially grasses) into intact native habitat and the subsequent alteration of the fire cycle.

Most native plants are not well adapted to intense and frequent fires and are often out-competed by aggressive alien species once a fire has occurred. Wildland fire in native habitats almost always converts native woodlands and forests to alien dominated savannas and grasslands, thereby displacing the native biota (see invasive plants section). In the past 100 years, invasion of alien vegetation and the introduction of browsing animals have altered Hawaiian ecosystems dramatically. At PTA, much of the native habitat was subalpine dryland ecosystem and was relatively sparsely vegetated making the spread of wildland fires difficult. Over time, invasive vegetation has established in open areas within many of these sparsely vegetated habitats,

resulting in contiguous vegetation dominated by fine, flashy fuels, thus creating conditions by which wildland fires may more easily spread across large areas.

The Army finalized a comprehensive Integrated Wildland Fire Management Plan (IWFMP) in October 2003 to proactively minimize risk from fire to listed species at PTA and to protect and manage the biological resources that support military training (USAG-HI 2003). The main objectives of the IWFMP are to: 1) provide specific requirements to delineate the responsibilities of the PTA Fire Department, Range Control, Environmental Division, and military training units for the prevention and suppression of wildland fires at PTA; 2) prevent unintentional wildland fire ignitions through reliable and consistent preventive measures, and; 3) establish procedures for wildland fire control and the protection of natural and cultural resources (USAG-HI 2003). Biological resources evaluated in the IWFMP include vegetation, ecosystem process and function, soil properties, and general character of the land.

Ignition sources within the action area include vehicle traffic (catalytic converters) and smoking. Potential wildland fire effects from the exploratory well are not expected due to existing SOPs established in the IWFMP. To reduce the risk of wildland fire in the action area, the following fire prevention measures will be followed (USAG-HI 2003):

- Smoking will be limited to areas of gravel, asphalt, concrete, or bare ground;
- Cigarettes will be disposed of in butt cans;
- Aggregate surface areas will be made for vehicle parking;
- No parking will be allowed on vegetated areas.

The exploratory well is deemed a low risk project with respect to wildland fire. The action area is surrounded on all sides by roads and/or firebreaks (Figure 5). Additionally, the action area is only 6 mi (10 km) from the PTA Fire Department located on PTA Cantonment. If a wildland were to ignite within the action area, it is not expected to cross existing roads and firebreaks. Furthermore, the duration of the project is relatively short, lasting approximately 6 months, so there is no long-term wildland fire threat.

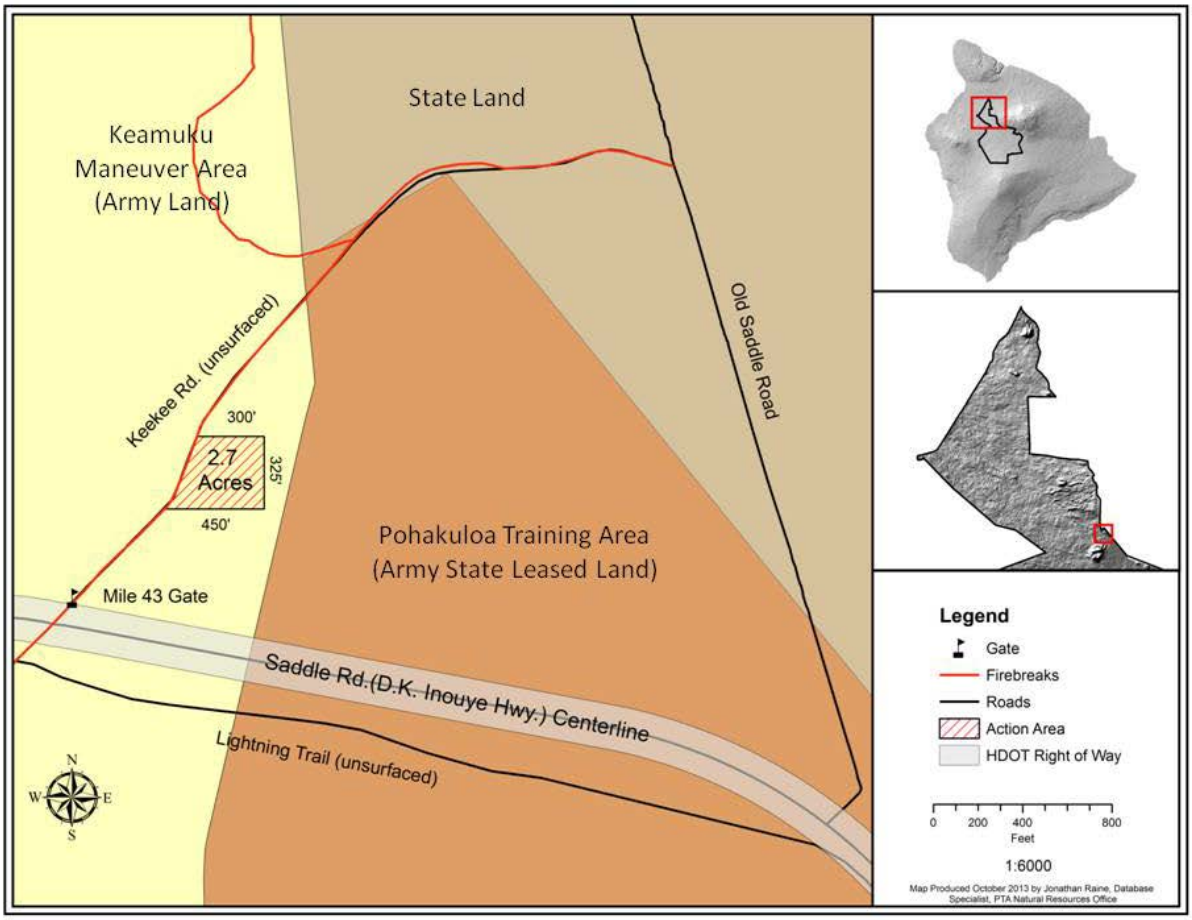

Figure 5. Existing Roads and Firebreaks Surrounding the Action Area

4.2.5 Dust

Fugitive dust will be generated during site preparation for drilling of Exploratory Well Hole No.2, and from vehicle traffic to and from the well site. Dust may affect photosynthetic rates and overall vigor of native vegetation within the action area. Dust may also have a detrimental effect to young animals if subjected to continuous bouts of dusting (US FWS 2003).

Dust concerns in the action area are minimal. All effects will be temporary, lasting only the duration of the project (6 months). The anticipated ground disturbance in the action area will be a maximum of 2.7 ac, so site preparation activities for the exploratory well are relatively small scale. Additionally, dust levels are unlikely to exceed natural conditions in the action area (i.e., on windy days) or the effects from the nearby Saddle Road. Therefore, dust is not expected to adversely affect biological resources in the action area.

Please contact Peter Peshut, 808-969-1966, peter.j.peshut.civ@mail.mil, for further discussions on drilling operations for Exploratory Well Hole No.2 and potential impacts on biological resources.

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Pohakuloa Training Area

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Suite 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2014-I-0083

JAN 0 8 2014

Eric P. Shwedo
Lieutenant Colonel, US Army
Commander, US Army Garrison-Pohakuloa
P.O. Box 4607
Hilo, Hawaii 96720

Subject: Informal Consultation for Exploratory Well Hole No. 2 in the Keamuku Maneuver Area, Hawaii

Dear Colonel Shwedo:

The U.S. Fish and Wildlife Service (Service) received your request on December 9, 2013, for concurrence with a may affect, not likely to adversely affect biological determination for the endangered Hawaiian petrel (*Pterodroma sandwichensis)* from the proposed Exploratory Well Hole No. 2 project in the Keamuku Maneuver Area (KMA), Hawaii. You also requested for this project an informal conference for the candidate band-rumped storm petrel (*Oceanodroma castro)* and our agreement with a no effect determination for the endangered Hawaiian goose (*Branta sandvicensis*), the endangered Hawaiian hoary bat *(Lasiurus cinereus semotus)*, federally-listed plants, and avifauna protected under the Migratory Bird Treaty Act (MBTA). This response is in accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*).

The proposed site for Hole No. 2 is located on Army fee-simple land in the KMA along Keekee Road approximately 500 feet north of the new Saddle Road. Operations for Hole No. 2 will involve drilling a borehole to a depth near sea level from the elevation of the drill site. Samples of groundwater and stratigraphic formations will be collected and analyzed; instruments will be installed to monitor water levels and temperatures. Drilling operations will be 24 hours per day, seven days per week for approximately six consecutive months. Drilling is expected to begin in the January - March 2014 timeframe. The disturbed footprint for Hole No. 2 drilling operations will be a maximum of 2.7 acres. Final delineation of the disturbed area will depend on site preparation needs, but will in no case extend beyond the designated area in your correspondence dated December 9, 2013.

The Pohakuloa Training Area Natural Resources Office (PTA NRO) conducted surveys to determine the reasonable likelihood that potential impacts will occur to biological resources from the Hole No. 2 drilling project. Three types of surveys were conducted: 1) botanical; 2) ground-nesting avifauna, and 3) invasive ants. Potential direct effects to petrels (Hawaiian petrel and band-rumped storm petrel) include mortality during site preparation and disturbing existing nests or incubating adults during drilling operations. Past studies show that petrel colonial activity on Hawaii Island occurs in relatively high elevation lava tubes and blisters where there is a low density of predators. The proposed well site is not at high elevation (5,400 feet), has high predator density, and is therefore not considered to be suitable habitat for petrels. As a result, no mortality and/or disturbance to petrels or petrel nests is expected from drilling operations.

The PTA NRO conducted botanical surveys on 17 October 2013 to determine the presence of federally-listed plant species and to assess overall vegetation in the vicinity of the well. No federally-listed plant species were found at the Hole No. 2 site; therefore, drilling operations will have no impact to federally-listed plant species. In addition, no indicators of ground-nesting avifauna presence (e.g., nests, feathers, feces, brooding females, protective males) were detected during surveys on 17 October 2013 at the well site. The PTA NRO will also re-survey the Hole No. 2 site immediately before site preparation begins to confirm that no ground-nesting avifauna is present in the area. If any is found, the Service will be contacted prior to work taking place.

There will be minimal exterior lighting associated with this proposed project. Lighting will be restricted to areas that require illumination for human life, health, and safety, such as the drill rig, entryways, interiors of storage containers, and yard lighting. To minimize potential impacts from anthropogenic lights at the well site, all lights will be shielded and directed downward wherever possible. When and where possible, motion sensors will also be used so that lights will automatically shut off if a work area is not in active use.

To prevent the spread of invasive plants and invertebrates to and from the well site, standard operating procedures will require that all vehicles and equipment be inspected and cleaned prior to entering and before leaving the project site. In addition, construction best management practices outlined in the USFWS 2003 Biological Opinion for PTA will be followed and help to reduce the risk associated with introducing invasive species. Furthermore, the PTA NRO will survey the well site for invasive plants quarterly from initiation of drilling operations through six months after project completion, and then once more 12 months later. If detected, invasive plants will be controlled.

Conclusion

The Service concurs that the proposed Well Hole No. 2 project may affect, but is not likely to adversely affect, the endangered Hawaiian petrel. The Service also determines that this project will not jeopardize the candidate band-rumped storm petrel and agrees that this project will have no effect on the Hawaiian goose, Hawaiian hoary bat, federally-listed plants, and avifauna protected under the MBTA. Unless the project description changes, new information reveals that the proposed project may affect listed species in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to section 7 of the ESA is necessary.

If you have any questions or concerns regarding this consultation, please contact Dr. Tim Langer, Fish and Wildlife Biologist (phone: 808-792-9462, email: tim_langer@fws.gov).

Sincerely,

Tim Langer

FOR Loyal Mehrhoff
Field Supervisor

APPENDIX B

Section 106 Consultation Letters

Letter Sent to Consulted Agencies for original EA for Sites B and C

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON
POHAKULOA
PO BOX 4607
HILO, HAWAII 96720-0607

REPLY TO
ATTENTION OF

MAY 23 2011

Office of the Commander

Mr. William Aila
State Historic Preservation Officer
Chairperson
Department of Land and Natural Resources Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Mr. Aila:

As Commander of the US Army Garrison, Pōhakuloa, I am writing to begin consultation under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations (36 CFR Part 800) on a project proposed at the Pōhakuloa Training Area (PTA) within the ahupua'a of Ka'ohe, district of Hāmākua , Hawai'i County, on the island of Hawai'i (TMK: (3) 4-4-016:005). Please see Enclosure 1 for a list of all consulting parties.

I have determined that this project constitutes an undertaking as it is defined under Section 800.16 (y) of the NHPA. The purpose of this undertaking is to drill a test well to a depth of between 5,000 and 7,000 feet at PTA to explore the potential to develop a ground-water well to provide a supply of potable water to PTA. The drilling effort will also recover rock/soil cores useful to understanding the geology and hydrology of Mauna Kea and Mauna Loa volcanoes. This undertaking will be contracted to the Research Corporation of the University of Hawaii, Center for the Study of Active Volcanoes, under direction of Dr. Don Thomas.

General background of the project, descriptions of the candidate project sites, and evaluations of the sites are presented in Enclosure 2. There are four areas of potential effect that are currently under consideration for the construction of this well. These four locations are presented and discussed in Enclosure 2. Site 1 has a maximum area of .8 acres, Site two is 1.4 acres, site 3 1.1 acres and site 4 2.4 acres. All of these locations have been heavily disturbed by modern human activity, and no historic properties are present at any of them.

In the event that iwi kūpuna or Native Hawaiian cultural deposits are encountered during the project, USAG-HI will implement our Inadvertent Discovery Plan (Enclosure 3).

I have determined that no historic properties will be affected by this project. Pursuant to Section 106 of the National Historic Preservation Act of 1966 as amended and 36 CFR Section 800.2(c), we are seeking your review and comments on this determination. Should you require additional information about this project, the point of contact is Dr. Julie M. E. Taomia, PTA Archeologist, at telephone number (808) 969-1966.

Sincerely,

Rolland C. Niles
Lieutenant Colonel, US Army
Commanding

Enclosures

List of Parties to Whom Letters Were Sent for Consultation

Mr. William Aila
Chairperson
Department of Land and Natural Resources Kakuhihewa Building, Room 555
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Kapolei, HI 96707

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Office of Hawaiian Affairs
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Ms. Lukela Ruddle
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162-A Baker Avenue
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Ms. Ruby McDonald
Office of Hawaiian Affairs
75-5706 Hanama Place, Suite 107
Kailua-Kona, HI 96740

Ms. Chris Lehnertz
PWRO Honolulu
National Park Service
300 Ala Moana Boulevard
Honolulu, HI 96850

Kahu Charles Maxwell
Hui Malama I Na Kupuna O Hawai'i Nei
157 'Ale'a Place
Pukalani, HI 96768

Mr. Kimo Lee
Hawaii Island Burial Council
State Historic Preservation Division, Kona Office
40 Pookela St.e. Unit C-5
Hilo, HI 96720

Mr. Gene Leslie
Hawaii Island District Council of Hawaiian Civic Clubs
P.O. Box 7164
Hilo, HI 96720

Ms. Elaine Jackson-Retondo
Pacific West Region
National Park Service
1111 Jackson Street, Suite 700
Oakland, CA 94607-4807

Ali'i Nui William Roback
Ali'i Nui, Heiau O Na Alii
2723 Kamelani Loop
Pukalani, HI 96768

Ali'i 'Ai Moku Pua Ashibashi
Royal Order of Kamehameha
P.O. Box 821
Honokaa, HI 96727

Ali'i 'Ai Moku Sir Joseph Spencer
Royal Order of Kamehameha
P.O. Box 1872
Kailua-Kona, HI 96745

Ms. Stephanie Nagata
Office of Mauna Kea Management
University of Hawai'i at Hilo
200 West Kawili Street
Hilo, HI 96720

Mr. Ed Stevens
Kahu Ku Mauna
c/o Office of Mauna Kea Management
200 West Kawili Street
Hilo, HI 96720

Attendees
Pohakuloa Cultural Advisory Committee Attendees
Bi-Montly Meetings held at PTA Headquarters

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD11/5777

July 8, 2011

Lieutenant Colonel Rolland C. Niles
Department of the Army
Headquarters, U.S. Army Garrison, Pōhakuloa
PO Box 4607
Hilo, Hawai'i 96720-0607

Re: National Historic Preservation Act consultation
Test well drilling
Pōhakuloa Training Area, Hawai'i

Aloha e Lieutenant Colonel Niles:

The Office of Hawaiian Affairs (OHA) is in receipt of your May 23, 2011 letter with enclosures, initiating consultation, pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended. The U.S. Army Garrison, Pōhakuloa (USAG-P) is proposing to drill a test well at one of four different sites around the Pōhakuloa Training Area (PTA), Hawai'i in order to explore the development of a groundwater well to provide a supply of potable water to PTA (the "undertaking"). The area of potential effect (APE) for the undertaking will depend on which of the four sites is chosen for the test well: Site 1 (0.8 acres), Site 2 (1.4 acres), Site 3 (1.1 acres), or Site 4 (2.4 acres). The single test well will be drilled to a depth of between 5,000 and 7,000 feet using a drilling rig approximately 60 feet tall, operated continuously over a six month period. According to a clarifying email from Army staff, an environmental review will be conducted for the undertaking, pursuant to Chapter 343 of the Hawai'i Revised Statutes.

Your letter describes the four potential sites as "heavily disturbed by modern human activity" and states that there are no historic sites at any of the four sites. You have determined this undertaking will result in no adverse effect to historic properties listed or eligible for listing

on the National Register of Historic Places. Based on information provided for this undertaking, OHA does not oppose this determination.

The Deep Test Well project does raise other concerns for our agency. We note that Site 1, Site 2, and Site 3 are in close proximity to the Mauna Kea Forest Reserve. Given the size of the drilling operation and the duration of the project, there is the potential for the project to impact nearby activities of our beneficiaries and biota in the Forest Reserve. We anticipate that these potential impacts will be addressed in the forthcoming environmental review documents. Should the propose undertaking proceed, we rely on the assurances detailed in your letter that staff will employ the Inadvertent Discovery Plan provided in Enclosure 3 of your letter in order to ensure the protection of human skeletal remains or previously unknown cultural resources.

Thank you for initiating consultation. Should you have any questions, please contact me or your staff contact Everett Ohta at 594-0231 or by email at everetto@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

C: OHA Trustee Robert K. Lindsey, Jr.
OHA Hawai'i Community Resources Coordinator
William Aila, Jr., State of Hawai'i Historic Preservation Officer
Pua Aiu, State Historic Preservation Division Administrator

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 7, 2011

Rolland C. Niles
Lieutenant Colonel, US Army Commanding
Headquarters, US Army Garrison, Pōhakuloa
P.O. Box 4607
Hilo, Hawai'i 96720-0607

LOG NO: 2011.1532
DOC NO: 1107TD10
Archaeology

Dear Lieutenant Niles:

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Consultation –**
Proposed Exploratory Well at the Pōhakuloa Training Area
Ka'ohe Ahupua'a, Hāmākua District, Island of Hawai`i
TMK: (3) 4-4-016: 005

This is in response to your request for concurrence regarding the subject undertaking, which we received in Kapolei May 25, 2011 and in Hilo June 22, 2011. We apologize for the delay in responding to this request. The University of Hawaii Research Corporation (RCUH) Center for the Study of Volcanoes proposes to drill an exploratory well at one of four potential locations within the Pōhakuloa Training Area (PTA). The purpose of the exploratory well is to assess the feasibility of developing a ground-water well for potable water, and to obtain deep rock/soil cores for geological studies. The test well is expected to be 5,000-7,000 feet in depth.

The area of potential effect (APE) for this undertaking consists of four disconnected area ranging from 0.9 to 2.4 acres in area; these locations are depicted on an enclosed map. Photographs and descriptive information on the four potential well areas is also included. The selected well site will require an area of about one acre to accommodate the drilling equipment, which will include a 60 ft. high drill rig. The well head will be covered with a 10 by 10 ft. concrete slab which will support the drill rig. Approximately six months of continuous drilling is anticipated.

The APE areas were included in prior inventory surveys, and no historic properties were identified within these potential test well locations. Three of the locations are previously disturbed by heavy machinery, and one location is disturbed by repeated training activities. You report that no historic properties are located within or near any of the four APE areas. We concur that no historic properties will be affected by this undertaking because there are no known historic properties within the APE.

In the unlikely event that historic properties are inadvertently discovered during construction, we concur that measures are in place to ensure that no newly discovered historic properties will be adversely affected. If you have any questions, please contact me at (808) 933-7653; or Theresa.K.Donham@hawaii.gov.

Aloha,

Theresa K. Donham
Deputy State Historic Preservation Officer
Historic Preservation Division

Kahu Kū Mauna
c/o Office of Mauna Kea Management
200 West Kawili Street
Hilo, Hawai`i 96720

July 25, 2011

Lt. Col. Rolland C. Niles, Commander
US Army Garrison, Pohakuloa
P.O. Box 4607
Hilo, Hawai`i 96720

Dear Lt. Colonel Niles:

In our meeting of July 13, 2011, the Kahu Ku Mauna Council reviewed your letter of May 23, 2011, proposing a project to drill a test well in order to explore the potential for developing a ground-water well at PTA; and your letter of June 16, 2011, proposing to establish a Tactical Recovery of Aviation Personnel (TRAP) site in the Ke`amuku Maneuver Area.

We appreciate your intention to begin the consultation process under Section 106 of the National Historic Preservation Act of 1966, as defined under Section 800.16 (y) of the NHPA, and would like to be included in the consultation process you are proposing.

Please inform your staff that our contact person for the above referenced consultation process will be Tiffnie Kakalia, our Vice Chairperson, who can be reached by phone number 974-7678 or by e-mail to tiffnie@hawaii.edu.

Sincerely,

Chad Kalepa Baybayan, Chairman
Kahu Kū Mauna Council

c: OMKM Interim Director Stephanie Nagata
Kahu Kū Mauna Council
PTA Archaeologist Dr. Julie Taomia

Section 106 letter sent for Draft EA for Site A

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON
PŌHAKULOA
PO BOX 4607
HILO, HAWAII 96720-0607

REPLY TO
ATTENTION OF

NOV 2 6 2013

Office of the Commander

Mr. William Aila
State Historic Preservation Officer
State Historic Preservation Office
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Mr. Aila:

As Commander of the US Army Garrison, Pōhakuloa (USAG-Pōhakuloa), I am writing to amend a previous consultation under Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations (36 CFR Part 800) on a project proposed at the Pōhakuloa Training Area (PTA) within the ahupua'a of Waikoloa, district of South Kohala, Hawai'i County, on the island of Hawai'i (TMK: (3) 6-7-001:041). Please see Enclosure 1 for a list of all consulting parties.

This consultation is an amendment to the consultation conducted in 2011 for an undertaking to test for ground water at PTA. The Army is providing funding to Dr. Donald Thomas of the University of Hawai'i at Hilo to conduct the research on water resources in the Interior Plateau where PTA is located. The first well drilled in the parade ground at the PTA Cantonment successfully located water. As a result of the data collected during that drilling project it was determined that the other possible well locations included in the previous consultation are too close to the first site to provide the additional data that is needed for this project. The second test well will be dug to a depth of approximately 6500 feet below the surface. The mast of the drill rig for the test well stands 38 feet (11.6 meters) above the ground surface. The well will provide additional information to evaluate the hydrologic resources in the Saddle region.

The area of potential effects (APE) for this new location is 2.7 acres and is illustrated on Enclosure 2. The APE is within the area purchased in fee simple by the Army in 2006. The project area will be accessed from the new Saddle Road (Daniel K. Inouye Memorial Highway) by an existing unimproved vehicle trail at approximately the 43 mile marker.

The current APE is part of a larger area that was surveyed for archaeological sites in anticipation of the purchase of the parcel in connection with the transformation of

the 2nd brigade to a Stryker Brigade Combat Team (SBCT). The results of the survey were documented in a 2005 report by Michael Desiltes and Alice Roberts of Garcia and Associates titled *Final Report: Phase I Archaeological Reconnaissance Survey of 1,010 Acres of Pu'u Ke'eke'e Lands at U.S. Army Pohakuloa Training Area, Waikoloa Ahupua'a, South Kohala District, Island of Hawai'i, Hawai'i (TMK: 3-6-7-001: por. 003)*. The report is on file at the State Historic Preservation Division. The current well project is not an SBCT project. No archaeological sites were identified in this project area by the archaeological survey. A ranch wall was identified approximately 63 meters west of the APE across the vehicle trail that extends southwest from the Old Saddle Road along the western side of Pu'u Ke'eke'e. Pu'u Ke'eke'e is approximately 370 meters south of the project area.

If iwi kūpuna or Native Hawaiian cultural deposits are encountered during the project, USAG-Pōhakuloa will implement our Inadvertent Discovery Plan (Enclosure 3).

I have determined that this project will have no effect on historic properties. Pursuant to Section 106 of the National Historic Preservation Act of 1966 as amended and 36 CFR part 800.2(c), we are seeking your concurrence on the determinations made in this letter. Should you require additional information about this project, the point of contact is Dr. Julie M. E. Taomia, PTA Archeologist, at telephone number (808) 969-1966 or by email at julie.m.taomia.civ@mail.mil.

Sincerely,

Eric P. Shwedo
Lieutenant Colonel, US Army
Commanding

Enclosures

Mr. William Aila
State Historic Preservation Office
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dr. Kamana'opono Crabbe
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Ms. Lukela Ruddle
Office of Hawaiian Affairs
162-A Baker Avenue
Hilo, HI 96720

Mr. Shane Nelsen
Office of Hawaiian Affairs
75-5706 Hanama Place, Suite 107
Kailua-Kona, HI 96740

Mr. Daniel Kawaiaea, Jr.
Pu'ukohola Heiau National Historic Site
National Park Service
62-3601 Kawaihae Road
Kawaihae, HI 96743

Mr. Edward Halealoha Ayau
Hui Malama I Na Kupuna O Hawai'i Nei
622 Wainaku Avenue
Hilo, HI 96720

Mr. Kimo Lee
Hawaii Island Burial Council
State Historic Preservation Division, Kona Office
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Hilo, HI 96720

Mr. Gene Leslie
Hawaii Island District Council of Hawaiian Civic Clubs
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Royal Order of Kamehameha
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Pukalani, HI 96768

Ms. Cindy Orlando
Hawai'i Volcanoes National Park
1 Crater Rim Drive
P.O. Box 52
Hawai'i National Park, HI 96718-0052

Ali'i 'Ai Moku Pua Ishibashi
Royal Order of Kamehameha
c/o Royal Order of Kamehameha I, Mamalahoa
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Hilo, HI 96720

Ali'i 'Ai Moku Sir Joseph Spencer
Royal Order of Kamehameha
P.O. Box 1872
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Ms. Stephanie Nagata
Office of Mauna Kea Management
University of Hawaii at Hilo
200 West Kawili Street
Hilo, HI 96720

Ali'i Sir Paul K. Neves
Royal Order of Kamehameha I
Mamalahoa, Helu Elua
318 Na Hale'a Street
Hilo, HI 96720

Ms. Kealoha Pisciotta
Mauna Kea Anaina Hou
P.O. Box 5864
Hilo, HI 96720

Mr. E. Kalani Flores
Flores-Case 'Ohana
P.O. Box 6918
Kamuela, HI 96743

Ms. Kelley L. Uyeoka
P.O. Box 234
Hakalau, HI 96710

Ali'i Okana Sir Kalikolekua V. Kanaele, KCK
Royal Order of Kamehameha
Moku o Mamalahoa
HC3 Box 13124
Kea'au, HI 96749

Enclosure 1

Ms. Moani K. Akaka
Aloha 'Aina Educational Center
P.O. Box 1523
Hilo, HI 96720

Mr. Maulili Dickson
Waimea Hawaiian Civic Club
65-1234 Puu Opelu Road
Kamuela, HI 96743

Mr. Rick Gmerkin
Ala Kahakai National Historic Trail
73-4786 Kanalani Street Number 14
Kailua-Kona, HI 96740

Ms. Lisa Oshiro Suganuma
Office of Native Hawaiian Relations
U.S. Department of the Interior
P.O. Box 50167
Honolulu, HI 96813

'Ohana Keliinoi
c/o Kalahikiola Keliinoi
89-107 Nanaikala Street
Waianae, HI 96792

'Ohana Kawainui
c/o Aliikaua Kawainui Kaleikini
89-107 Nanaikala Street
Waianae, HI 96792

'Ohana Kaleikini
c/o Kala Waahila Kaleikini
89-107 Nanaikala Street
Waianae, HI 96792

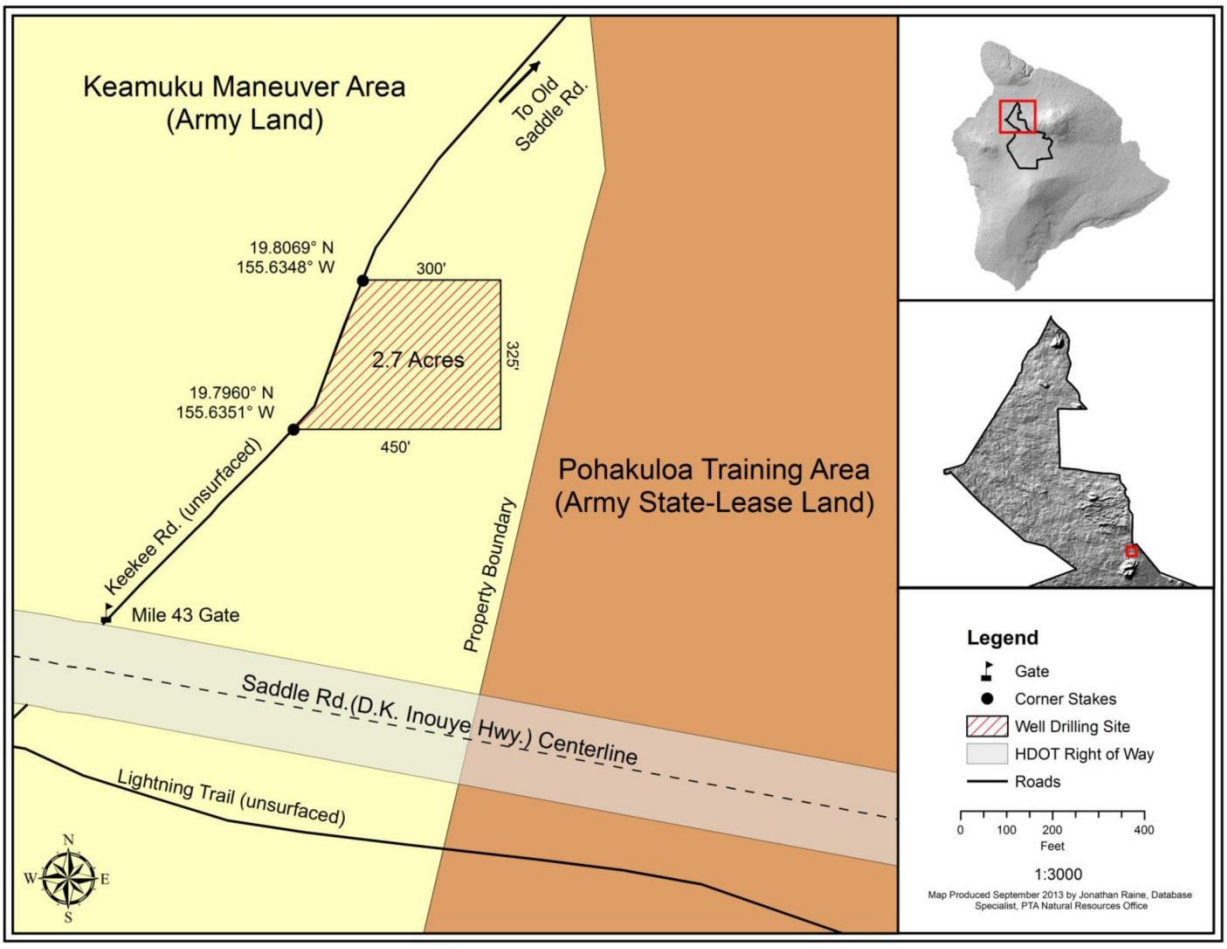
ʻOhana Huihui
c/o Mana Kaleilani Caceres
91-225 Pilipiliula Place
Kapolei, HI 96707

Ms. Paulette Ka'anohiokalani Kaleikini
'Ohana Keaweamahi
89-107 Nanaikala Street
Wai'anae, HI 96792-3900

Mr. JR Keoneakapu Williams
'Ohana Kapu
85-1029 Mahi Aina St
Waianae, HI 96792

Mr. James Medeiros
'Ohana Medeiros
P.O. Box 166
Honaunau, HI 96726

Enclosure 2


Keamuku Maneuver Area
(Army Land)
To Old Saddle Rd.
19.8069° N
155.6348° W
300'
2.7 Acres
325'
19.7960° N
155.6351° W
450'
Keekee Rd. (unsurfaced)
Mile 43 Gate
Property Boundary
Pohakuloa Training Area
(Army State-Lease Land)
Saddle Rd.(D.K. Inouye Hwy.) Centerline
Lightning Trail (unsurfaced)
N
W
E
S
Legend
Gate
Corner Stakes
Well Drilling Site
HDOT Right of Way
Roads
0
100
200
400
Feet
1:3000
Map Produced September 2013 by Jonathan Raine, Database Specialist, PTA Natural Resources Office

Letter Response (1) received regarding Draft EA for Site A

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 30, 2013

Eric Shwedo, Lieutenant Colonel
US Army Garrison Pohakuloa
PO Box 4607
Hilo, HI 96720-0607

LOG NO: 2013.6880
DOC NO: 1312MV25
Archaeology

Dear Lieutenant Colonel Shwedo,

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Consultation – Research on Water Resources at Pohakuloa Training Area (PTA) Waikoloa Ahupua'a, South Kohala Districts, Island of Hawai'i TMK: (3) 6-7-001:041**

Thank you for the opportunity to consult on this undertaking that was received by our office on December 9, 2013. The purpose of your letter is to amend consultation for a 2011 undertaking to conduct research on water resources at PTA. According to the letter the previously consulted locations are too close to one another and will therefore require re-location. The current undertaking involves the excavation of a test well to a depth of 6500ft below the surface. The mast of the drill rig for the test well will stand 38ft tall, and the area of potential effect APE is considered to be the 2.7 acre area illustrated on enclosure 2.

A review of our records indicates that the project area was previously subjected to an archaeological inventory survey by Desilets and Roberts (2005). The AIS did not identify any historic properties within the APE. In addition, we recognize that Native Hawaiian Organizations (NHO) were provided the opportunity to review this determination letter. However, if this is the only opportunity that NHO's have had to consult, we do not believe this constitutes a reasonable and good faith effort to consult with Native Hawaiian Organizations in your efforts to identify historic properties pursuant to 36 CFR Part 800.4(a)(4). We believe that consultation with NHO should follow the guidelines established in the Advisory Council on Historic Preservation's handbook for consultation with NHO in the Section 106 review process (ACHP, June 2011) and a description of the consolation process should be presented to ensure that your request for SHPO concurrence meets the documentation standards for a determination of no historic properties affected pursuant to 36 CFR Part 800.11(d)(2). Therefore, **we request more information** in the form of a description of efforts to consult with NHO's on the potential location and significance of historic properties in this area.

Please contact Michael Vitousek at (808) 652-1510 or Michael.Vitousek@hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

Theresa K. Donham
Archaeology Branch Chief and
Deputy State Historic Preservation Officer
Historic Preservation Division

APPENDIX C

Pre-Consultation Communications
2012 Draft Environmental Assessment
And
Current Draft Environmental Assessment

Parties to whom Preliminary Draft Environmental Assessment copies were provided for pre-consultation:

Agency/Organization	Comments Received
Office of Hawaiian Affairs	None
Leeward Planning Conference	None
Saddle Road Task Force (presentation)	None
Department of Hawaiian Home Lands	Letter attached
Department of Land and Natural Res.	
CWRM	None
SHPD	None
Land Division	None
DoFAW	None
Engineering Division	
Department of Health	None
Office of Mauna Kea Management	None

University of
Hawai'i
MĀNOA

Hawai'i Institute of Geophysics and Planetology
School of Ocean and Earth Sciences and Technology
1680 East-West Rd., Honolulu, HI 96822
Telephone (808) 221-2135 FAX (808) 956-6322

April 26, 2012

Dr. Kamana'opono M. Crabbe, Ph.D
Chief Executive Officer
Office of Hawaiian Affairs
711 Kapiolani Ave.
Honolulu, HI 96813

Dear Dr. Crabbe:

The University of Hawaii is currently in the pre-consultation process for a proposed hydrologic study of the Humu'ula Saddle region and the installation of two small-diameter test holes that will document the geology and hydrology underlying the central to western Saddle region. The prospective locations evaluated for the planned boreholes include portions of TMK parcels: 3-4-4-16-005, 3-4-4-16-006, and 3-4-4-16-007. We expect the activities associated with drilling of boreholes will each occupy approximately 1 acre of land during drilling and that those activities will have durations of about six months for each borehole. Each of the prospective sites that were selected for drilling have experienced prior uses and are believed to have neither significant environmental or cultural resources; we do not anticipate the need to clear or grade the sites as they have been graded/leveled during their prior use.

We are contacting OHA to solicit any concerns or comments that they may have regarding the proposed project. The analysis of the impacts of the project has identified night-time lighting and noise associated with the drill rig engines as potentially have detectable impacts over the largest region surrounding the prospective drill sites. We have identified mitigation measures including shielding of lights used on the prospective sites to ensure minimal dispersal of light, monitoring of the site for any evidence of impacts on night-time migratory birds, and muffling of the rig motors if noise levels offsite exceed County limitations. Potential favorable impacts may accrue to: Office of Hawaiian Affairs beneficiaries, if shallow groundwater resources are identified, due to the need for water to supply ~57,000 acres of OHA lands in the eastern Saddle region; and to the residents of the Big Island in the better understanding of the water resources available to both users of the Saddle region in particular and to those who farm and ranch on the upper slopes of Mauna Kea.

We have posted digital copies of the preliminary draft Environmental Assessment for review at the following locations:
Adobe Acrobat pdf format:
https://docs.google.com/file/d/0B2HdabpCpa_oMk53VWhuWjVRcHVJdlN2MXJrREJqZw/edit
MS Word format:
https://docs.google.com/file/d/0B2HdabpCpa_oZGpBYnktM0dRQWFQRVkwRElMTHhKZw/edit
Should you wish to receive paper copies of the document please contact me at your convenience at the following address:

Dr. Donald Thomas
Center for the Study of Active Volcanoes
200 W. Kawili St.
Hilo, HI 96720

Written comments can be sent via U.S. Mail to the above address or electronically to dthomas@soest.hawaii.edu. If possible, we would request that comments be forwarded to my office by the second week of May in order to allow us to compile comments and modify the draft in time to submit the Draft EA to the Office of Environmental Quality Control by mid-May for publication.

Thank you,

Donald Thomas
Principal Investigator

NEIL ABERCROMBIE
GOVERNOR
STATE OF HAWAI'I

ALBERT "ALAPAKI" NAHALE-A
CHAIRMAN
HAWAIIAN HOMES COMMISSION

MICHELLE K. KAUHANE
DEPUTY TO THE CHAIRMAN

STATE OF HAWAI'I
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAI'I 96805

April 24, 2012

Donald M. Thomas, Director
Center for the Study of Active Volcanoes
200 W. Kawili Street
Hilo, Hawaii 96720-4091

Subject: Environmental Assessment (EA) Pre-Assessment Consultation, University of Hawaii - Hawaii Institute of Geophysics and Planetology, Humu'ula Saddle Region Detailed Hydrologic Evaluation and Exploratory Drilling Program, Multiple TMKs, Humu'ula, Hawai'i Island, Hawai'i

Dear Dr. Thomas:

Thank you for the opportunity to provide pre-assessment comments prior to the Draft Environmental Assessment (DEA) for the Hawaii Institute of Geophysics and Planetology, Humu'ula Saddle Region Detailed Hydrologic Evaluation and Exploratory Drilling Program. The Department understands that the project at this stage is for drilling of two test wells using state-of the-art diamond wireline core drilling technology, and associated testing and sampling. The selection of the specific sites for drilling will rely on any new information provided by the environmental review process as well as the geologic and hydrologic information provided by the initial borehole.

As adjacent landowners engaged in our own planning processes, it is our responsibility to engage with other agencies and plan appropriately for the larger region. In addition, it is our priority to ensure that DHHL's plans are as consistent as possible with other plans for the area.

Please consider the following comments on the proposed project in the development of the Draft Environmental Assessment:

1. The Department of Hawaiian Home Lands (Department) owns the Humu'ula tract, approximately 48,750 acres in the Central Hawai'i Region which is considered a high priority planning area. It is a rural and isolated tract recommended for pastoral use, with a total of 78 Pastoral lots of 100 acres each recommended. Water connections will constitute a significant share of development costs for these lots. Please reflect the location of Hawaiian Home Lands on the location and other maps.

2. Please include cultural resource impact assessment information for the Humu'ula area. In addition to the volcanoes themselves, the areas between the volcanoes is also culturally significant to N(n)ative Hawaiians and our beneficiaries may exercise rights of traditional access for gathering, spiritual and cultural practices in the vicinity of the testing. Consultation with cultural practitioners that use the area should be conducted.

3. Please continue to keep the Department informed as to the environmental review process as well as the progress and results of the research program. Water is life, and the results of this study as well as future research efforts may provide important benefits to the Department and its beneficiaries.

We thank you for the opportunity to provide preliminary comments as part of early consultation for preparation of a Draft Environmental Assessment. If you have any questions, please contact Nancy McPherson at our Planning Office via email at nancy.m.mcpherson@hawaii.gov or by phone at 808.620.9519.

Aloha and mahalo,

Albert "Alapaki" Nahale-a, Chairman
Hawaiian Homes Commission

Attachments

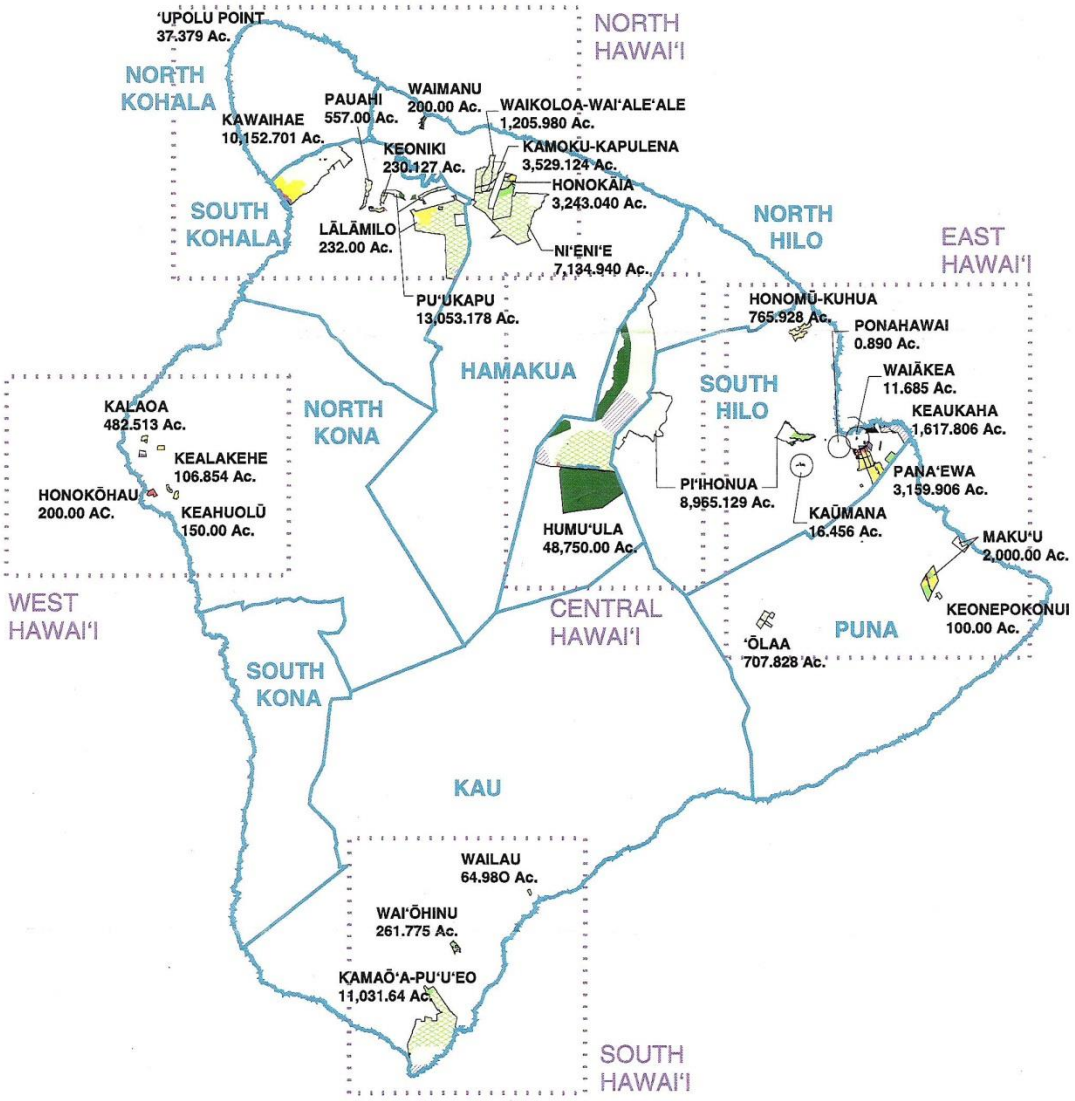


Figure 1
Locational Map

HAWAI'I LAND INVENTORY

DEPARTMENT OF HAWAIIAN HOME LANDS — ISLAND OF HAWAI'I

NORTH

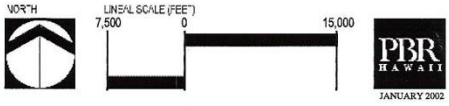
NEAI SCALE (FEET)
40,000 0 80,000

PBR HAWAII

MAY 2002

Land Use	Lot Count	Lot Size
Pastoral	78 Lots	100 Acs.

Figure 17
HUMU'ULA-PI'IHONUA TRACT
HAWAI'I LAND INVENTORY
DEPARTMENT OF HAWAIIAN HOME LANDS — ISLAND OF HAWAI'I



JANUARY 2002

University of
Hawai'i
MĀNOA

Hawai'i Institute of Geophysics and Planetology
School of Ocean and Earth Sciences and Technology
1680 East-West Rd., Honolulu, HI 96822
Telephone (808) 221-2135 FAX (808) 956-6322

June 22, 2012

Mr. Albert Alapaki Nahale-a
Chair
Hawaiian Home Commission
P.O. Box 1879
Honolulu, HI 96805

Dear Mr. Nahale-a:

Thank you for your letter and comments on the Preliminary Draft Environmental Assessment for our project: Humu'ula Saddle Region: Detailed Hydrologic Evaluation and Exploratory Drilling Program. We appreciate your taking the time to review the document in detail and for offering suggested improvements to the Preliminary Draft.

You suggested that:

1) We include more detail on the location of the DHHL lands within the eastern Humu'ula Saddle region: we have added new maps and modified several of the prior ones to include a clear designation of the lands under DHHL jurisdiction and their relationship to the planned research and drilling activities.
2) We include additional information on historical uses and cultural activities that occurred within the Humu'ula Saddle region and that we consult with cultural practitioners that use this area: we have expanded our discussion of the historical and cultural uses of the Saddle region and broadened the focus of that discussion to include uses of the eastern Saddle region. We have also consulted with the PTA Cultural Advisory Committee as part of the assessment process and have sent out requests for comment to a number of groups having an interest in perpetuation of Hawaiian culture (see Appendix B). We have continued our outreach to the Hawaiian community on the project and believe that should be an ongoing effort throughout the duration of the project. We appreciate your providing us with additional information and contacts to continue this effort; certainly if you receive an feedback or inquiries from your beneficiaries regarding the project, we would be more than happy to meet with them and discuss the project or how we might mitigate any concerns that they may have regarding the project.
3) We provide your agency with updates on the progress of the project and the findings that arise from the investigation: we will do that. In past projects of this nature, we have maintained a web site at which we post daily updates on the project progress; as that becomes established, we will provide the web link to that and your staff will be able to track our progress in as near real time as we are able to provide project results.

Thank you again for your comments on the Preliminary Draft Environmental Assessment; should additional issues of mutual interest arise regarding the project, please don't hesitate to contact me at your convenience.

Best regards,

Donald Thomas

Donald Thomas
Project Director

Additional informal pre-consultation for the second test hole site was conducted by project director prior to submission of the Draft Environmental Assessment. Specifically, the following organizations were provided with a detailed description of the findings of the first test hole and the rationale for selection of the second test hole site along with a description of the preferred site for the second test hole:

Pohakuloa Training Area Cultural Advisory Committee and Staff

Office of Mauna Kea Management Environment Committee

Office of Mauna Kea Management Kahu Ku Mauna

Department of Hawaiian Home Lands Land Management Staff

No adverse comments or concerns regarding the proposed drilling program or its proposed location were provided by the participants at those presentations.

APPENDIX D

Comment Communications Received
in Response to
Draft Environmental Assessment
and
Anticipated Finding of No Significant Impact

Subject: Hu'umula drilling
From: "Cory \(Martha\) Harden" <mh@interpac.net>
Date: 8/25/2012 7:24 PM
To: "'Donald Thomas'" <dthomas@soest.hawaii.edu>

Please acknowledge receipt

Comments on DEA/AFNASI for Humu'ula Saddle Region of Hawai'i Island: A Detailed Hydrological Evaluation and Exploratory Drilling Program

Hello Don Thomas,

I hope you will consider these comments, though they are late due to workload and the McAfee problem. After I get back on the Internet, I will try to send more information on the Modernization, TMT, and Pan-Starrs EISs. I apologize for the delay.

Please test the water for

- Depleted uranium

- Hazardous substances and potential contaminants noted in these EISs:
  Draft Programmatic EIS for Modernization of Training Infrastructure and Construction and Operation of an Infantry Platoon Battle Area…at Pohakuloa Training Area, October 2011

  Draft EIS for the Thirty Meter Telescope, May 23, 2009-- pages 3-94 to 3-95

  Draft Supplemental Programmatic EIS for Army Growth and Force Structure Relignment, U.S. Army Pacific, May 2008, Section 4.4.14

  Pan-STARRS EIS 2007?

  Final EIS for Outrigger Telescopes Project, February 2005, sections 3.1.4.5 and 3.1.5.2

  Final EIS for Transformation of the 2nd Brigade, 25th Infantry Division (Light) to a Stryker Brigade Combat Team in Hawai'i, May 2004-- sections about Pohakuloa in appendices K-2 p. 10 to 16, K-5, and M-1l

- Substances cited in these articles, since they may be in one of the Pohakuloa dumps (see letter to editor below) :
  "Army Road has interesting history", Kent Warshauer, Hawai'i Tribune-Herald, 9-8-02
  For tests in Upper Waiakea Forest Reserve1964-1967:
  Bacillus globigii bacteria
  Serratia marcescens bacteris
  Fluorescent powder
  G-B/ Sarin
  B-Z

  For tests betwen Stainback Highway and Saddle Road 1966-1967:

Triisopropanoilamine salt piclorin
24D/ DDT

"Nerve gas tests detailed", Hawai'i Tribune-Herald, 10-10-02
For tests in Upper Waiakea Forest Reserve and Olaa Forest Preserve, May-June 1966:
Sarin nerve gas
Benzilic acid
Defoliants

My letter to editor, December 2003 (excerpts):
WAIAKEA: MORE ARMY SECRETS?

What's in the Pohakuloa dump? "All the residue from the test pits [at Waiakea Forest Reserve] will be buried in the trash dump at the Pohakuloa Training Area this week" states an October 1970 Army memo.

The memo is in a DERP report on"Possible biological/chemical contamination as a result of prior open-air testing of incapacitating and lethal chemical agents and biological stimulants" conducted secretly in Waiakea in the 1960s. (1)

The Army says it has no documents indicating what went into the dump and whether anything leached out.

But a 1992 report states "In the past unknown wastes were disposed of in the landfill however no records of contents were kept…There is probably release to the environment due to improper facility design and maintenance…No attempts to contain wastes have been made." (2)

Why is Waiakea information still classified?
The DERP report is missing in "Appendix A (CONFIDENTIAL) and "Test details" which are in "several classified reports."

Appendix A is cited in connection with "potential sources of environmental contamination and hazards" and "hazardous/toxic material" and "an operation…to locate and remove all remaining hazardous materials and ordnance…"

The Army says Appendix A is still "classified" almost forty years after the tests.

Why the secrecy around cleanup?
A commander from DTC (DESERET Test Center, Utah) who came to help clean up Waiakea wanted "his activities kept quiet until we hear further from him." A DTC staff person "stated that DTC should not be affiliated with the project and for this reason all personnel working in the forest would be in civilian coveralls." And for cleanup the Army made sure "No mention of the DTC would be made." (3)…

(1) Defense Environmental Restoration Program report July 1988
(2) Pohakuloa Federal Facility Preliminary Assessment/ Site Inspection Review July 1992
(3) per 1970s memos in DERP report

In February 20034, the Army said Appendix A had been destroyed and was not available to the best of their knowledge. I have more information if you wish to see it.

Mahalo,

Cory Harden
PO Box 10265
Hilo, Hawai'i 96721
mh@interpac.net
808-968-8965

Subject: revised comments
From: "Cory \(Martha\) Harden" <mh@interpac.net>
Date: 8/27/2012 8:42 PM
To: "GVT STA HI UH Thomas, Don" <dthomas@soest.hawaii.edu>

Please acknowledge receipt

Hello Don Thomas,
Revisions are in red. Sorry for the delay, some of it caused by computer problems. Cory

.....

Revised Comments on DEA/AFNASI for Humu'ula Saddle Region of Hawai'i Island: A Detailed Hydrological Evaluation and Exploratory Drilling Program

Documents with no Web address should be available at the University of Hawai'i or Hilo Public Library.

Please test the water for

- Depleted uranium

- Hazardous substances and potential contaminants noted in these EISs:

  Draft Programmatic EIS for Modernization of Training Infrastructure and Construction and Operation of an Infantry Platoon Battle Area…at Pohakuloa Training Area, October 2011, section 3.11 pp. 3-116 to 3-124

  Final EIS for the Thirty Meter Telescope, May 8, 2010, pp. 3-124 to 127
  http://www.tmt-hawaiieis.org/pdfs/feis/feis_volume_1_reduced.pdf

  Final EIS for Military Training Activities at Makua Military Reservation, June 2009
  Section 3.11, pp. 3-337 to 3-363
  http://www.garrison.hawaii.army.mil/makua/FinalDocs
  /Makua%20FEIS%20Volume%201%20-%20Chapter%203.pdf

  Section 4.11, pp. 4-211 to 4-279
  http://www.garrison.hawaii.army.mil/makua/FinalDocs
  /Makua%20FEIS%20Volume%201%20-%20Chapter%204.pdf
  Appendix G-3 Muliwai Sediment Sampling Report (pages unknown since file doesn't come in well)
  http://www.garrison.hawaii.army.mil/makua/FinalDocs
  /Makua%20FEIS%20Volume%202%20Appendix%20G-
  3_Muliwai%20Sediment%20Sampling%20Report_Part1.pdf

  http://www.garrison.hawaii.army.mil/makua/FinalDocs
  /Makua%20FEIS%20Volume%202%20Appendix%20G-
  3_Muliwai%20Sediment%20Sampling%20Report_Part2.pdf

  Final Supplemental Programmatic EIS for Army Growth and Force Structure Realignment, U.S. Army Pacific, July 2008, Section 4.4.14, pp. 252-256
  http://aec.army.mil/usaec/nepa/usarpacdspeis_july08.pdf

Final EA for renovation of the UH- Hilo 24-inch telescope, August 2006

Final EIS for Outrigger Telescopes Project, February 2005, sections 3.1.4.5 and 3.1.5.2
http://www.docstoc.com/docs/41159058/FINAL-ENVIRONMENTAL-IMPACT-STATEMENT-FOR-THE-OUTRIGGER-TELESCOPES

Final EIS for Transformation of the 2nd Brigade, 25th Infantry Division (Light) to a Stryker Brigade Combat Team in Hawai'i, May 2004, sections about Pohakuloa in appendices K-2 p. 10 to 16, K-5, and M-11
http://aec.army.mil/usaec/nepa/sbctfeis.pdf

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Mahalo,

Cory Harden
PO Box 10265
Hilo, Hawai'i 96721
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808-968-8965

University of
Hawai'i
MĀNOA

Hawai'i Institute of Geophysics and Planetology
School of Ocean and Earth Sciences and Technology
1680 East-West Rd., Honolulu, HI 96822
Telephone (808) 221-2135 FAX (808) 956-6322

September 5, 2012

Ms. Cory Harden
PO Box 10265
Hilo, Hawai'i 96721

Dear Ms. Harden:

Thank you for your email messages of August 25 and 27 with comments related to the Draft Environmental Assessment for our project: Humu'ula Saddle Region: Detailed Hydrologic Evaluation and Exploratory Drilling Program. We appreciate your taking the time to review the document. Although your comments arrived after the end date of the 30 day comment period, August 23, we will include the text of your messages along with this response letter in the Final Environmental Assessment and Finding of No Significant Impact.

In your letter you requested that we test the water we encounter in the well for hazardous substances and potential contaminants noted in the following documents:

Draft Programatic EIS for Modernization of Training Infrastructure and Construction and Operation of an Infantry Platoon Battle Area at Pohakuloa Training Area, dated October 2011;

Final EIS for the Thirty Meter Telescope, dated May 8, 2010;

Final EIS for Military Training Activities at Makua Military Reservation, dated June, 2009;

Final Supplemental Programmatic EIS for Army Growth and Force Structure Realignment, U.S. Army Pacific, dated July 2008;

Final EA for renovation of the UH-Hilo 24-inch telescope, dated August 2006;

Final EIS for Outrigger Telescopes Project, dated February 2005;

Final EIS for Transformation of the 2nd Brigade, 25th Infantry Division (Light) to a Stryker Brigade Combat Team in Hawaii, dated May 2004. (As a point of information, the appendices you cite for this document extend only to Appendix E, Appendices K and M, do not exist.)

You also requested that we test for substances cited in a number of newspaper articles and letters to the editor submitted by you and others to the Hawaii Tribute Herald:

"Army Road has interesting history", Kent Warshauer, Hawai'i Tribune-Herald, dated 9-8-02;

"**Nerve gas tests detailed",** Hawaii Tribune Herald, dated 10-10-2002;

Your letter to the editor titled "**Waiakea: More Army Secrets?"**, dated December 2003.

Although not presented in detail in the Draft EA, we will be conducting analyses of groundwater samples collected from the test holes. Our primary objective is to determine the source of the groundwater, determine the residence times (if possible) of water within the different aquifers encountered, and to define the water quality within the aquifers. As part of that effort, we will be conducting major and trace element analyses of the waters, isotopic analysis of the hydrogen and oxygen isotopes, and age dating, using ^{14}C analysis, of the carbon dioxide in the water. As part of our water quality analyses, we expect to also analyze the major aquifers for potential contaminants mandated by the Hawaii Department of Health (HDOH) for new sources of drinking water. The latter include a broad suite of potentially toxic heavy metals (e.g. lead, chromium, cadmium, etc.) as well as a suite of herbicides and pesticides and other organic compounds associated with fuels and solvents. I have attached a full list of the compounds that are mandated for testing by the Hawaii Department of Health for your reference. We expect to publish the results of our chemical analyses in the refereed scientific literature at the conclusion of the project.

With respect to the documents cited in your message, a majority of the contaminants specifically mentioned there are present in the HDOH list and they will be analyzed for. However, the EA/EIS documents you cite also contain non-specific references to an open-ended collection of potential contaminants that we have neither the capabilities within the project to sample for, nor the project funding with which to perform the necessary analyses. Further, some of the specific constituents that you have mentioned in your message are so labile that, even if they had been present at some time in the past, their environmental half-life would have reduced their concentrations to non-detectable values decades ago. For example, literature estimates of the half-life of Sarin, a neurotoxin cited in your message, range from a few minutes to several hours; B-Z, another neurological toxicant you cite, is given an environmental half-life of ~10 days. Even if these compounds had been present in the environment in past decades, the likelihood that they could have survived even long enough to reach groundwater, at an estimated 1,000 m below the ground surface, in this low rainfall environment, is vanishingly small; and the likelihood that those compounds would have survived to the present are smaller still. The converse may be true for some of the other constituents you request analysis of: Bacillus globigii and Serratia marcescens bacteria are both listed as being nearly ubiquitous in the environment and found in moist soils and damp environments. Even if found, it would be nearly impossible to determine their origin. If, on conducting the planned analyses, we find evidence of migration of contaminants from surface spills or disposal (e.g. fuel constituents, solvents, etc.) then we may seek to expand the analytical program to further characterize the extent of the contamination.

Thank you again for taking the time to review our Draft Environmental Assessment and for your comments on the project. As we complete the environmental and regulatory review process, we will begin preparations for the project and will have a website at which we will be posting progress updates on a regular basis. Please feel free to contact me in the future and I will be happy to provide the url for that site after we have it established.

Best regards,

Donald Thomas
Project Director

CONTAMINANTS TO BE TESTED IN ALL NEW SOURCES OF DRINKING WATER

(Based on Chapter 11-20, effective November 28, 2005 and Code of Federal Regulations Title 40, Part 141 of July 1, 2006, the Phase I and Phase II Rule effective January 1, 1993, and the Phase V Rule effective January 17, 1994)

MICROBIOLOGICAL

- Total Coliform
- Fecal Coliform (MPN) or E. Coli
- Microscopic Particulate Analysis *(surface water sources, springs, shafts, tunnels, and wells with less than 50 feet of solid grouting - by EPA Consensus Method, EPA 910/0-92-029, October 1992)*

WATER QUALITY PARAMETERS

- Alkalinity
- Calcium
- Chlorine residual
- Conductivity
- pH (field measurement)
- Temperature (field measurement)
- Turbidity

INORGANIC CHEMICALS

- Antimony
- Arsenic
- Asbestos
- Barium
- Beryllium
- Cadmium
- Chromium
- Copper
- Cyanide
- Fluoride
- Lead
- Mercury
- Nickel
- Nitrate (as nitrogen)
- Nitrite (as nitrogen)
- Selenium
- Thallium

ORGANIC CHEMICALS

Volatile Organic Chemicals

- Benzene
- Carbon Tetrachloride
- Chlorobenzene
- o-Dichlorobenzene
- p-Dichlorobenzene
- 1,2-Dichloroethane
- 1,1-Dichloroethylene
- cis-1,2-Dichloroethylene
- trans-1,2-Dichloroethylene
- Dichloromethane
- 1,2-Dichloropropane (DCP)
- Ethylbenzene

Volatile Organic Chemicals (cont.)

- Styrene
- Tetrachloroethylene
- Toluene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- 1,2,4-Trichlorobenzene
- Trichloroethylene
- Vinyl Chloride
- Xylenes (total)

Synthetic Organic Chemicals

- 2,4-D
- Alachlor
- Aldicarb
- Aldicarb Sulfone
- Aldicarb Sulfoxide
- Atrazine
- Benzo(a)Pyrene
- Carbofuran
- Chlordane
- Dalapon
- Dibromochloropropane (DBCP)
- Di(2-ethylhexyl)adipate
- Di(2-ethylhexyl)phthalate
- Dinoseb
- Diquat
- Dioxin (2,3,7,8-TCDD)
- Endothall
- Endrin
- Ethylene Dibromide (EDB)
- Glyphosate
- Heptachlor
- Heptachlor epoxide
- Hexachlorobenzene
- Hexachlorocyclopentadiene
- Lindane
- Methoxychlor
- Oxamyl (Vydate)
- Pentachlorophenol
- Picloram
- Polychlorinated biphenyls (PCBs)
- 2,4,5-TP (Silvex)
- Simazine
- Toxaphene
- 1,2,3-Trichloropropane (TCP)

RADIONUCLIDES

- Beta/photon emitters
- Gross alpha particle
- Combined radium 226/228
- Uranium

NOTES:

(1) With the exception of turbidity and water quality parameters, all analyses must be performed by a laboratory certified or approved by the Hawaii Department of Health, State Laboratories Division. However, turbidity and water quality parameters must be done using EPA approved methods.

(2) Please consult with the Safe Drinking Water Branch for acceptable laboratories to perform Microscopic Particulate Analysis.

(3) All laboratory reports must be submitted to allow the Department of Health to verify that the analyses were performed by an approved laboratory, using EPA approved methods for drinking water analysis. The EPA method and detection levels must be clearly stated for each chemical contaminant tested.

(4) The Director of Health may require additional analyses whenever appropriate to evaluate the new source.

SURFACE WATER AND GROUNDWATER UNDER THE DIRECT INFLUENCE OF SURFACE WATER (GWUDI) SOURCES ONLY:

The following additional water quality parameters may be required by the State at its discretion:

- Wet and dry weather Microscopic Particulate Analyses (MPA) using *Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), EPA 910/9 29-029 EPA (October 1992)*
- MPA analyses shall be accompanied by a particle sizing analysis (down to 2 um) with the tabular results segregated by size in bins reflective of *Cryptosporidium* and *Giardia* sized particles, as well as those particles smaller and larger in size, e.g. <2 um, 2-5 um, 5-15 um, 15-30 um, 30-50 um, 50-100 um, >100 um.
- Total Suspended Solids (TSS)
- Color (True and Apparent)
- Total Organic Carbon (TOC)
- Dissolved Organic Carbon (DOC) fraction
- Total Trihalomethane Formation Potential (TTHM FP)
- Five Haloacetic Acid Formation Potential (HAA5 FP)

The State reserves the right to require pilot testing of all alternative filtration technologies, applicable under HAR 11-20-46(c)(2)(D), on all surface water or GWUDI sources proposed for use in a regulated public water system. Water quality parameters not listed here may be added to the pilot testing protocol at State discretion.

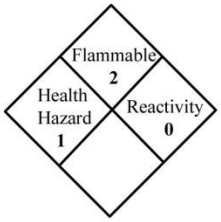
APPENDIX E

Material Safety Data Sheets

For Drilling Materials

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET



NFPA FIRE HAZARD
IDENTIFICATION SYSTEM

I. PRODUCT IDENTIFICATION

Trade Name(s): **AIR FOAM®**

Generic Name(s): Detergent

Chemical Name(s): Proprietary blend of anionic aliphatic and aromatic sulfonates

Manufacturer:	Telephone Numbers:
WYO-BEN, INC. Address: P.O. Box 1979 Billings, MT 59103	Information: (406) 652-6351 EMERGENCY: (406) 652-6351

II. HAZARDOUS INGREDIENTS

Ingredient	CAS No.	%	Hazard
Isopropanol	67-63-0	2-5	Concentrated vapors may be combustible in enclosed areas (See Section IV) and may be irritating or nauseous (See Section VI).

III. PHYSICAL DATA

Boiling Point (°F): ND	Specific Gravity (H_2O=1): 1.08
Vapor Pressure (mm. Hg): ND	Melting Point: NA
Vapor Density (Air = 1): ND (Est. to be heavier than air)	Evaporation Rate (Butyl Acetate = 1): ND
Solubility in Water: Completely soluble	pH: 6.5 - 7.5
Density (at 20° C): 9.0 lb./gal.	Viscosity: 100 – 200 cPs @ 25˚C

Appearance and Odor: Light yellow liquid with alcohol odor.

IV. FIRE AND EXPLOSION DATA

Flash Point: 151°F [66.1˚C] OSHA Flammability Class: Combustible IIIA	Flammable Limits: LEL: ND UEL: ND

Special Fire Fighting Procedures: Wear full protective clothing. Emergency personnel should be equipped with NIOSH approved SCBA with full face piece operated in the positive pressure mode. Cool exposed containers with water.

Unusual Fire and Explosion Hazards: Heating may cause pressure buildup and possible rupture of containers.

Extinguishing Media: Water fog, dry chemical, alcohol resistant foam or CO_2.

V. REACTIVITY

Stability: Stable at normal temperatures. Avoid high temperatures.

Hazardous Polymerization: Will not occur.

Incompatibility: Strong oxidizing agents, strong acids.

Hazardous Thermal Decomposition Products: SO_x, $N0_x$ and NH_x

NA = Not Applicable ND = Not Determined	

Date Updated: October 29, 2007 Doc #: 4010-90

VI. HEALTH HAZARD INFORMATION

Routes of Exposure and Effects:

Eyes: Vapors may be irritating; contact by liquid may be moderately to severely irritating.

Skin: Prolonged or repeated skin contact may remove skin oils leading to mild dermatitis (irritation and redness).

Inhalation: Vapors may cause headache, nausea, disorientation and other symptoms of exposure to isopropyl alcohol. Air borne mists or sprays may result in non-specific irritation to the upper respiratory tract.

Ingestion: May cause irritation to mouth and gastrointestinal tract, nausea, vomiting, cramps and diarrhea. No chronic affects, either local or systemic, are known.

Permissible Exposure Limits:	OSHA PEL	ACGIH		NIOSH	
(for air contaminants)	(8hr. TWA)	(TWA)	(STEL)	(TWA)	(STEL)
Isopropyl alcohol	400 ppm (980 mg/m^3)	200 ppm	400 ppm	400 ppm (980 mg/m^3)	500 ppm (1225 mg/m^3)

Carcinogenicity: Not listed by NTP, IARC or OSHA.

State Right-to-Know (California): May contain trace amounts of Formaldehyde (CAS# 50-00-0) and 1,4-Dioxane (CAS # 123-91-1) as a by-products which can be absorbed through the skin or by inhalation. Formaldehyde and 1,4-Dioxane are cancer-suspect agents that may cause a variety of injuries with over-exposure.

Oral LD_{50} Rat: (Isopropanol) 5045 mg/kg	Oral LD_{50} Rat: (Isopropanol) 5045 mg/kg	Oral LD_{50} Rat: (Isopropanol) 5045 mg/kg

Emergency and First Aid Procedures:

Eyes: Immediately flush with clear water for 15 minutes holding eyelids open. Obtain medical attention if irritation persists.

Skin: Flush thoroughly with large amounts of water. Obtain medical attention if irritation persists.

Inhalation: Remove to fresh air; give oxygen or artificial respiration and seek medical attention if necessary.

Ingestion: Obtain medical attention if ingestion does occur. Treat symptomatically.

VII. HANDLING AND USE PRECAUTIONS

Steps to be Taken if Material is Released or Spilled: Eliminate all sources of ignition. Ventilate area. Keep upwind of spill and out of low areas. Wear suitable protective clothing. Prevent additional discharge. Contain area of spill and recover by pumping or with suitable absorbent. All equipment should be grounded. If not significantly contaminated, product may be used as originally intended.

Waste Disposal Methods: Incineration preferred. Sorbed product may be disposed of in a permitted landfill in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Store in dry, well ventilated area. Do not handle or store near an open flame. Do not get in eyes, on skin, on clothing or ingest. Wash skin & clothing thoroughly after contact with liquid.

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

Ventilation Requirements: Provide adequate local exhaust ventilation to maintain exposure below exposure limits.

Respirator: If vapors are present use NIOSH or MSHA approved regulator for organic vapors. SCBA recommended when vapors present in high concentrations.

Eye Protection: Mono-goggles or full face shield suggested if splashing is possible.

Gloves: Chemical resistant.

Other Protective Clothing or Equipment: Synthetic, chemical resistant apron; eye wash station should be nearby.

IX. SPECIAL PRECAUTIONS

Store in cool (below 120° F) well ventilated area. Keep away from heat, sparks or open flame. Ground all equipment to prevent static discharge. Do not use with hypochlorite bleach since skin sensitizing sultones may form.

As with most detergents, this product may be toxic to aquatic life due to its interference with oxygen uptake mechanisms. For this reason it should not be allowed to enter streams or lakes or other aquatic habitats.

DEPARTMENT OF TRANSPORTATION HAZARDOUS MATERIAL INFORMATION

(FOR SHIPMENTS WITHIN THE U.S. ONLY)**

** Shipping Name: Combustible Liquid (NOS)	Hazardous Substance: Alcohol
** Cautionary Labeling: Combustible Liquid	** Hazard Class: Combustible Liquid (DOT 173.115) (for containers having more than 1,000 lbs. ONLY)

Date Updated: October 29, 2007 Doc. #: 4010-90

Ciba Specialty Chemicals Corporation

Material Safety Data Sheet

OSHA / ANSI Z400.1-2004 Compliant

MSDS date: 30-Mar-2006

NFPA Rating:	**Health:** 1	**Flammability:** 1	**Instability:** 0	
HMIS Rating:	**Health:** 1	**Flammability:** 1	**Physical Hazard:** 0	**Personal Protection:** X

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: **ALCOMER 120L**

Product Number: **5991062**

Chemical Family: Copolymer of sodium acrylate and acrylamide dispersed in mineral oil.

Manufacturer/Supplier:

Ciba Specialty Chemicals Corporation
2301 Wilroy Road
Suffolk, VA 23434
8:30am - 5pm Phone Number: 1-757-538-3700
MSDS Request Line (voicemail): 1-800-431-2360
Customer Service/Product Information 1-800-322-3885

Emergency 24-Hour Health/Environmental Phone: 1-800-873-1138

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word:	CAUTION!
Physical Form:	Liquid
Color:	White to off-white
Odor:	Slight hydrocarbon oil-like odor
Health:	Contact causes eye irritation. Contact causes skin irritation.
Physical Hazards:	Slip hazard when wet.

OSHA Hazardous Substance: This material is classified as hazardous under OSHA regulations.

Primary Route(s) of Entry: Eyes, Skin, Inhalation, Ingestion.

3. COMPOSITION/INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS

Components	CAS Number	Weight %
Distillates, petroleum, hydrotreated heavy naphthenic	64742-52-5	30-40
Alcohols, C12-15, ethoxylated propoxylated	68551-13-3	1-5
Naphtha, petroleum, hydrotreated heavy	64742-48-9	0-5

4. FIRST AID MEASURES

Eyes: Flush the eye(s) with lukewarm, gently flowing water for 5-10 minutes or until the chemical is removed. Get medical attention if irritation persists.

Skin: Wash off immediately with soap and plenty of water. Get medical attention if irritation occurs. If clothing is contaminated, remove and launder before reuse.

Inhalation: Remove to fresh air, if not breathing give artificial respiration. If breathing is difficult, give oxygen and get immediate medical attention.

Ingestion: Do not induce vomiting. If vomiting occurs naturally, have casualty lean forward to reduce the risk of aspiration. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

Fire Fighting Measures: Standard procedure for chemical fires. The product becomes slippery when wet. Restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Suitable Extinguishing Media: Carbon dioxide, dry chemical or foam.

Unsuitable Extinguishing Media: If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Fire Fighting Equipment: Wear self-contained breathing apparatus and protective suit.

Unusual hazards: The product is slippery when wet.

Hazardous Combustion Products: Burning may produce oxides of carbon or nitrogen.

6. ACCIDENTAL RELEASE MEASURES

Cleanup Instructions: Absorb spill with inert material (e.g. dry sand or earth), then place in a chemical waste container. Spills are very slippery. Clean up promptly.

Other Information: This product may be classified as an oil under Section 311 of the Clean Water Act and 40 CFR Part 1 10, Part 1 12. Spills entering (A) surface waters or (B) any water courses or sewers entering/leading to surface waters that cause a sheen must be reported to the National Response Center (NRC: 800-424-8801). In Washington, DC metropolitan areas call 202-426-2675.

7. HANDLING AND STORAGE

Handling: As with all industrial chemicals, use good industrial practices when handling. Avoid eye, skin, and clothing contact. Do not inhale. Do not taste or swallow. Use only with adequate ventilation.

Storage: Keep containers tightly closed in a cool, well-ventilated place. Avoid extremes of temperature.

For Industrial Use Only

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines:

There are no OSHA or ACGIH exposure guidelines available for component(s) in this product.

Components	OSHA PEL	OSHA STEL	ACGIH TWA	ACGIH STEL	Ciba/ Manufacturer IEL:
Distillates, petroleum, hydrotreated heavy naphthenic 64742-52-5	2000 mg/m^3 500 ppm				

Personal Protective Equipment

Eye/Face Protection: Wear splash proof chemical goggles.

Skin Protection: Wear chemical resistant gloves and protective clothing.

Respiratory Protection: Use NIOSH approved respirator as needed to mitigate exposure.

Engineering Controls: Work in well ventilated areas. Do not breathe vapors or mist. Local exhaust/ventilation recommended.

Other Protective Equipment: Eye wash station and safety shower should be available in immediate work area. Select additional protective equipment based upon potential for exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form: Liquid
Color: White to off-white
Odor: Slight hydrocarbon oil-like odor.
Boiling Point: > 100°C (212°F)
Freezing/Melting Point: Not determined
Solubility in water: Soluble, solubility limited by viscosity
Vapor Density: Not determined
Vapor Pressure: Not determined
Specific Gravity: 1.1
pH: 7.5 (1 % solution)
Percent Volatile: Not determined
VOC: Not determined
Partition Coefficient (Octanol/Water): Not determined
Autoignition Temperature: Not determined
Decomposition Temperature: Not determined
Flammability Limits in Air:
Upper Not determined
Lower Not determined

Flash point: > 93°C (200°F)
Test Method (for Flash Point): PMCC

10. STABILITY AND REACTIVITY

Stability:	Stable.
Conditions to Avoid:	Avoid temperature extremes, especially frost and freezing conditions.
Incompatibility:	Strong oxidizing agents. (may degrade polymer)
Hazardous Decomposition Products:	No decomposition expected under normal storage conditions.
Possibility of Hazardous Reactions:	None expected.

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:	Not determined.
Acute Dermal Toxicity:	Not determined
Acute Inhalation Toxicity:	Not determined.
Eye Irritation:	Not determined.
Skin Irritation:	Not determined.
Skin Sensitization:	Not determined
Carcinogenicity (IARC; NTP; OSHA; ACGIH):	None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.
Carcinogenicity Studies:	Not listed as a carcinogen by IARC, NTP, OSHA, or ACGIH.
Mutagenicity:	Not determined
Reproductive Toxicity:	Not determined
Teratogenicity:	Not determined.
Neurotoxicity:	Not determined
Subacute Toxicity:	Not determined
Subchronic Toxicity:	Not determined
Chronic toxicity:	Not determined
Absorption / Distribution / Excretion / Metabolism:	Not determined
Additional Information:	Not determined

12. ECOLOGICAL INFORMATION

Toxicity to Fish:	LC50 811 mg/L 96 hour (Rainbow trout)
Toxicity to Invertebrates:	Not determined
Toxicity to Algae:	Not determined
Toxicity to Sewage Bacteria:	Not determined
Activated Sludge Respiration Inhibition Test:	Not determined
Biochemical Oxygen Demand (BOD):	Not determined
Chemical Oxygen Demand (COD):	Not determined
Total Oxygen Demand (TOD):	Not determined
Biodegradability:	Not determined
Bioaccumulation:	Not determined
Additional Environmental Data:	Product not considered toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with local, state, provincial and federal regulations.

14. TRANSPORT INFORMATION

U.S. Department of Transportation (DOT):

Not regulated for this mode of transport.

DOT (Bulk) Oil Statement:
This product is considered to be an oil per the definitions in 49 CFR 130.2. If packed in a container with a capacity of 3,500 gallons or more, the Communication Requirements at 49 CFR 130.11 and the Response Plan Requirements at 49 CFR 130.31 and 130.33 apply to Domestic transportation by motor vehicles and rolling stock.

Notification of releases to the National Response Center (NRC), 800-424-8802, may be necessary. In the Washington, DC metropolitan area, call 202-426-2675.

International Maritime Dangerous Goods (IMDG):

Not regulated for this mode of transport.

International Air Transportation Authority (IATA):

Not regulated for this mode of transport.

15. REGULATORY INFORMATION

Federal Regulations

OSHA Hazardous Substance: This material is classified as hazardous under OSHA regulations

Clean Air Act - Hazardous Air Pollutants (HAP): This product contains the following Hazardous Air Pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).

Components	CAA Section 112 Statutory Hazardous Air Pollutants
2-propenamide 79-06-1 (0-0.05 %)	Listed.

Clean Air Act - Volatile Organic Compounds (VOC): This product contains the following SOCMI Intermediate or Final Volatile Organic Compounds (VOC), as defined by the U.S. Clean Air Act Section 111 (40 CFR 60.489).

Components	CAA Section 111 Volatile Organic Compounds
2-propenamide 79-06-1	Listed.

Clean Air Act - Ozone Depleting Substances (ODS): This product neither contains, nor was manufactured with, a Class I or Class II ozone depleting substance (ODS), as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App. A+B).

Clean Water Act - Priority Pollutants (PP): This product does not contain any priority pollutants listed under the U.S. Clean Water Act Section 307 (2)(1) Priority Pollutant List (40 CFR 401.15).

Resource Conservation and Recovery Act (RCRA): Not a hazardous waste under RCRA (40 CFR 261.21).

SARA Section 302 Extremely Hazardous Substances (EHS): This product contains the following component(s) regulated under Section 302 (40 CFR 355) as Extremely Hazardous Substances.

Components	Section 302 Extremely Hazardous Substances (EHS)
2-propenamide 79-06-1 (0-0.05 %)	Listed.

SARA Section 304 CERCLA Hazardous Substances: This product contains the following component(s) regulated under Section 304 (40 CFR 302) as hazardous chemicals for emergency release notification ("CERCLA" List).

Components	Section 304 CERCLA Hazardous Substances	CERCLA Reportable Quantity
2-propenamide 79-06-1 (0-0.05 %)	Listed.	5000 LBS

SARA Section 311/312 Hazard Communication Standard (HCS): This product is regulated under Section 311/312 HCS (40 CFR 370). Its hazard(s): Acute (immediate) health hazard.

SARA Section 313 Toxic Chemical List (TCL): This product does not contain any component(s) listed on the Section 313 Toxic Chemical List.

TSCA Section 8(b) Inventory Status: All component(s) comprising this product are either exempt or listed on the TSCA inventory.

TSCA Section 5(e) Consent Orders: This product is not subject to a Section 5(e) Consent Order.

TSCA Significant New Use Rule (SNUR): This product is not subject to a Significant New Use Rule (SNUR).

TSCA Section 5(f): This product is not subject to a Section 5(f)/6(a) rule.

TSCA Section 12(b) Export Notification: This product does not contain any component(s) that are subject to a Section 12(b) Export Notification

State Regulations

California Proposition 65: This product contains the following component(s) currently on the California list of Known Carcinogens and Reproductive Toxins.

Components	California Proposition 65
2-propenamide *79-06-1*	Carcinogenic.

Pennsylvania Right-To-Know: This product contains the following component(s) which are subject to Pennsylvania Right-to-Know disclosure requirement.

Components	CAS Number	Pennsylvania Right-to-Know
2-Propenoic acid, sodium salt, polymer with 2-propenamide	25085-02-3	Not Listed.
Distillates, petroleum, hydrotreated heavy naphthenic	64742-52-5	Listed.
Naphtha, petroleum, hydrotreated heavy	64742-48-9	Not Listed.
Alcohols, C12-15, ethoxylated propoxylated	68551-13-3	Not Listed.
2-propenamide	79-06-1	Listed. Environmental hazard.

International Regulations

Chemical Weapons Convention (CWC): This product does not contain any component(s) listed under the Chemical Weapons Convention Schedule of Chemicals.

Domestic Substance List (DSL) Status: All components either exempt or listed on the DSL.

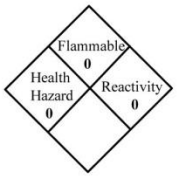
16. OTHER INFORMATION

Reason for revision: MSDS update.

Disclaimer: The information contained herein is based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to such data or information. The user is responsible for determining whether the product is suitable for its intended conditions of use.

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET



NFPA FIRE HAZARD
IDENTIFICATION SYSTEM

I. PRODUCT IDENTIFICATION

Trade Name(s): **NATURALGEL®**

Generic Name(s): Wyoming (Western) Bentonite; Bentonite Clay (CAS No. 1302-78-9)

Chemical Name(s): Sodium Montmorillonite (CAS No. 1318-93-0)

Manufacturer: **WYO-BEN, INC.** Address: P.O. Box 1979 Billings, Montana 59103	Telephone Numbers: Information: (406) 652-6351 EMERGENCY: (406) 652-6351

II. HAZARDOUS INGREDIENTS

Ingredient	CAS NO.	%	Hazard
Crystalline Silica (SiO_2) as Quartz	14808-60-7	See Note	Low concentrations of crystalline silica (SiO_2) in the form of quartz may be present in airborne bentonite dust. See Section VI for discussion of health hazard.

Note: Although the typical quartz content of western bentonite is in the range of 2 to 6% most of the quartz particles are larger than the 10 µ respirable threshold size. The actual respirable quartz concentration in airborne bentonite dust will depend upon bentonite source, fineness of product, moisture content of product, local humidity and wind condition at point of use and other use specific factors.

III. PHYSICAL DATA

Boiling Point (°F): NA	Specific Gravity (H_2O=1): 2.45-2.55
Vapor Pressure (mm. Hg): NA	Melting Point: Approx. 1450°C
Vapor Density (Air = 1): NA	Evaporation Rate (Butyl Acetate = 1): NA
Solubility in Water: Insoluble, forms colloidal suspension.	pH: 8-10 (5% aqueous suspension)
Density (at 20° C): 55-68 lbs./cu.ft. as product.	

Appearance and Odor: Bluegray to green as moist solid, light tan to gray as dry powder. No odor.

IV. FIRE AND EXPLOSION DATA

Flash Point: NA	Flammable Limits: LEL: NA UEL: NA

Special Fire Fighting Procedures: NA

Unusual Fire and Explosion Hazards: None. Product will not support combustion.

Extinguishing Media: None for product. Any media can be used for the packaging. Product becomes slippery when wet.

V. REACTIVITY

Stability: Stable

Hazardous Polymerization: None

Incompatibility: None

Hazardous Decomposition Products: None

NA = Not Applicable ND = Not Determined

Date Prepared: October 5, 2007 Doc #1060-00:

VI. HEALTH HAZARD INFORMATION

Routes of Exposure and Effects:

Skin: Possible drying resulting in dermatitis.

Eyes: Mechanical irritant.

Inhalation: *Acute* (short term) exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough. *Chronic* (long term) exposure to airborne bentonite dust containing respirable size (≤ 10 µm) quartz particles, where respirable quartz particle levels are higher than TLV's, may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion may be symptomatic.

Ingestion: No adverse effects.

Permissible Exposure Limits: (for air contaminants)	OSHA PEL (8hr. TWA)	ACGIH TLV
Bentonite as "Particulates not otherwise regulated" (formerly nuisance dust)		
Total dust	15mg/m^3	ND
Respirable dust	5mg/m^3	ND
Crystalline Silica: Quartz (respirable)	10 mg/m^3 % Silica + 2	0.025 mg/m^3

Carcinogenicity: Bentonite is not listed by ACGIH, IARC, NTP or OSHA. IARC, 1997, concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica from occupational sources (IARC Class 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. NTP classifies respirable crystalline silica as "known to be a human carcinogen" (NTP 9th Report on Carcinogens – 2000). ACGIH classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

Acute Oral LD_{50}: ND	Acute Dermal LD_{50}: ND	Aquatic Toxicology LC_{50}: ND

Emergency and First Aid Procedures:

Skin: Wash with soap and water until clean.

Eyes: Flush with water until irritation ceases.

Inhalation: Move to area free from dust. If symptoms of irritation persist contact physician. Inhalation may aggravate existing respiratory illness.

VII. HANDLING AND USE PRECAUTIONS

Steps to be Taken if Material is Released or Spilled: Avoid breathing dust; wear respirator approved for silica bearing dust. Vacuum up to avoid generating airborne dust. Avoid using water. Product slippery when wetted.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Use NIOSH/MSHA respirators approved for silica bearing dust when free silica containing airborne bentonite dust levels exceed PEL/TLV's. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

Ventilation Requirements: Mechanical, general room ventilation. Use local ventilation to maintain PEL's/TLV's.

Respirator: Use respirators approved by NIOSH/MSHA for silica bearing dust.

Eye Protection: Generally not necessary. Personal preference.

Gloves: Generally not necessary. Personal preference.

Other Protective Clothing or Equipment: None

IX. SPECIAL PRECAUTIONS

Avoid prolonged inhalation of airborne dust.

DEPARTMENT OF TRANSPORTATION HAZARDOUS MATERIAL INFORMATION

Shipping Name: NA (Not Regulated)	Hazard Class: NA
Hazardous Substance: NA	Caution Labeling: NA

Date Prepared: October 5, 2007 Doc #1060-00:

APPENDIX F

Drilling Equipment

Photograph of Drill Rig Proposed for Use in Core Drilling Project

Photograph of drill rig proposed for use in Core Drilling Project:
Operator end with mast fully extended

Photograph of Drill Rig Proposed for Use in Core Drilling Project:
Side view of rig with mast extended

Power Products

Print Version

Back | Current Location: Home > Serial Number Database > Results (Power Units)

Power Units | DC Gensets | CANtrak | MyCPP | International | Records | Contact Us

Details for Engine Serial Number: 46800895 - View Full Order

Cummins Distributors - Click Here for Additional Details

Purchased By:	Cummins Eastern Canada, Inc.	P.O. Number:	1338078
Job Name:	ANDRE ROY	Ship Date:	9/28/2007 1:12:02 PM
Order Date	5/7/2007 10:52:55 AM	Horsepower:	275
Engine Model:	QSC8.3-P	Base Only:	☐
Paint Code:	Primer	Enclosure:	☑
Comments:			

CPP Option	Cummins Option	Description	Parts Information
AA11186	AAPU10153	25 G/CFM AIR CLEANER	
DE11083	DEPU10062	DECALS	
EA11034	EAPU10020	ENGINE ACCESSORIES, J1939 HARNESS	
EC11097	ECPU10081	ENGINE CONTROL, 12 FT. EXTENSION	
EN11134	ELPU10108	ENCLOSURE, FULL, TOP A/C	
GE11109	GEPU10096	ELECTRICAL SYSTEM, HEATER GRID, 12V	
GE11128	GEPU10117	ELECTRICAL SYSTEM, 12V DELCO 20SI OR GREATER	
GE11134	GEPU10121	GROUND STRAP	
IN11177	INPU10163	INSTRUMENT ASSY., 12V OR 24V, 24FT. EXTENSION	
MM11184	MMPU10151	BASE RAILS, W/O ISOLATION, SAE#1	
OD11006	ODPU10002	Oil Drain	
PP11004	PPPU10004	PACKING MATERIALS	
RA11216	RAPU10137	COOLING SYSTEM, SUCKER, 125 LAT, W/CAC	
RI11003	RIPU10003	A-SERIES TO QSK23 RESTRICTION INDICATOR W/ 25" H2O RESTRICTION	
WL11009	WLPU10009	WATER LEVEL SENSOR	

Engine specifications for the preferred drilling equipment for this project

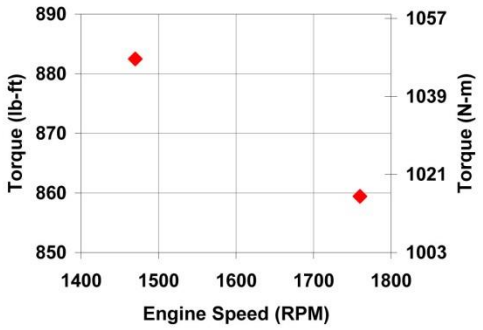
Engine Performance Curve
Cummins Fire Power
DePere, WI 54115
http://www.cumminsfirepower.com

Basic Engine Model
CFP83-F40
Curve Number: **FR - 90940**
Revision Date: **November 2006**

Engine Family:	**G Drive**	CPL Code:	**8000**
Displacement - in.3 (litre):	**505 (8.3)**	Emission Certification:	**2002 EPA/CARB Tier 2**
Dry Weight - lbs (kg):	**2045 (920)**	Aspiration:	**Turbocharged, Chrg Air Cooled**
Compression Ratio:	**16.8:1**	Engine Configuration:	**D413035GX02**
No. of Cylinders:	**6**	Minimum rating:	**247 HP @ 1470 RPM**
Fuel System:	**Bosch - P7100 Inline**	Maximum rating:	**288 HP @ 1760 RPM**

Torque Output *

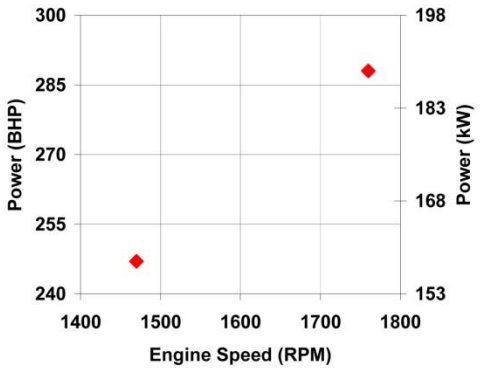
RPM	lb-ft	N-m
1470	882	1196
1760	859	1165



Horsepower Output *

RPM	BHP	kW
1470	247	184
1760	288	215

***CFP83-F40 is not a speed rated engine.**



1. Curves shown above represent mature gross engine performance capabilities obtained and corrected in accordance with SAE J1349 conditions of 29.61 in Hg (100 kPa) barometric pressure [300 ft. (91.4 m) altitude], 77 °F (25 °C) inlet air temperature, and 0.30 in. Hg (1 kPa) water vapor pressure with No. 2 diesel fuel.

2. The engine may be operated without changing the fuel setting up to 300 ft. (91.4 m) altitude and up to 77 °F (25 °C) ambient temperature. For sustained operation at high altitudes, the fuel rate of the engine should be adjusted to limit performance by 3% per 1,000 ft. (305 m) above 300 ft. (91.4 m) altitude. For sustained operation at high ambient temperatures, the fuel rate of the engine should be adjusted to limit performance by 1% per 10 °F above 77 °F (2% per 11 °C above 25 °C).

3. Engine is certified at only 1470 and 1760 RPM.

Scott Danforth
Engineering Manager

Certified Within 5%

Performance Curve for CFP83-F40 Drawing No. 9744, Rev. C

This and the next several pages provide the engine operating characteristics and atmospheric emissions of the preferred drilling equipment.

Cummins Fire Power	**Engine Datasheet** **Cummins Fire Power** DePere, WI 54115 http://www.cumminsfirepower.com	Basic Engine Model **CFP83-F40**
		Curve Number: **FR - 90940** CPL Code: **8000**
Configuration Number: **D413035GX02** Installation Drawing: **8710**		Engine Family: **Industrial** Revision Date: **November 2006**

General Engine Data

Type	4 Cycle; In-Line; 6 Cylinder	
Aspiration	Turbocharged, Chrg Air Cooled	
Bore & Stroke - in. (mm)	4.49 x 5.32	(114 x 135)
Displacement - $in.^3$ (litre)	505	(8.3)
Compression Ratio	16.8:1	
Valves per Cylinder - Intake	1	
- Exhaust	1	
Dry Weight - lb (kg)	2045	(920)
Wet Weight - lb (kg)	2117	(953)
Maximum Allowable Bending Moment @ Rear Face of Block - lb.-ft. (N-m)	1000	(1356)

Air Induction System

Max. Temperature Rise Between Ambient Air and Engine Air Inlet - °F (°C)	30	(16.7)
Maximum Inlet Restriction with Dirty Filter - in. H_2O (mm H_2O)	25	(635)
Recommended Air Cleaner Element - (Standard)	Donaldson (CFP) B105006	(8535)
- (Optional)	K&N (CFP) RU5045	(9606)

Lubrication System

Oil Pressure Range at Rated - PSI (kPa)	40-60	(276-414)
Oil Capacity of Pan (High - Low) - U.S. quarts (litre)	20-16	(18.9-15.1)
Total System Capacity - U.S. Gal. (litre)	6.3	(23.8)
Recommended Lube Oil Filter	Fleetguard (Cummins) LF9009	(3401544)

Cooling System

Raw Water Working Pressure Range at Heat Exchanger - PSI (kPa)	60	(413) MAX
Recommended Min. Water Supply Pipe Size to Heat Exchanger - in. (mm)	1.00	(25.40)
Recommended Min. Water Disch. Pipe Size From Heat Exchanger - in. (mm)	1.25	(31.75)
Coolant Water Capacity (Engine Side) - U.S. gal. (litre)	5.9	(22.3)
Standard Thermostat - Type	Modulating	
- Range - deg F (deg C)	180-203	(82-95)
Minimum Raw Water Flow with Water Temperatures to 90 °F (32 °C) - U.S. GPM (litre/s)	30	(1.89)
Recommended Cooling Water Filter	Fleetguard (Cummins) WF2072	(4058964)

A jacket water heater is mandatory on this engine. The recommended heater wattage is 2250 down to 40 °F (4 °C).

Exhaust System

Max. Back Pressure Imposed by Complete Exhaust System in in. H_2O (kPa)	40.8	(10.2)
Exhaust Pipe Size Normally Acceptable - in. (mm)	5.0	(127)

Noise Emissions

Top	97.7 dBa
Right Side	97.7 dBa
Left Side	97.7 dBa
Front	97.7 dBa
Exhaust	N/A dBa

The noise emission values are estimated sound pressure levels at 3.3 ft. (1 m.).

Fuel Supply / Drain System	**1470**	**1760**
CFP83-F40 Nominal Fuel Consumption - Gal./hr. (L/hr)	11.8 (44.8)	14.5 (55.0)
Fuel Type	Number 2 Diesel Only	
Minimum Supply Line Size - in. (mm)	0.375	(9.53)
Minimum Drain Line Size - in. (mm)	0.25	(6.35)
Maximum Fuel Line Length Between Supply Tank & Fuel Pump - ft. (m)	40	(12)
Maximum Fuel Height above C/L Crankshaft - in. (mm)	80	(2032)
Recommended Fuel Filter - Primary ..... Fleetguard (Cummins).....	FS1251	(3286503)
- Secondary	None	
Maximum Restriction @ Lift Pump-Inlet - With Clean Filter - in. Hg (mm Hg)	4.0	(102)
Maximum Restriction @ Lift Pump-Inlet - With Dirty Filter - in. Hg (mm Hg)	8.0	(203)
Maximum Return Line Restriction - Without Check Valves - in. Hg (mm Hg)	10	(254)
Minimum Fuel Tank Vent Capability - ft^3/hr (m^3/hr)	12	(0.36)
Maximum Fuel Temperature @ Lift Pump Inlet - °F (°C)	160	(71)

Starting and Electrical System	**12V**	**24V**
Min. Recommended Batt. Capacity - Cold Soak at 0°F (-18°C) or Above		
Engine Only - Cold Cranking Amperes - (CCA)	1250	625
Engine Only - Reserve Capacity - Minutes	400	800
Battery Cable Size (Maximum Cable Length Not to Exceed 5 ft. [1.5 m] AWG)	00	00
Maximum Resistance of Starting Circuit - Ohms	0.002	0.004
Typical Cranking Speed - RPM	120	120
Alternator (Standard), Internally Regulated - Ampere	95	45
Wiring for Automatic Starting (Negative Ground)	Standard	
Reference Wiring Diagram	8512	

Performance Data

All data is based on the engine operating with fuel system, water pump, lubricating oil pump, air cleaner, and alternator; not included are compressor, fan, optional equipment, and driven components. Data is based on operation at SAE standard J1394 conditions of 300 ft. (91.4 m) altitude, 29.61 in. (752 mm) Hg dry barometer, and 77 °F (25 °C) intake air temperature, using No.2 diesel or a fuel corresponding to ASTM-D2.

Altitude Above Which Output Should be Limited - ft. (m)	300	(91.4)
Correction Factor per 1000 ft. (305 m) above Altitude Limit	3%	
Temperature Above Which Output Should be Limited - °F (°C)	77	(25)
Correction Factor per 10 °F (11 °C) Above Temperature Limit	1%	(2%)

Exhaust Emissions (EPA Tier T2) [Reference Emissions Data Doc. 9812]	**g/kW-hr**	**g/BHP-hr**
Hydrocarbons (HC/OMHCE)	0.14	0.10
Oxides of Nitrogen (NOx)	5.37	4.00
Non-Methane Hydrocarbons + NOx (NMHC+NOx)	5.51	4.11
Carbon Monoxide (CO)	0.60	0.45
Particulate	0.09	0.07

FM Approved and UL Listed Ratings for CFP83-F40

Engine Speed - RPM	**1470**	**1760**
CFP83-F40 Output - BHP (kW)	**247 (184)**	**288 (215)**
Ventilation Air Required for Combustion - CFM (litre/sec)	492 (232)	657 (310)
Exhaust Gas Flow - CFM (litre/sec)	1247 (589)	1632 (770)
Exhaust Gas Temperature - °F (°C)	971 (522)	952 (511)
Engine Heat Rejection to Coolant- BTU/min. (kW)	3184 (56)	3854 (68)
Engine Heat Rejection to Ambient - BTU/min. (kW)	1497 (26)	1470 (26)

All Data is Subject to Change Without Notice.

Manager Engineering: ***Scott Danforth***
Cummins Fire Power, DePere, WI 54115 U.S.A.

THE SULLAIR AIR COMPRESSOR

750XHH/900XHDL

750 CFM AT 500 PSIG/900 CFM AT 350 PSIG
355 L/S AT 34.5 BAR/425 L/S AT 24 BAR

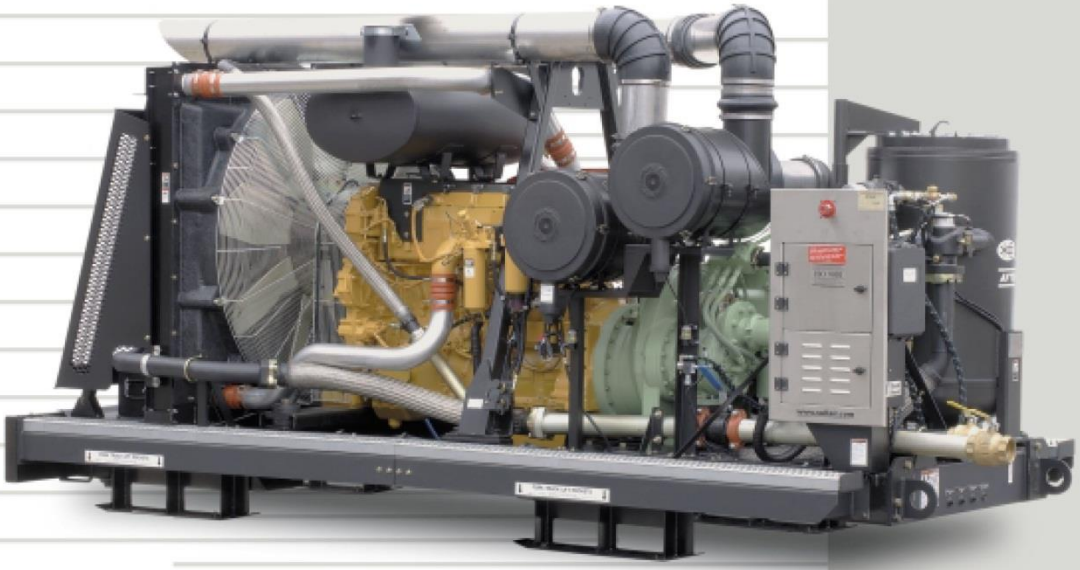
900XHH/1150XHDL

900 CFM AT 500 PSIG/1150 CFM AT 350 PSIG
425 L/S AT 34.5 BAR/543 L/S AT 24 BAR

1150XHH/1350XHDL

1150 CFM AT 500 PSIG/1350 CFM AT 350 PSIG
543 L/S AT 34.5 BAR/637 L/S AT 24 BAR

- ROTARY SCREW COMPRESSOR
- COMPASS CONTROLLER
- ELECTRONIC ENGINE CONTROL
- DUAL CAPACITY/DUAL PRESSURE
- WEATHER-PROOF INSTRUMENT PANEL
- PROTECTIVE SHUTDOWN SWITCHES
- CONTAINMENT FRAME
- REMOTE FLUID DRAINS
- TWO-STAGE AIR FILTERS WITH SAFETY ELEMENTS
- AWF COMPRESSOR FLUID
- 0 to 100% CAPACITY CONTROL



SULLAIR®

This is the recommended air compression system for use with the air foam system of coring. The specific model will be the 1150XHH.

"COMPASS" Controller
The Brains of the system monitors every aspect of the compressor and engine.

Monitoring and Control System
The user friendly Control Panel (housed in a weathertight enclosure) provides real time system information.

Rotary Screw Compressor
Two-stage, fluid flooded. Cast iron housing is dimensionally stable, thick-walled and machined to close tolerances.

Sullair AWF Compressor Fluid
Improved hot and cold weather lubrication. Longer compressor fluid life. Extended air-end warranty.

"COMPASS" Controller
Gauges and a LCD Graphic Display on the "COMPASS" Controller indicate:

- discharge pressure,
- discharge temperature,
- ambient air temperature,
- separator restriction,
- aftercooler air temperature and louver activation if equiped,
- engine speed,
- hours of operation,
- voltage,
- engine coolant temperature,
- engine coolant level,
- fuel level,
- fuel usage rate,
- fuel pressure,
- fuel temperature,
- percent engine load,
- engine air temperature, and
- engine oil pressure.
- compressor and engine status

Indicator lights for:

- low fuel,
- high compressor temperature,
- compressor shutdown and warning
- engine shutdown and warning.

An engine diagnostic service port, displayed diagnostic messages and retrievable shutdown history includes all monitored system parameters at time of shutdown,

high/low selector switch and a rocker-type start switch are also provided,

back lit swiches and gauges for night use,

E-stop, and auto and remote start capability

Dual Performance
The compressor incorporates well proven Spiral Valve technology into the first stage of the air-end to achieve dual performance.Two distinct compressor models in one package.

0 to 100% Capacity Control
Automatic inlet valve and unloaded starting.

Two-Stage Dry-Type Filters
Filters incorporate safety elements and are positioned to draw cool ambient air.

Open Frame Design
Heavy duty frame with mounting feet offers complete fluid containment and remote "bulkhead" drain valves for all fluids. The unit is provided without on-board fuel tanks.

Quick connect fuel couplings to easily fuel from a remote fuel tank.

Single point lifting bail.

Low Emission Engine Technology
Complies with Tier 3 and Stage 3 emission legislation.

Air End Warranty
5 year or 10,000 hour warranty when continuously serviced at the recommended intervals with Sullair AWF Compressor Fluid and filters.

Options
Sullair's options allow you to customize the compressor to meet your specifications without paying for items you don't need.

Block heater
Aftercooler with moisture separator
Louvers
Special color paint

This product is manufactured to the highest quality standards in an ISO 9001 certified quality system.

SPECIFICATIONS, WEIGHTS AND DIMENSIONS—SULLAIR 750XHHDL, 900XH, 900XHHDL, 1150XH, 1150XHHDL, 1350XH COMPRESSORS

Delivery @ Rated Pressure	Rated Pressure psig (bar)	Designated Model	Weight (wet) lbs (kg)	Length in (mm)	Width in (mm)	Height in (mm)
*750 / 900 cfm (355 L/S / 425 L/S)	500 / 350 (34.5/24)	Open Frame	13050 (5919)	182 (4623)	86 (2185)	87 (2210)
**900 / 1150 cfm (425 L/S / 543 L/S)	500 / 350 (34.5/24)	Open Frame	13050 (5919)	182 (4623)	86 (2185)	87 (2210)
***1150 / 1350 cfm (543 L/S / 637 L/S)	500 / 350 (34.5/24)	Open Frame	13050 (5919)	182 (4623)	86 (2185)	87 (2210)

Engine Make	Engine Type	Engine Model	Displacement cu in (cc)	Cylinders	Cycles	Bore and Stroke in (mm)	Rated Speed rpm	Rated Power hp (kW)
*Caterpillar	Diesel	C-15 ACERT	928 (15.2)	6	4	5.4 X 6.7 (137 X 171)	1800	475 (354)
**Caterpillar	Diesel	C-15 ACERT	928 (15.2)	6	4	5.4 X 6.7 (137 X 171)	1800	540 (403)
***Caterpillar	Diesel	C-18 ACERT	1106 (18.1)	6	4	5.7 X 7.2 (145 X 183)	1800	630 (476)

SULLAIR.

www.sullair.com

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SULLAIR EUROPE, Zone des Granges, BP 82, 42602 Montbrison, Cedex, France, Telephone: (33) 4.77.96.84.70 Fax: (33) 4.77.96.84.99
SULLAIR ASIA LTD., 74 Joo Koon Circle, Jurong, Singapore 629093, Telephone: (65) 861-1211 Fax: (65) 861-2967 Telex RS25117
SULLAIR ASIA, 1 Sullair Road, Chiwan, Shenzhen, China 518068, Telephone: (86) 755-6853477 or (86) 755-6851686 Fax: (86) 755-6853473
SULLAIR TAIWAN LTD., 3F-1., No.248, Chung Shan Road, Lin-Kou Hsiang, Taipei Hsien, Telephone: (02)2601-3500, Fax: (02)2601-3032
SULLAIR ARGENTINA, Goncalves Dias 1145, 1276 Buenos Aires, Argentina, Telephone: 54-11-5941-4444, Fax: 54-11-5941-4549

DIESEL GENERATOR SET

CATERPILLAR®

Image shown may not reflect actual package.

STANDBY
400 ekW 500 kVA
50 Hz 1500 rpm 400 Volts

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

FEATURES

FUEL/EMISSIONS STRATEGY
EU Stage II Emissions Compliant
Suitable for Mobile Applications
in the European Community

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE PRODUCT SUPPORT
- Cat dealers provide extensive post sale support including maintenance and repair agreements
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- The Cat® S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT® C15 ATAAC DIESEL ENGINE
- Utilizes ACERT™ Technology
- Reliable, rugged, durable design
- Field-proven in thousands of applications worldwide
- Four-stroke diesel engine combines consistent performance and excellent fuel economy with minimum weight
- Electronic engine control

CAT GENERATOR
- Matched to the performance and output characteristics of Cat engines
- Load adjustment module provides engine relief upon load impact and improves load acceptance and recovery time
- UL 1446 Recognized Class H insulation

CAT EMCP 3 SERIES CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway

The diesel engine use for the Sulair compressor is CAT C15 ATAAC engine described in this date sheet.

STANDBY 400 ekW 500 kVA

50 Hz 1500 rpm 400 Volts

CATERPILLAR®

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Light Duty Air filter • Service indicator	[ ] Single element air filter [ ] Dual element air filter [ ] Heavy-duty dual element air filter with precleaner [ ] Air inlet shut-off
Cooling	• Radiator package mounted • Coolant level sight gauge • Coolant drain line with valve • Fan and belt guards • Cat® Extended Life Coolant	[ ] Radiator duct flange [ ] Low coolant level sensor
Exhaust	• Dry exhaust manifold • Stainless steel flex fittings with split-cuff connection • Exhaust flange outlet	[ ] Industrial [ ] Residential [ ] Critical Mufflers [ ] Manifold and turbocharger guards [ ] Elbows and through-wall kits
Fuel	• Primary fuel filter with integral water separator • Secondary fuel filters • Fuel priming pump • Engine fuel transfer pump • Fuel cooler* • Flexible fuel lines *Not included with packages without radiators	[ ] Integral single wall fuel tank base [ ] Integral dual wall fuel tank base [ ] Fuel level switch
Generator	• Class H insulation • Self excited (SE) • Class H temperature rise • VR6 voltage regulator with 3-phase sensing with load adjustment module • IP23 protection	[ ] Oversize generators [ ] Permanent magnet excitor (PMG) [ ] Internal excited (IE) [ ] Digital voltage regulator (CDVR) with kVAR/PF [ ] Anti-condensation space heaters [ ] Coastal Insulation Protection (CIP) [ ] Reactive droop
Power Termination	• Power Center houses EMCP controller and power/control terminations (rear mounted) • Circuit breaker, UL listed, 3 pole (80% & 100% Rated) • Circuit breaker, IEC compliant, 3-4 pole (100% Rated) • Segregated low voltage wiring termination panel • IP22 protection • Bottom cable entry	[ ] Power Center mounting option (right side) [ ] Multiple circuit breakers [ ] C.B. Shunt trips [ ] C.B. Auxiliary contacts
Governor	• ADEM™A4	[ ] Load share module
Control Panel	• EMCP 3.1 (rear mounted) • Speed adjustment • Voltage adjustment • Emergency stop pushbutton	[ ] EMCP 3.2 (can be RH mounted) [ ] Local annunciator modules [ ] Remote annunciator modules [ ] Discrete I/O module
Lube	• Lubricating oil • Oil drain line with valves • Oil filter and dipstick • Fumes disposal • Lube oil level indicator • Oil cooler	[ ] Oil temperature sensor [ ] Manual sump pump
Mounting	• Formed steel narrow base frame • Linear vibration isolation-seismic zone 4	[ ] Oil skid base [ ] Formed steel wide base frame
Starting/Charging	• 24 volt starting motor • 24 volt, 45 amp charging alternator	[ ] Jacket water heater [ ] Block heater [ ] Ether starting aid [ ] Oversize batteries [ ] Battery disconnect switch [ ] Battery charger (5 or 10 Amp) [ ] Batteries with rack and cables
General	• Paint - Caterpillar Yellow except rails and radiators gloss black • Flywheel housing - SAE No.1	[ ] EU Certificate of Conformance [ ] Weather protective enclosure [ ] Sound attenuated protective enclosure

STANDBY 400 ekW 500 kVA

50 Hz 1500 rpm 400 Volts

CATERPILLAR®

SPECIFICATIONS

CAT GENERATOR

Frame size..... LC6114D
Excitation..... Self Excitation
Pitch..... 0.6667
Number of poles..... 4
Number of bearings..... Single Bearing
Number of Leads..... 012
Insulation..... UL 1446 Recognized Class H with tropicalization and antiabrasion
- Consult your Caterpillar dealer for available voltages
IP Rating..... IP23
Alignment..... Pilot Shaft
Overspeed capability..... 125% of rated
Wave form Deviation (Line to Line)..... 2%
Voltage regulator..... Three phase sensing
Voltage regulation..... Less than +/- 1/2% (steady state) Less than +/- ½% (w/ 3% speed change)
Telephone influence factor..... Less than 50
Harmonic Distortion..... Less than 5%

CAT DIESEL ENGINE

C15 ATAAC, L-6, 4-stroke water-cooled diesel
Bore..... 137.20 mm (5.4 in)
Stroke..... 171.40 mm (6.75 in)
Displacement..... 15.20 L (927.56 in^3)
Compression Ratio..... 16.1:1
Aspiration..... ATAAC
Fuel System..... MEUI
Governor Type..... Caterpillar ADEM control system

CAT EMCP 3 SERIES CONTROLS

- EMCP 3.1 (Standard)
- EMCP 3.2 / EMCP 3.3 (Option)
- Single location customer connector point
- True RMS metering, 3-phase
- Controls
  - Run / Auto / Stop control
  - Speed Adjust
  - Voltage Adjust
  - Emergency Stop Pushbutton
  - Engine cycle crank
- Digital Indication for:
  - RPM
  - Operating hours
  - Oil Pressure
  - Coolant temperature
  - System DC volts
  - L-L volts, L-N volts, phase amps, Hz
  - ekW, kVA, kVAR, kW-hr, %kW, PF (EMCP 3.2 / 3.3)
- Shutdowns with common indicating light for:
  - Low oil pressure
  - High coolant temperature
  - Low coolant level
  - Overspeed
  - Emergency stop
  - Failure to start (overcrank)
- Programmable protective relaying functions: (EMCP 3.2 & 3.3)
  - Under and over voltage
  - Under and over frequency
  - Overcurrent (time and inverse time)
  - Reverse power (EMCP 3.3)
- MODBUS isolated data link, RS-485 half-duplex (EMCP 3.2 & 3.3)
- Options
  - Vandal door
  - Local annunciator module
  - Remote annunciator module
  - Input / Output module
  - RTD / Thermocouple Modules
  - Monitoring software

STANDBY 400 ekW 500 kVA

50 Hz 1500 rpm 400 Volts

CATERPILLAR®

TECHNICAL DATA

Open Generator Set - - 1500 rpm/50 Hz/400 Volts	DM9185	
EU Stage II		
Generator Set Package Performance		
Genset Power rating @ 0.8 pf	500 kVA	
Genset Power rating with fan	400 ekW	
Fuel Consumption		
100% load with fan	112.8 L/hr	29.8 Gal/hr
75% load with fan	82.3 L/hr	21.7 Gal/hr
50% load with fan	57.0 L/hr	15.1 Gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Engine Coolant capacity with radiator/exp. tank	57.8 L	15.3 gal
Engine coolant capacity	20.8 L	5.5 gal
Radiator coolant capacity	37.0 L	9.8 gal
Inlet Air		
Combustion air inlet flow rate	33.0 m^3/min	1165.4 cfm
Exhaust System		
Exhaust stack gas temperature	520.6 ° C	969.1 ° F
Exhaust gas flow rate	92.6 m^3/min	3270.1 cfm
Exhaust flange size (internal diameter)	152.4 mm	6.0 in
Exhaust system backpressure (maximum allowable)	6.8 kPa	27.3 in. water
Heat Rejection		
Heat rejection to coolant (total)	158 kW	8985 Btu/min
Heat rejection to exhaust (total)	414 kW	23544 Btu/min
Heat rejection to atmosphere from engine	84 kW	4777 Btu/min
Heat rejection to atmosphere from generator	27.8 kW	1581.0 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	923 skVA	
Frame	LC6114D	
Temperature Rise	163 ° C	293 ° F
Lube System		
Sump refill with filter	60.0 L	15.9 gal
Emissions (Nominal)[3]		
NOx mg/nm3	1840.6 mg/nm^3	
CO mg/nm3	347.8 mg/nm^3	
HC mg/nm3	6.3 mg/nm^3	
PM mg/nm3	12.8 mg/nm^3	

[1] For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.
[2] Generator temperature rise is based on a 40° C (104° F) ambient per NEMA MG1-32.
[3] Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77°F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

Note in above sheet: Emissions (Nominal) are for the air emissions from the diesel engine driving the recommended air compressor to be used for this project.

STANDBY 400 ekW 500 kVA

50 Hz 1500 rpm 400 Volts

CATERPILLAR®

RATING DEFINITIONS AND CONDITIONS

Meets or Exceeds International Specifications: AS1359, CSA, IEC60034-1, ISO3046, ISO8528, NEMA MG 1-22, NEMA MG 1-33, UL508A, 72/23/EEC, 98/37/EC, 2004/108/EC

Standby - Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year. Standby power in accordance with ISO8528. Fuel stop power in accordance with ISO3046. Standby ambients shown indicate ambient temperature at 100% load which results in a coolant top tank temperature just below the shutdown temperature.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions. **Fuel rates** are based on fuel oil of 35° API [16° C (60° F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29° C (85° F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Additional ratings may be available for specific customer requirements, contact your Cat representative for details. For information regarding Low Sulfur fuel and Biodiesel capability, please consult your Cat dealer.