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QUALITY CONTROL

June 26, 2012

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

Dear Director Hooser:

#### Draft Environmental Assessment for: Humu'ula Saddle Region of Hawaii Island: A Detailed Subject: Hydrologic Evaluation and Exploratory Drilling Program; Hamakua District, Hawaii Island

The University of Hawaii has reviewed the Draft 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 Publication 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.

Sincerely,

any M. alter .

Gary Ostrander Vice Chancellor for Research and Graduate Education

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# Agency Action EA Chapter 343, HRS Publication Form

Project Name:	Draft Environmental Assessment; Humu'ula Saddle Region of Hawaii Island: A Detailed Hydrologic Evaluation and Exploratory Drilling Program
Island: District:	Hawaii Island Hamakua TMK 3.4.4.16.005; TMK 3.4.4.16.006; and TMK 3.4.4.16.007;
Permits:	Non-Covered Source Permit; Observation Well Drilling Permit
Proposing/Determ	nination
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
Consultant:	Dr. Donald Thomas; above

Status: 30-day comment period

# Summary:

**Proposed Action:** The proposed action is a detailed investigation of the subsurface geology and hydrology of the western Humu'ula Saddle region. The investigation will involve the installation of two small-diameter, continuously cored, test bores to depths of approximately 2000 m below ground surface. **Purpose/Need:** The purpose of the project is to collect and analyze core samples that will: provide a detailed record of the geologic history and structure within the study area; and document the geologic structures responsible for retention and flow of groundwater through the area. The bores will enable access to one or more saturated aquifers within the stratigraphic column and allow sampling for chemical and isotopic analysis of groundwater and allow determination of the source and residence time of groundwater within the region; the bores will also enable long term monitoring of the aquifers within the Saddle to better assess the magnitude of the groundwater resource within the region and to track the impacts of global climate change on Hawaii Island'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 for which almost no hydrologic data is currently available.

# **DRAFT ENVIRONMENTAL ASSESSMENT**

# HUMU'ULA SADDLE REGION OF HAWAI'I ISLAND: A DETAILED HYDROLOGIC EVALUATION AND EXPLORATORY DRILLING PROGRAM

Hamakua District Island of Hawaii

Hawai'i Institute of Geophysics and Planetology University of Hawaii

March 5, 2012

#### **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<sup>1</sup> 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 resource while enabling Stakeholders active in the Saddle region to make more efficient use of the resources at their disposal.

This 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. Although test wells are often exempted from this requirement due to their minimal environmental impacts, the University of Hawaii is conducting this Environmental Assessment 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).

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The proposed action, and the preferred alternative, is to drill two small-diameter, continuouslycored boreholes in the Saddle region on two of the following three land parcels: TMK 3-4-4-16-006; TMK 3-4-4-16-007; and TMK 3-4-4-16-005. 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 locations 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; minimizes the likelihood that rocks from Hualālai would be encountered; provides the shallowest access to ground water within the Saddle; 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. Three prospective sites were identified on lands currently under the control of the Army Garrison, Pohakuloa; the impacts of drilling test bores on two of these three sites are evaluated in this document. 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. 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, 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; flora; 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; 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; High Altitude Mountainous Environment Training – HAMET; construction of the Tactical Vehicle Wash Facility; construction of an Ammunition Storage Facility; 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; 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:

- 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.
- 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.
- The possible impacts on fauna by the preferred action are associated with 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 islands 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:

- Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;
- 2) Curtails the range of beneficial use the environment;
- 3) Conflicts with the States 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;
- 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;
- 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;
- Substantially affects scenic vistas 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.

# TABLE OF CONTENTS

EVECUTIVE SUMMADY	Page
	E9-1
1.0 PURPOSE, NEED, SCOPE	1-1
1.1 Introduction	1-1
1.2 Overview and Background	1-1
1.3 Purpose and Need of the Proposed Action	1-2
1.4 Scope and Organization of this Document Action	1-6
2.0 REGULATORY FRAMEWORK AND COMPATIBILITY WITH STATE.	
COUNTY, AND DISTRICT PLANNING DOCUMENTS	2-1
2.1 Introduction	2-1
2.2 Regulatory Requirements	2-1
2.2.1 Chapter 343 Environmental Impact Statements	2-1
2.2.2 Clean Air Act as Amended	2-2
2 2 3 Hawai'i Administrative Rules Title 13 Chapter 168	2-3
2.2.5 Findingered Species Act 16 U.S.C. 1536(a)(2) and (4)	2-3
2.2.4 Endungered Species Fiel, 10 0.5.0. 1550(a)(2) and (1)	2-3
2.2.5 Executive order 19112 invusive species	2-2
2.2.0 Instolle Treservation rice (10 0.5.0. § 170)	$2^{-1}$
2.2.7 Clean Water Act of 1977: Water Quality Act of 1987	2 - 4
2.2.0 Elean Water Net of 1977, Water Quanty Net of 1907	2-5
2.2.9 1 annual Protection Poncy Planning Documents	2-6
2.5 Comparising With State Plan	2-6
2.3.1 Hawai'i County General Plan	2.0
2.3.2 Hawai'i County Water Use and Development Plan	2-10 2-14
2.3.5 Hawai recounty water ose and Development rian	$2^{-1+}$ 2_15
2.3.4 Department of Hawanan Home Lands	2-15 2-16
2.4 Required Fernits and Approvais	2-10
3.0 THE PROPOSED ACTION AND ALTERNATIVES	3-1
3.1 Description of the Proposed Action and Alternatives	3-1
3.1.1 Selection of Technology	3-1
3.1.2 Selection of Location	3-5
3.1.3 The Proposed Action	3-10
3.1.4 No Action Alternative	. 3-11
4.0 Affected Environment and Environmental Consequences	<i>A</i> _1
4.1 Introduction	4-1
4.1 I Terminology	
4.1.1 Commonly	4-2
4.1.2 Summary of impacts	4-2
4.2 Dackground, Location, and History	4-4
4.5 Topography, Sons, and Ocology	4-9
4.3.2 Environmental Consequences	. +-ソ / 17
4.5.2 Environmental Consequences	. <del>-1</del> / / 10
4.4 1 Affected Environment	4-10 1 10
4.4.1 AITEUEU EITVITOIIITEIT	4-10 1 20
4.5 Noise	4-20 1 00
サ.J 10100	. +-∠∠

4.5.1 Affected Environment	4-22
4.5.2 Environmental Consequences for Noise	4-22
4.6 Anthropogenic Light	4-22
4.6.1 Affected Environment	
4.6.2 Environmental Consequences for Anthropogenic Light	4-25
4.7 Air Quality	4-26
4.7.1 Affected Environment	4-26
4.7.2 Environmental Consequences for Air Quality	4-27
4.8 Flora	4-28
4.8.1 Affected Environment	4-28
4.8.2 Environmental Consequences for Flora	4-29
4.9 Fauna	4-30
4.9.1 Affected Environment	4-30
4.9.2 Environmental Consequences for Fauna	4-30
4.10 Cultural Resources	4-31
4.10.1 Affected Environment	4-31
4.10.2 Environmental Consequences for Cultural Resources	4-34
4.11 Potable Water	4-34
4.11.1 Affected Environment	4-34
4.11.2 Environmental Consequences for Water Resources	4-35
4.12 Wastewater Disposal	4-36
4.12.1 Affected Environment	4-36
4.12.2 Environmental Consequences for Water Resources	4-36
4.13 Solid and Hazardous Wastes	4-37
4.13.1 Affected Environment	4-37
4.13.2 Environmental Consequences for Solid and Hazardous Wastes	4-37
4.14 Transportation	4-37
4.14.1 Affected Environment	4-37
4.14.2 Environmental Consequences for Transportation	
4.15 Land Use Classification and Land Use	
4.15.1 Affected Environment	4-38
4.15.2 Environmental Consequences for Land Use	
4.16 Socioeconomic Environment	
4.16.1 Affected Environment	
4.16.2 Environmental Consequences for Socioeconomic Environment	
4.17 Environmental Justice and Protection of Children	
4.17.1 Affected Environment	4-44
4.1/.2 Environmental Consequences for Environmental Justice and	1 15
Protection of Cmildren	4-45
50 Cumulativa Impaata	5 1
5.1 Saddle Road Realignment Island of Hawai'i	5 1
5.2 High Altitude Environment Training – HAMET	
5.3 Tactical Vehicle Wash Facility	
5.4 Ammunition Storage Facility	
5.5 Battle Area Complex (BAX)	
5.6 Proposed Modernization of Pohakuloa Training Area - USARPAC	
5.7 U.S. Marine Corps MV-22 and Cobra Attack Squadron Training at PTA	
5.8 Range Maintenance Facility	5- <u>4</u>

5.9 Analysis of Cumulative Impacts	5-4
5.9.1 Noise Impacts	5-4
5.9.2 Anthropogenic Light	5-4
5.9.3 Air Quality Impacts	5-5
5.9.4 Fauna Impacts	5-5
5.9.5 Solid, Hazardous, or Medical Waste Impacts	5-5
5.9.6 Transportation Impacts	5-6
5.10 Follow-on or Secondary Impacts	5-6
6.0 Determination of Significance and Findings	. 6-1
6.1 Criteria	6-1
6.1.1 Involves an irrevocable commitment to loss or destruction of any	
natural or cultural resource	6-1
6.1.2 Curtails the range of beneficial use of the environment	6-1
6.1.3 Conflicts with the States long-term environmental policies	6-3
6.1.4 Adversely affects the economic and social welfare of the community or State	. 6-3
6.1.5 Substantially affects public health	6-3
6.1.6 Involves substantial secondary impacts	6-3
6.1.7 Involves a substantial degradation of environmental quality	. 6-3
6.1.8 Is individually limited but cumulatively has considerable effects	.6-3
6.1.9 Substantially affects a rare, threatened, or endangered species	6-4
6.1.10 Detrimentally affects air or water quality or ambient noise levels	. 6-4
6.1.11 Affects, or is likely to suffer damage by located in geologically	
hazardous land	. 6-4
6.1.12 Substantially affects scenic vistas	6-4
6.1.13 Requires substantial energy consumption	6-4
6.2 Findings	. 6-4
7.0 References	.7-1
8.0 List of Preparers	. 8-1
9.0 List of Agencies and Individuals Consulted	8-1
9.1 Agencies	8-1
9.2 Individuals	8-2

# LIST OF FIGURES

LIST OF FIGURES	Page
Figure 1-1 Map showing location of m`agnetotelluric surveys on	
the Island of Hawai'i	1-3
Figure 1-2 Cross section showing resistivity distribution	
through the Humu'ula Saddle	1-3
Figure 1-3a Map showing location of project area within Hamakua District	1-4
Figure 1-3a Map showing project location within Section 4, Plat 16, Hamakua District	. 1-4
Figure 2-1 Map of Agricultural Lands of Interest to State of Hawai'i	2-5
Figure 2-2 Map showing lands held by DHHL in Central Hawai'i	2-16
Figure 3-1 Landsat image of Saddle Region showing PTA lands	2-16
Figure 4-1 Landsat Image of Hawai'i Island showing general study area as well as	
location of PTA lands within the study area	4-5
Figure 4-2 Map showing major landowners in the proposed region of study	4-6
Figure 4-3 Map showing PTA lands and prospective drill sites	4-7
Figure 4-4 Geologic Map showing age distribution of lava flows	. 4-10
Figure 4-5 Detail map showing volcanic flows on PTA lands	4-11
Figure 4-6 Map showing surface geology of PTA lands	4-13
Figure 4-7 Map showing soils distribution on PTA lands	4-14
Figure 4-8 Aerial view of a portion of PTA lands showing prospective drill sites	4-15
Figure 4-9 Photo of landscape at Site I Cantonment	4-16
Figure 4-10 Photo of landscape at Site II Armor Road	. 4-16
Figure 4-11 Photo of landscape at Site III Landfill	4-17
Figure 4-12 Map of rainfall distribution on Hawai'i Island	. 4-20
Figure 4-13 Map showing State Land Use Classifications	. 4-40
Figure 4-14 Conservation Subzones for Conservation Lands	4-41

# LIST OF TABLES

Table 3-1 Screening Analysis of Drilling Technology	3-2
Table 3-2 Screening Analysis for Site Selection	3-6
Table 4-1 Summary of Impacts of Project Alternatives	4-3
Table 5-1 Summary of Projects that May Occur Concurrently with Proposed Project	5-2
Table 6-1 Summary of Potential Impacts and Level of Significance	6-2

# **APPENDICES**

Appendix A Natural/Cultural Resources Evaluation

Appendix B Section 106 Consultation Letters

Appendix C Pre-Consultation Communications

Appendix D MSDS for drilling materials

Appendix E Details of drilling equipment proposed for project

# 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
РТА	Pōhakuloa Training Area
ROI	Region of Influence
SY	Sustainable Yield
ТМК	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 process occurring inside the Big Island. The planned project will be located on two of three prospective locations within the Humu'ula Saddle region of Hawaii Island on the following parcels: TMK 3-4-4-16-005; TMK 3-4-4-16-006; and TMK 3-4-4-16-007. 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 (EA), 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 EA 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 Islands 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 Pailet, 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 freshwater lens 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. The proposed test holes, to be located at two of three prospective sites located on land with the following designations: TMK 3-4-4-16-006 and TMK 3-4-4-16-007, owned by the U.S. Army, and TMK 3-4-4-16-005, owned by the State of Hawaii and leased to the U.S. Army. Test holes at these locations will provide fundamentally new information for a part of the island for which there is almost no existing hydrologic data and will significantly enhance our ability to effectively and sustainably manage our groundwater resources.

#### **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 elevation of the water table within the Saddle region; to document the geologic structures overall as well as those that impact the groundwater system; 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).



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 project location within the Hamakua District and in relation to the Mauna Kea summit.



Figure 1-3b. Showing project location within Zone 4, Section 4, Plat 16 of the Hamakua District.

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 Humu'ula 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, along with a public visitor center and 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 Pohakuloa 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 a production well in the region, uncertainties about the depth to 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 boreholes will enable us to provide a much more detailed understanding of the groundwater systems and the geologic structures that host those resources beneath the Humu'ula Saddle and enable the agencies responsible for the regions 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 Hawai'i, Office of Mauna Kea Management; the Department of Hawaiian

Home Lands; U.S. Army Garrison, Pōhakuloa (referred to, collectively, in the following discussion referred to 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 three candidate drilling sites for location of the small diameter core holes that will provide access to the subsurface geology and hydrologic resources in the region; a fourth prospective drilling location was initially considered but was found to fail on critical scientific screening criteria and was eliminated from further consideration. 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, a positive outcome, in terms of identifying accessible groundwater resources, may enable more productive and economically viable uses for these lands.

#### 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 fundamentally new information on Hawai'i Islands geologic structure and groundwater resources in an area for which we have almost no ground truth data to support inferences and assumptions about our groundwater resources. 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; with encouraging findings from these test holes, development of a reliable source of water would 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 boreholes 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 is currently awaiting the Governor's signature, 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 to 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 Hāmākua 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 Hāmākua District:

### §2.4.4.2 Courses of Action:

(a) Assist the further development of agriculture and continue to cooperate with the agricultural sector and other appropriate agencies to provide the necessary services to assist agriculture.(d) Diversify the economic base and enhance historical aspects of the area including existing ranching operations and the former sugar industry.

(f) Support the growth of astronomical research and development.

Favorable findings on the availability of potable groundwater at accessible depths in the Saddle region could be of benefit to both 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 Ka'ū 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 Hāmākua District:

## §11.2.4.2.2 Courses of Action

(b) Investigate groundwater sources in the upper Waiākea Uka, Kā'ie'ie Mauka,

Kulaimano, Saddle Road, and Honomu areas.

(c) Further investigate future ground water resources.

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.

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 Hāmākua district as well as in the North Hilo district.

#### 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. However, the geophysical results, on which the proposed test holes are based, show a resistivity distribution that projects groundwater at significantly higher elevations than the traditional models have indicated. With results from the test holes that confirm the geophysical evidence, 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 Humu'ula tract and it was in that area that geophysical anomalies were identified that were similar to those in the western Saddle region. If the high level groundwater inferred from our interpretation of the geophysical data is



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

confirmed, then there is a strong likelihood that water at similar elevations are 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:

- 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;
- 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

	Conventional	Small Diameter	Wireline
	Rotary	Rotary	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

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

 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 this 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, smaller volumes of air are used that are going to be much more sensitive to hydrostatic pressures. Further, when 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.

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.

Because core drilling provides a near real-time geologic record as the hole is being drilled, the critical transition zones can be identified as core is withdrawn from the hole. This allows the scientific staff to provide guidance to the drillers to watch for changes in rock type or in degree of saturation as these transitions are approached.

5. We have gauged the adverse impact based on the acreage of land likely to be impacted 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 sites 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.

The Screening Criteria for site selection are as follows:

- 1) A site where high-level groundwater is likely to be encountered;
- 2) A site where the geologic structure is most representative of Mauna Kea's subaerial stratigraphic section;
- 3) A site that will allow us to characterize the internal structure of Mauna Kea;
- Existing access to the drill site is available for equipment with a minimum of ground disturbance;
- 5) Support infrastructure for the drilling program is readily available;
- 6) The site will allow us to perform the investigation and analysis with minimal adverse environmental impact to the Saddle regions' environmental attributes;
- 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:

For Criteria #1, our primary guidance for selection of a site derives from 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 was located near station

	Western Saddle Region			Eastern Saddle Region	
	Site I	Site II	Site III	Site IV	
1. Probability for					
high-level water	7	8	9	7	
2. Representative					
geologic structures	9	6	7	0	
3. Characterize					
MK internal					
structure	9	6	7	2	
4. Equipment					
access	10	9	8	7	
5. Proximity to					
support					
infrastructure	9	4	4	2	
6. Minimum					
impact on					
environmental					
attributes	0	-1	-3	-5	
7. Minimum					
impact on future					
land use	-1	-1	-2	-2	
Total	43	31	30	13	

Table 3-2. Screening Analysis for Site Selection

4PT1, immediately south of Mauna Kea State Park (Figure 1-2). The second general location in which shallow saturated resistivities were encountered was east of the Mauna Kea Summit access road; hence, that general region was included in the screening of prospective sites to be considered for the planned study. Within the western region three prospective sites were chosen (based on the criteria below) with the more northerly sites being somewhat removed from the mapped anomalies and, therefore receiving a lower ranking, than the southerly sites located significantly closer to the route of the geophysical survey; the eastern Saddle region, for purposes of the screening, is reviewed as a more generalized Site IV.

2. Selection Criteria 2 and 3: In order to obtain the most representative stratigraphic section of Mauna Kea's subaerial lavas, we needed to avoid known or likely structural features that would interfere with that objective. In the magnetotelluric surveys, the freshwater saturated resistivity feature on the eastern edge of the Saddle is associated with an extremely high resistivity in the shallow subsurface; the high resistivity feature is believed to be a buried



Figure 3-1. Landsat image of Saddle Region showing areas in which geophysical surveys indicated high level groundwater may be present. Also shown are the prospective sites in the western Saddle Region and Mauna Kea State Park.

rift zone which would render Site IV non-representative of Mauna Kea's overall geologic structure. Further, since the intrusive bodies associated with the rift zone would interfere with our recovering a continuous sequence of subaerial Mauna Kea flows, our objective of recovering a representative – and complete – stratigraphic section would not be met. Hence, the eastern Saddle area, Site IV, has been ranked quite low for these attributes.

The western Saddle Region (WSR) sites are located on the southern flank of Mauna Kea, well removed from its western rift zone, and would provide a continuous stratigraphic sequence of erupted (rather than intrusive) lavas that would be more reflective of the bulk of Mauna Kea's mass. Further, the western saturated resistivity feature of the MT cross section is free of any clear evidence of geologic structures that would prove negative for these considerations. However, there is substantial uncertainty regarding the relationship between Mauna Kea and Hualālai in this region. As was demonstrated in the Hilo borehole, the younger volcanoes gradually encroach upon the flanks of their older sister volcanoes. Hence, as the selected site is moved to the south, the likelihood that we will encounter Hualālai lavas underlying Mauna Kea increases and, therefore, a site in a more northerly direction, closer to Mauna Kea's south-facing flank, would minimize that likelihood. Therefore the WSR sites are ranked according to their location relative to Hualālai volcano: those sites closest to Hualālai receive a lower ranking than those higher on the Mauna Kea flank.

- 3. Selection 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, we have identified specific sites that are on, or adjacent to, existing, accessible roadways within this region of the Saddle. The WSR Site I is accessible for drilling equipment exclusively on paved roads; the WSR Site II will require access through existing paved and secondary roads that are easily accessible; and WSR Site III will require access through existing paved and secondary roads, but will require use of some less-maintained roads than WSR Site II. The eastern Saddle area would require access over paved and secondary roads.
- 4. Selection Criteria 5: Proximity to support infrastructure is both a cost-related and an environmental impact item and we have graded the three WSR tentative sites on a scale of 1 to 10. If we can locate the drilling site near a source of electrical power and source of water, the costs associated with these utilities will be lower and the impacts associated with electrical generation and hauling water will likewise be reduced. The WSR Site I provides access to power and water at the drill site; WSR Site II and III will require that water be hauled in to the site and that we maintain on-site generation for lighting and utilities. The water source will be from the PTA non-potable water supply. The eastern region would also require that we haul water and maintain on-site power generation and is ranked lower due to the greater distance for water hauling.
- 5. 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 I** is located at the southeastern edge of the PTA cantonment and is centered on coordinates N 19° 45′ 19.4″ & W 155° 32′ 11.7″ at elevation of 1939 m (6,362 ft.);

**Site II** located in a maneuvers area southwest of the PTA cantonment and is centered on coordinates N 19° 44′ 57.7″ & W155° 33′ 07.4″ at elevation of 1873 m (6145 ft.); and **Site III** 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 heavily disturbed by prior use and have little in the way of environmental attributes that would be directly affected by planned drilling operations. Well sites at these locations have little likelihood of impacting current and future uses of the existing landscape and were selected to avoid impacting Mauna Kea State Park, or users of Mauna Kea State Park, while providing a high likelihood of meeting the other screening criteria discussed above.

Within the eastern region, there were no similarly situated sites that would be available for use that would not require some impact of clearing or grading either in pasture land or on undeveloped and relatively pristine lava surfaces. Hence, the eastern region is ranked lower than the western region sites.

Table 3-2 summarizes the ranking of each prospective site according to the respective screening criteria and based on the sums of the ranking, WSR Site I offers us the greatest likelihood of meeting the project objectives while minimizing the adverse impacts of the disturbances associated with establishing a drill site and executing the proposed drilling and sampling program. WSR sites II and III are about equivalent in the ranking; we intend to incorporate the results of the drilling at Site I into the ultimate selection of Site II or Site III as a site for a second borehole when a decision is made to proceed to that second borehole. The Eastern Saddle Region location, Site IV, falls well below the ranking of the three other locations due to its likely poor scientific return and higher likelihood of environmental impacts and, hence, was eliminated from further consideration in the project and the Environmental Assessment.

#### 3.1.3 The Proposed Action

The proposed action will be the drilling of a borehole at Site I, above, and a second borehole at Site II or Site III depending on the results and interpretations resulting from the Site I drilling and analysis. 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.

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

- A site having an area of ~0.5 hectares (1 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 but will convert to a foam drilling fluid as soon after drilling out of the conductor base as is practical;
- 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 return to the use of a conventional bentonite-based drilling fluid as increasing hydrostatic pressures with depth render continued foam-based drilling impractical;

• Drilling will be periodically suspended, to allow samples of formation fluids to be collected.

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.

As borehole data are gathered regarding the formation fluids, a recommendation will be developed as to where a second exploratory borehole should be undertaken. The decision to undertake a second exploratory borehole will be based upon: the structural interpretation of the rock cores that are collected during drilling; depth to a stable water table; the quality of the water encountered in the first bore; and evidence regarding the recharge rate and sustainable yield of the water resources. The decision on which site will be selected will depend on the interpretation of the structural features as they relate to the screening criteria discussed in the Site Selection paragraphs above. At the selected site for the second borehole, the sequence of actions described above will be repeated.

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
	Site I	Site II	Site III	Alternative
Topography, Soils, and Geology	$\odot$	$\odot$	$\odot$	$\odot$
Water Resources	$\oplus$	$\oplus$	$\oplus$	$\odot$
Noise	Ô	$\odot$	$\bigcirc$	$\odot$
Anthropogenic Light	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\odot$
Air Quality	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\odot$
Flora	$\odot$	$\odot$	$\odot$	$\odot$
Fauna	Ô	Ô	$\bigcirc$	$\odot$
Cultural Resources	$\odot$	$\odot$	$\odot$	$\odot$
Potable Water	$\odot$	$\odot$	$\odot$	$\odot$
Wastewater Disposal	$\odot$	$\odot$	$\odot$	$\odot$
Solid and Hazardous Wastes	Ô	Ô	Ø	$\odot$
Transportation	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\odot$
Land Use	$\odot$	$\odot$	$\odot$	$\odot$
Socioeconomic Environment	$\oplus$	$\oplus$	$\oplus$	$\odot$
Environmental Justice and Protection of Children	$\odot$	$\odot$	$\odot$	$\odot$

Table 4-1. Summary of Impacts of Project Alternatives

LEGEND	
Positive Impact	$\oplus$
No Impact	$\odot$
Less than Significant Impact	$\bigcirc$
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 Ka'ohe (4) and Humu'ula tracts of the Hāmākua and North Hilo Districts in central Hawai'i Island (Figure 4-1). These lands are under the jurisdiction of the Hawai'i Department of Land and Natural Resources (DLNR), the Department of Hawaiian Home Lands, and the U.S. Army Garrison Pohakuloa (USAGP) (Figure 4-2). The DLNR lands are managed by their Land Division and Division of State Parks; the DHHL lands are held for leasing to beneficiaries of DHHL; and the Army-controlled lands are used as a field training site, collectively referred to as the Pohakuloa Training Area (PTA). The screening process has eliminated the eastern lands, in the Humu'ula tract, from further consideration due to the geological objectives of the project and will not be discussed further here. 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 Hawai'i 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 Ka'ohe 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

4 - 4 -



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, Waiki'i 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 any given time 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

4 - 7 -

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). However, the quality of 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 1/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 1/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.

#### 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 Ka'ohe tract of the Hāmākua land 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 boreholes is approximately 1950 m (6,400 feet) 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 Ka'ohe tract 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 a'a character and form an extremely rough surface whereas the

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

Mauna Kea surface underlying the northern portion of the Ka'ohe tract consists of weathered lava flows, finely-divided rock fragments, derived from glacial weathering, and ash. The dominant characteristic of the surface is a dusty rocky soil of a few centimeters to more than 1 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 a'a 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 Ke'eke'e 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 and documented by Kuapa Services (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:

- Site I Cantonment (Kuapa Site 1); Figure 4-9: This site is located along the southeastern border of the Cantonment security fence, at N19° 45 19.4" & W155° 32 11.7" with an elevation of 1939 m (6,362 feet), adjacent to the former alignment of the Saddle Road. The site consists of a mixture of Mauna Kea dusty soils with pebbles and cobbles and welded a'a lava; the site is a flat, heavily modified (graded) surface covered with nonnative grasses.
- 2) Site II 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.





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



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 I Cantonment.



Figure 4-10: Candidate Site II Armor Road.

3) Site III 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 4-11: Candidate Site III 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 0.4 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 0.4 hectare will need to be available for rig-up and short term storage of drilling materials at each site used. This area needs to be reasonably flat and accessible to vehicles but will not need to be paved. At prospective drill **Site I Cantonment** (see Figure 4-9 above), minimal grading and grubbing will have to be done over this area as it is flat and allows 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 II 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 III Landfill**, prior activities have already graded the surface contour and minimal disturbance will be required.

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 grain soil components. It is not expected that the ground 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.

<u>Mitigation</u>: 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.

#### 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 Ka'ohe 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.

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 508 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 PTA within the privately owned Waiki'i 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.

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). More recent geophysical surveys within the PTA area indicate that subsurface rocks, at an elevation of 1 km (3280.8) or more above sea level, have resistivity characteristics that are consistent with freshwater-saturated basalts (Pierce and Thomas, 2009).



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).

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 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 be washed down to the basal lens by infiltrating rainfall; the conventional drilling 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.

<u>Mitigation:</u> The drilling strategy of using a foam/air drilling fluid in the unsaturated zone is, itself, a mitigation strategy. Conventional drilling would use a bentonite based fluid but,

because that process would continuously lose all those fluids to the formation, foam based drilling will minimize the total mass of materials left in the formation as drilling progresses. Once the water table is reached, foam based drilling becomes impractical due to the hydrostatic pressure in the water column. 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. 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. As the Saddle Road construction work continues to improve cross-island transit conditions, it is expected that the level and frequency of daytime and nighttime traffic noise will progressively increase. During periods of live fire training, some low frequency percussive noise may be heard throughout the region (Stout and Assoc., 2006).

Because prospective **Site I Cantonment** is located within the PTA cantonment, the level and frequency of anthropogenic background noise from PTA and highway noise will be greatest. Prospective **Site II Armor Road** is well removed from both the highway and PTA and will experience the lowest level of anthropogenic noise whereas prospective **Site III Landfill** will experience a background noise level intermediate between that of Sites I and II.

#### **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 1 km from the drilling activity. At this distance, we believe that the noise generated by the drilling activities will be well below nuisance levels.

4 - 21 -

**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, or three shifts of eight 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 I Cantonment, noise receptors will be staff and troop trainees working and sleeping within the Cantonment area. Other potential receptors for this site include campers using the Mauna Kea State Park located about 1.5 km to the east of prospective drill Site I.

At prospective Site II Armor Road, the nearest noise receptors will be within the Cantonment about 2 km north east of the proposed drilling site and somewhat further than that from any Mauna Kea State Park campers.

**Prospective Site III 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. Hence, we do not anticipate that noise levels from the operating rig will be disruptive to either staff or troops at PTA nor for campers at the Mauna Kea State Park.

**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 PTA, **Site I Cantonment**, was chosen in a location where there is a natural berm that will serve to deflect noise from the drilling operations away from the command offices. Although there are some troop quarters that will be in close proximity to the drilling activity, we will work with the PTA Commander to minimize, to the extent possible, the number of troops affected by noise associated with the drilling activities.

The location of this site relative to the Mauna Kea State Park is such that there is no direct line of sight from the Park to the drilling site and hence noise will be dispersed by the natural ground contours; more importantly, this site is located downwind of the Park, further reducing the sound levels that are likely to impact the Park area. 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.

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 Waiki'i 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 I Cantonment**, the rig lights will be surrounded by existing nighttime area lighting within the cantonment; the addition of the area and rig mast lights will not add significantly to the existing ambient lighting.

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 III 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.

<u>Mitigation:</u> 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.

The temporary use of lights during the drilling activities is not considered likely to cause a significant impact on mammal or bird populations in the area.

# 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 to the southeast 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. Because of the distance of PTA to developed areas, only the personnel stationed at PTA are expected to experience even small impacts from the drilling activities and only from activities at prospective drill **Site I Cantonment**; the other sites are far enough removed from actively occupied lands that impacts from those sites would be insignificant.

**The No Action Alternative:** Under the no-action alternative there will be no additional emissions of diesel emissions 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 indicated by the conditions occurring at the site during drilling. 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 <u>Pōhakuloa Deep Well Test Candidate Sites Descriptions and Natural/Cultural Resources</u> <u>Evaluations</u> (Kuapa Services, 2010) as attached. The findings from that analysis are as follows:

**Site I Cantonment:** Common plants include lovegrass (*Eragrostis atropiodes*) and telegraph weed (*Heterotheca grandiflora*) with small amounts of fountain grass (*Pennisetum setaceum*), mullein (*Verbascum thapsus*), aweoweo (*Chenopodium oahuense*), golden crown-beard (*Verbesina encelioides*), māmane (*Sophora chrysophylla*) and naio (*Myoporum sandwiensis*). The parade ground area supports patchy coverage of kikuyu grass (*Pennisetum clandestinum*) along with clusters of geraniums (*Pelargonium* sp.) a few māmane and naio trees that occur on higher relief near the east side of the site. None of these plant species are considered to be endangered although the māmane trees are considered important to the survival of the endangered palila bird.

**Site II Armor Road:** 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 III Landfill:** This site 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 seen nearby 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. Given the already disturbed nature of the prospective sites, and the near absence of sensitive plants, the impacts of the project on native and sensitive plants will be negligible.

Because the equipment to be used for the drilling will be transported from a mainland location, there is the possibility of introduction of exotic or invasive species. In recognition of that possibility, care will have to be taken to ensure that the equipment is thoroughly cleaned prior to introduction to the Saddle region in order to minimize that potential during the transportation process.

**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.

<u>Mitigation</u>: 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. In terms of prevention of introduction of exotics to the prospective drilling sites, we will require that drilling equipment shipped from the mainland be

4 - 28 -

thoroughly cleaned prior to shipping and again in Hilo prior to being introduced to the Saddle area; in particular, the undercarriage of drilling vehicles will be sprayed down with a pre-emergent herbicide while in Hilo to ensure that we minimize the survival and propagation of seeds from introduced plant species that may be adhering to the vehicles.

No 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 (<u>Hemignathus virens</u>), the Palila (<u>Loxioides bailleui</u>), Akiapōlāau (<u>Hemignathus munroi</u>), and Hawaiian Hawk (<u>Buteo solitarius</u>). Eleven species of introduced birds are known to frequent the region as well with the most common of these being the House Sparrow (<u>Passer domesticus</u>) and common Myna (<u>Acridotheres tristis</u>).

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 Hawai'i 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 Ali'i. The high rainfall, lower elevation regions of the mountain Waoma'ukele 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, a'ali'i and 'ilima.

Although not within the above land classification system, much of the area within the Saddle was referred to as Ka'ohe. 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 reference to the springs in the region, or the tendency of this location to attract the clouds is not known; however, this area was also considered to be the domain of Lilinoe, the spiritual embodiment of the fog and mists.

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 'ua'u (petrel) chicks were a prized delicacy reserved for the Ali'i although the mamo, 'ō'ō, and 'i'iwi 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 Waiki'i 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 (<u>Pōhakuloa Deep Well Test</u> <u>Candidate Sites Descriptions and Natural/Cultural Resources Evaluations</u>; Appendix A, Kuapa Services, 2010) 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 consulted with the PTA Cultural Advisory Committee 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 that group. 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 State Historic Preservation Office of the Department of Land and Natural Resources, and the Office of Hawaiian Affairs concurred that no historic or culturally significant resources were likely to be impacted (Appendix C). Kahu Ku Mauna, a cultural advisory group to the Office of Mauna Kea Management at the University of

Hawai'i have requested that they be included in further discussions of the project; the other agencies and organizations did not provide a response to the consultation request.

# 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:** 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 Waiki'i 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 Ka'ūmana well located at an elevation of ~610 m (2000 feet) just west of Hilo.

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 Waiki'i Ranch is believed to be drawing water from the Mauna Kea west rift system and, hence, is drawing from a different aquifer than is present within the Saddle region.

The present drilling will attempt to verify the existence of potable water at depths of about 1 km below the ground surface. Some drilling materials will be lost to the formation during the drilling process and will include soap, or foaming agent, while we are drilling the shallow portion of the section above the water table. Once the water table is penetrated by some depth, we will then convert to conventional drilling fluid composed of 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 fluid bailers to remove as much of the drilling fluids from the bore as is possible to enable us to collect clean samples of formation waters for the planned chemical analyses and evaluation of water quality.

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 PTAs 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.

**<u>Mitigation</u>**: 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 4 - 36 -

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 in progress 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).

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.

**<u>Mitigation</u>**: 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 Keamuku parcel is classified as Agricultural land. The Conservation lands, either owned or 4 - 37leased 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<sup>2</sup> (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 I Cantonment** is located within the cantonment area of PTA. The Land Use Commission (LUC) Land Classification is Conservation, with a DLNR subzone of General, the least protective of the Conservation classifications. This area is currently used as an assembly and parade ground as well as open area within the cantonment compound.

**Site II Armor Road** is located south west of the PTA Cantonment and has a Land Classification of Conservation and a Resource subzone, the next more 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 and maneuvers.

**Site III 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.



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



Figure 4-13. Conservation Subzones for Conservation Lands at and around PTA 4 - 40 -

# 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 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.

**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 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: 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 Waiki'i 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 Hawai'i 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. Substantial progress has been made on this project and work is nearly complete as of the present date on portions of the road between mile marker 10 and 18, east of PTA. The Federal Highways Administration recently awarded contracts for grading for the West Saddle Road section from MM 42 to Māmalahoa Highway. Funding for completion of that interval is currently being secured. 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 High Altitude Mountainous Environment Training – HAMET

The 25th Infantry Division–25th Combat Aviation Brigade (25th CAB) has proposed to undertake specialized high altitude flight training for helicopter pilots and crews for high-altitude missions in preparation for deployment to Afghanistan and to satisfy compulsory aviation training doctrine. That training will involve conducting flight maneuvers at elevations of 2500 m to 3000 m above sea level on the upper slopes of Mauna Kea and Mauna Loa.

# 5.3 Tactical Vehicle Wash Facility

The Tactical Vehicle Wash facility will be located south of, and adjacent to, the former Saddle Road alignment approximately 800 m west of the proposed drilling Site I. The facility will be used for washing down tactical vehicles used for training exercises to remove soils and organic matter prior to transport between training ranges or away from PTA. Cleaning of the vehicles is intended as a

Project	Location	Sponsor	Project Description	Projected Completion Date
Saddle Road Realignment	Across island of Hawaiʻi, 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)
25 <sup>th</sup> CAB High Altitude Mountainous Environment Training	PTA/ Mauna Loa & Mauna Kea	U.S. Army	25 <sup>Th</sup> CAB proposes to train helicopter air crews for high- altitude, mountainous environment flights through the HAMET program.	2011
Tactical Vehicle Wash Facility	РТА	U.S. Army	Proposal to construct a tactical vehicle wash facility with four wash stations.	2012
Ammunition Storage	РТА	U.S. Army	Proposal to construct three new earth-covered ammunition bunkers (igloos), totaling 6,750 ft2 (627 m2), within the existing ammunition storage facility.	2012
Battle Area Complex	РТА	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.	2012
Infantry Platoon Battle Area and PTA Modernization	РТА	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.	2013-2022
U.S. Marine Corps MV-22 and Cobra Attack Squadron Training at PTA	РТА	U.S. Marine Corps	Conduct periodic U.S. Marine Corps training requirements.	Ongoing from 2013
Range Maintenance Facility	РТА	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

# 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)

sanitation measure that will reduce transport of propagules (e.g. seeds, insect eggs, etc.) among the training ranges as well as reduce impacts of vehicle transport over public roads.

# **5.4 Ammunition Storage Facility**

Three earth-covered ammunition structures will be constructed that cover an area totaling 6,750 square feet at the ammunition storage facility. Installation of support infrastructure would include installing pole-mounted security lights, floodlights above each entrance, and telephone and computer systems; utility support would include electric service, storm water drainage, paving, and access roads. This site is located approximately 500 m northwest of prospective drill Site II.

# **5.5 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 II.

# 5.6 Proposed Modernization of Pohakuloa 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 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.

# 5.7 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 Kāne'ohe 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.

# **5.8 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<sup>2</sup> 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.

# 5.9 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.

#### 5.9.1 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 drilling site. The only project among the above list that would have night time activities, the High Altitude Mountainous Environment Training, is now complete and is unlikely to be resumed for the duration of the proposed drilling timeline. The planned construction projects will occur during normal working hours and will not contribute to any nighttime noise generated by the proposed drilling.

# 5.9.2 Anthropogenic Light

Light emission will be a small contribution to an existing outdoor lighting load at Drill Site I and, with proper shielding and vigilance for evidence of disturbance of nighttime bird flight, should contribute minimally to that currently in operation within the cantonment. The other prospective drill sites are more isolated, but are not in proximity to any of planned projects that are anticipated

5 - 4 -

to have nighttime activities associated with them. 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 II. Construction of that site is expected to occur during daylight hours; if construction is completed within the timeframe of possible drilling, safety considerations preclude active drilling during any period when that area is in use for training. Hence, any lighting effects from drilling will not be contemporaneous with nighttime activities at that site. Prospective Drill Site III is well removed from any of the planned construction activities in the above table.

# **5.9.3 Air Quality Impacts**

The air quality impacts from the drilling activities will be associated with the drill rig engine and the air compressor engine which are stationary emission sources. Activities associated with construction of new sections of the Saddle Road, and 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.

# 5.9.4 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.

# 5.9.5 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.

# **5.9.6 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 mid-night and at noon each day and will avoid the early morning and late afternoon commuting times typically used by the construction industry. 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.

# 5.10 Follow-on or secondary impacts

The completion of one or more test bores in the Saddle region near PTA could potentially document 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. The decision to develop a water resource will depend on circumstances including, but not limited to: the depth to the stable water table; estimates of the sustainable yield of any discovered aquifer; formation transmissivities; the economics of pumping that water to the surface; the chemical quality of the water resource encountered; and a host of other parameters that the present project is intended to better define. Whereas the impacts of the imputed follow-on development are deserving of consideration and analysis, the data needed for a rigorous and credible analysis of those future impacts can only come from completion of the present project.

# 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 this determination 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; 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 I Cantonment	Site II Armor Road	Site III Landfill	No Action
Involves an irrevocable commitment to loss or destruction of any natural or cultural resource	$\odot$	$\odot$	$\odot$	$\odot$
Curtails the range of beneficial uses of the environment	$\odot$	$\odot$	$\odot$	$\odot$
Conflicts with the States long-term environmental policies or goals and guidelines	$\odot$	$\odot$	$\odot$	$\odot$
Substantially affects the economic and social welfare of the community or State	$\odot$	$\odot$	$\odot$	$\odot$
Substantially affects public health	$\odot$	$\odot$	$\odot$	$\odot$
Involves substantial secondary impact, such as population changes or effects on public facilities	$\odot$	$\odot$	$\odot$	$\odot$
Involves a substantial degradation of environmental quality	Ø	Ø	Ô	$\odot$
Is individually limited but cumulatively has considerable effect upon the environment	O	Ø	0	$\odot$
Substantially affects a rare, threatened, or endangered species	O	Ø	Ø	$\odot$
Detrimentally affects air or water quality or ambient noise levels	O	Ø	O	$\odot$
Affects, or is likely to suffer damage, by being located in an environmentally sensitive area	Ø	O	0	$\odot$
Substantially affects scenic vistas and view planes identified in County or State plans or studies	Ø	Ø	0	$\odot$
Requires substantial energy consumption	Ô	Ô	Ô	$\odot$

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

 $\bigcirc$  = less than significant impact

 $\odot$  = 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 these boreholes, 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, 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 bores will determine a range of critical parameters for those resources that may currently underlie Saddle region including: depth to the water; formation characteristics; quality of the water; and estimates of the rates of recharge to the aquifers identified. 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 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.
- 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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# 9.0 LIST OF AGENCIES AND INDIVIDUALS CONSULTED

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# 9.2 Individuals

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Dr. Julie M. E. Taomia, Archeologist, Cultural Resources Section, Environmental Division, Directorate of Public Works, US Army Garrison - Pōhakuloa

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# **APPENDIX A**

Natural and Cultural Resource Evaluations Kuapa Services

# 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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- 4. US Army Hawaii and 25<sup>th</sup> Infantry Division (Light). 2001. *Integrated Natural Resources Management Plan and Environmental Assessment/Finding of No Significant impact 2002-2006 Pohakuloa Training Area.* August 2001.
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- 7. US Army Hawaii and 25<sup>th</sup> Infantry Division (Light) 2003. *Final Environmental Assessment for Pohakuloa Training Area 2010 Master Plan for Base Camp Facilities*. December 2003.

# **APPENDIX B**

Section 106 Consultation Letters



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,

00

Rolland C. Niles Lieutenant Colonel, US Army Commanding

Enclosures

## List of Parties to Whom Letters Were Sent for Consultation

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

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

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

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

#### PHONE (808) 594-1888



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

HRD11/5777

FAX (808) 594-1865

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, Hawaiʻi

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, Põhakuloa (USAG-P) is proposing to drill a test well at one of four different sites around the Põhakuloa 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 Lieutenant Colonel Rolland C. Niles Headquarters, U.S. Army Garrison, Pōhakuloa July 8, 2011 Page 2 of 2

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 no me ka 'oia'i'o,

Clyde ₩. 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





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

GUY H. KAULUKUKUI

WILLIAM M. TAM DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES BOATING AND OCCAN RECREATION BURLOUP CONVEY ANCES COMISSION ON WATER RESOURCE MANAGEMENT CONSERVATION AND CONSTAL LANDS CONSERVATION AND CONSTAL LANDS FOREITRY AND WILDLIFE HISTORIC PRESERVATION KAHOOLAWE ISLAND RESERVE COMMISSION LAND STATE PARKS

LOG NO: 2011.1532 DOC NO: 1107TD10 Archaeology

### 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, Põhakuloa P.O. Box 4607 Hilo, Hawai'i 96720-0607

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

20030000000

(633757675556263752627

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 <u>tiffnie@hawaii.edu</u>.

Sincerely,

Chad Kalepa Baybayan, Chairman Kahu Kū Mauna Council

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

# APPENDIX C

**Pre-Consultation Communications** 

Parties to whom Preliminary Draft Environmental Assessment copies were provided for preconsultation:

Agency/Organization	<b>Comments Received</b>
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



Hawaiʻi 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:

An Equal Opportunity/Affirmative Action Institution

Dr. Crabbe 4/24/12 Page 2

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 <u>dthomas@soest.hawaii.edu</u>. 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



ALBERT "ALAPAKF" NAHALE-A CHAIRMAN HAWAIIAN HOMES COMMISSION MICHELLE K. KAUHANE DEPITY 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:

NEIL A BERCR OMBIE GO VER NOR STATE OF HAWAI'I Dr. Donald M. Thomas April 24, 2012 Page 2

- 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,



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

Attachments







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:

- 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.

Mr. Nahale-a 6/22/2012 Page 2

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,

Danald Thomas

Donald Thomas Project Director

# **APPENDIX D**

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 <sup>®</sup>				
Generic Name(s): Detergent				
Chemical Name(s): Proprietary blend of anioni	c aliphatic and aro	matic sulfo	onates	
Manufacturer: WYO-BEN, INC. Address: P.O. Box 1979 Billings, MT 59103	nufacturer: WYO-BEN, INC. Address: P.O. Box 1979 Billings, MT 59103 Telephone Numbers: Information: (406) 652-6351 EMERGENCY: (406) 652-6351			
	II. HAZARDOU	JS INGRE	EDIEN	TS
Ingredient	CAS No.	%		Hazard
Isopropanol	67-63-0	2-5 Concentrated vapors may be combustible inclosed areas (See Section IV) and may be irritating or nauseous (See Section VI).		Concentrated vapors may be combustible in enclosed areas (See Section IV) and may be irritating or nauseous (See Section VI).
	III. PHYS	ICAL DA	ТА	
Boiling Point (°F): ND Specific Gravity (H <sub>2</sub> O=1): 1.08		ity (H <sub>2</sub> O=1): 1.08		
Vapor Pressure (mm. Hg): ND Melting Point: NA		: NA		
Vapor Density (Air = 1): ND (Est. to be heavie	r than air)	Evapora	Evaporation Rate (Butyl Acetate = 1): ND	
Solubility in Water: Completely soluble		pH: 6.5 - 7.5		
Density (at 20° C): 9.0 lb./gal.		Viscosi	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 <sub>2</sub> .				
V. REACTIVITY				
Stability: Stable at normal temperatures. Avoid high temperatures.				
Hazardous Polymerization: Will not occur.				
Incompatibility: Strong oxidizing agents, strong	g acids.			
Hazardous Thermal Decomposition Products: $SO_x$ , $N0_x$ and $NH_x$				
NA = Not Applicable ND = Not Determi	ned			

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 PELAddition(for air contaminants)(8hr. TWA)(TWA)Isopropyl alcohol400 ppm (980 mg/m³)200 ppmCarcinogenicity: Not listed by NTP, IARC or OSHA.State Right-to-Know (California):May contain trace amounts ofas a by-products which can be absorbed through the skin or by inthat may cause a variety of injuries with over-exposure.	Permissible Exposure Limits: OSHA PEL ACGIH NIOSH   (for air contaminants) (8hr. TWA) (TWA) (STEL) (TWA) (STEL)   Isopropyl alcohol 400 ppm (980 mg/m <sup>3</sup> ) 200 ppm 400 ppm (980 mg/m <sup>3</sup> ) 500 ppm (1225 mg/m <sup>3</sup> )   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		
Oral LD <sub>50</sub> Rat: (Isopropanol) 5045 mg/kg Oral LD <sub>50</sub> Rat: (Isop	ropanol) 5045 mg/kg Oral LD <sub>50</sub> 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 AN	D 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. <u>ONLY</u> )		
Date Updated: October 29, 2007	Doc. #: 4010-90		

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.



**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

MSDS date: 30-Mar-2006

Components	CAC Number	W/= ===== 0/
Distillates, petroleum, hydrotreated heavy	64742-52-5	30-40
naphthenic	00551.40.0	
Naphtha, petroleum, hydrotreated heavy	64742-48-9 0-5	
	4. FIRST AID MEA	SURES
Eyes:	Flush the eye(s) with lukewarm, chemical is removed. Get medic	gently flowing water for 5-10 minutes or until the al attention if irritation persists.
Skin:	Wash off immediately with soap occurs. If clothing is contaminate	and plenty of water. Get medical attention if irritation ed, remove and launder before reuse.
Inhalation:	Remove to fresh air, if not breatl give oxygen and get immediate	hing give artificial respiration. If breathing is difficult, medical attention.
Ingestion:	Do not induce vomiting. If vomit reduce the risk of aspiration. Se	ing occurs naturally, have casualty lean forward to eek medical attention immediately.
	5. FIRE FIGHTING M	EASURES
Fire Fighting Measures:	Standard procedure for chemica Restrict pedestrian and vehicula	I fires. The product becomes slippery when wet. Ir 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 pedestri may exist.	an and vehicular traffic in areas where slip hazard
Fire Fighting Equipment:	Wear self-contained breathing a	pparatus and protective suit.
Unusual hazards:	The product is slippery when we	it.
Hazardous Combustion Products:	Burning may produce oxides of	carbon or nitrogen.
6. /	ACCIDENTAL RELEAS	E MEASURES
Cleanup Instructions: Other Information:	Absorb spill with inert material (e waste container. Spills are very This product may be classified a and 40 CFR Part 1 10, Part 1 12 courses or sewers entering/lead reported to the National Respon DC metropolitan areas call 202-	e.g. dry sand or earth), then place in a chemical slippery. Clean up promptly. Is an oil under Section 311 of the Clean Water Act 2. Spills entering (A) surface waters or (B) any water ing to surface waters that cause a sheen must be se Center (NRC: 800-424-8801). In Washington, 426-2675.
	7. HANDLING AND S	STORAGE
Handling:	As with all industrial chemicals, eye, skin, and clothing contact. with adequate ventilation.	use good industrial practices when handling. Avoid Do not inhale. Do not taste or swallow. Use only
Storage:	Keep containers tightly closed in temperature.	a cool, well-ventilated place. Avoid extremes of

Ciba Specialty Chemicals Corporation

Page 2 of 7

### 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 <sup>3</sup> 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

MSDS date: 30-Mar-2006

	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**

Ciba Specialty Chemicals Corporation
MSDS date: 30-Mar-2006

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.

Ciba Specialty Chemicals Corporation

MSDS date: 30-Mar-2006

### **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	Listed.
79-06-1 (0-0.05 %)	

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	Listed.	
79-06-1		

**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	Listed.		
79-06-1 (0-0.05 %)			

**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.

Ciba Specialty Chemicals Corporation

Page 6 of 7

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	Carcinogenic.
79-06-1	

### 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.

Ciba Specialty Chemicals Corporation



# WYO-BEN, INC.

# MATERIAL SAFETY DATA SHEET



**NFPA** FIRE HAZARD IDENTIFICATION SYSTEM

I. PRODUCT IDENTIFICATION				
Trade Name(s): NATUR	Trade Name(s): NATURALGEL <sup>®</sup>			
Generic Name(s): Wyon	ning (Western) Bentonite;	Bentonite Clay	(CAS No. 1302-78-9)	
Chemical Name(s): Sodi	um Montmorillonite (CA	AS No. 1318-93	-0)	
Manufacturer:WYO-BEN, INC.Telephone Numbers:Address:P.O. Box 1979Information:(406) 652-6351Billings, Montana 59103EMERGENCY:(406) 652-6351			Telephone Numbers:           Information:         (406) 652-6351           EMERGENCY:         (406) 652-6351	
	II.	HAZARDOUS	S INGREDIENTS	
Ingredient	CAS NO.	%	Hazard	
Crystalline Silica (SiO <sub>2</sub> ) 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 ty the 10 μ respira bentonite source other use specifi	pical quartz content of west able threshold size. The a e, fineness of product, mo- ic factors.	stern bentonite i actual respirable bisture content o	s in the range of 2 to 6% most of the quartz particles are larger than e quartz concentration in airborne bentonite dust will depend upon of product, local humidity and wind condition at point of use and	
		III. PHYSI	CAL DATA	
Boiling Point (°F): NA			Specific Gravity (H <sub>2</sub> O=1): 2.45-2.55	
Vapor Pressure (mm. Hg): NA Melti		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)		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 EX	XPLOSION DATA	
Flash Point: NA			Flammable Limits: LEL: NA UEL: NA	
Special Fire Fighting Pro-	cedures: NA			
Unusual Fire and Explosi	on Hazards: None. Produ	ict will not supp	ort combustion.	
Extinguishing Media: No	one for product. Any medi	ia can be used fo	or the packaging. Product becomes slippery when wet.	
V. REACTIVITY				
Stability: Stable				
Hazardous Polymerizatio	n: None			
Incompatibility: None				
Hazardous Decompositio	n Products: None			
NA = Not Applicable	ND = Not Determined	1		
Date Prepared: October 5,	2007		Doc #1060-00:	

VI. HEALTH HAZARD INFORMATION				
Routes of Exposure and Effects: Skin: Possible drying resulting in derm Eyes: Mechanical irritant. Inhalation: <i>Acute</i> (short term) exposur cough. <i>Chronic</i> (long term) exp respirable quartz particle levels Persistent dry cough and labore Ingestion: No adverse effects.	natitis. The to dust levels exceet posure to airborne ben are higher than TLV d breathing upon exe	ding the PEL may caus tonite dust containing r 's, may lead to develop rtion may be symptoma	the irritation of respiratory tract resulting in a dry espirable size ( $\leq 10 \ \mu$ m) quartz particles, where ment of silicosis or other respiratory problems. atic.	
Permissible Exposure Limits: (for air contaminants) Bentonite as "Particulates not of (formerly nuisance)	therwise regulated" e dust)	OSHA PEL (8hr. TWA)	ACGIH TLV	
Tota Resg Crystalline Silica: Quartz (respir	l dust birable dust able)	$15 \text{mg/m}^3$ $5 \text{mg/m}^3$ $10 \text{ mg/m}^3$ % Silica + 2	ND ND 0.025 mg/m <sup>3</sup>	
Carcinogenicity: Bentonite is not listed b humans for the carcinogenicity of inhale detected in all industrial circumstances s external factors affecting its biological ac 9 <sup>th</sup> Report on Carcinogens – 2000). ACG	y ACGIH, IARC, NT d crystalline silica fro tudied and that carcir tivity. NTP classifies IH classifies crystallir	P or OSHA. IARC, 19 om occupational source logenicity may depend respirable crystalline si le silica, quartz, as a sus	97, concludes that there is sufficient evidence in s (IARC Class 1), that carcinogenicity was not on characteristics of the crystalline silica or on lica as "known to be a human carcinogen" (NTP pected human carcinogen (A2).	
Acute Oral LD <sub>50</sub> : ND	Acute Derm	al LD <sub>50</sub> : ND	Aquatic Toxicology LC <sub>50</sub> : 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 A	AND USE PRECAUTI	ONS	
Steps to be Taken if Material is Released up to avoid generating airborne dust. Avo	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 HYO	GIENE CONTROL M	EASURES	
Ventilation Requirements: Mechanical,	general room ventilation	on. Use local ventilatio	n to maintain PEL's/TLV's.	
Respirator: Use respirators approved by	NIOSH/MSHA for si	ica bearing dust.		
Eye Protection: Generally not necessary.	Personal preference.			
Gloves: Generally not necessary. Person	nal preference.			
Other Protective Clothing or Equipment:	None			
	IX. SPECIA	L 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: N	JA	
Date Prepared: October 5, 2007			Doc #1060-00:	

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances. No warranty or guarantee, expressed or implied is made by WYO-BEN, INC. as to this information, or as to the safety, toxicity or effect of the use of this product.

# **APPENDIX E**

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

cummins Power	r Products					Print Version
Back   Current Location: Ho	me > Serial Number Database >	Results (Power Units)				
Power Units	DC Gensets	CANtrak MyC	PP Internat	tional Re	ecords	Contact Us
Details for Engi	ne Serial Number: 4 butors - Click Here 1	6800895 - <u>View Full</u> for Additional Det	Order ails			
Purchased By: Job Name: Order Date	Cummins Eastern ANDRE ROY 5/7/2007 10:52:	Canada, Inc. 55 AM	P.O. Number: Ship Date: Horsepower: Base Only:	1338078 9/28/2007 1 275	:12:02 PM	
Paint Code:	Primer		Enclosure:			
Comments:	1 miller		Enclosure.			
CPP Option	Cummins Option	Description			Ir	Parts nformation
AA11186	AAPU10153	25 G/CFM AIR	CLEANER			6
DE11083	DEPU10062	DECALS				6
EA11034	EAPU10020	ENGINE ACCE	SSORIES, J19	39 HARNES	s 🔊	>
EC11097	ECPU10081	ENGINE CONT	ROL, 12 FT. E	XTENSION		2
EN11134	ELPU10108	ENCLOSURE,	FULL, TOP A/C	;		2
GE11109	GEPU10096	ELECTRICAL S	SYSTEM, HEAT	ER GRID, 12	2V 💭	2
GE11128	GEPU10117	ELECTRICAL S	SYSTEM, 12V D	ELCO 20SI	OR	6
GE11134	GEPU10121	GROUND STR	AP			6
IN11177	INPU10163	INSTRUMENT	ASSY., 12V OF	24V, 24FT.		6
MM11184	MMPU10151	BASE RAILS, V	V/O ISOLATION	I, SAE#1		>
OD11006	ODPU10002	Oil Drain				2
PP11004	PPPU10004	PACKING MAT	ERIALS			6
RA11216	RAPU10137	COOLING SYS	TEM, SUCKER	, 125 LAT, V	V/CAC 🔊	>
RI11003	RIPU10003	A-SERIES TO ( INDICATOR W/	QSK23 RESTR 25" H20 RES	ICTION TRICTION		2
WL11009	WLPU10009	WATER LEVEL	SENSOR			6

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Engine specifications for the preferred drilling equipment for this project



This and the next several pages provide the engine operating characteristics and atmospheric emissions of the preferred drilling equipment.

Fire Engine Datasheet	Basic Engine Model		
Power Cummins Fire Power	CFF	P83-F40	
DePere, WI 54115	Curve Number:	FR - 90940	
http://www.cumminsfirepower.com	CPL Code:	8000	
Configuration Number: D413035GX02	Engine Family:	Industrial	
Installation Drawing: 8710	Revision Date:	November 2006	
General Engine Data			
Туре	4 Cycle; In	-Line; 6 Cylinder	
Aspiration	Turbochar	aed. Chra Air Cooled	
Bore & Stroke - in. (mm)	4.49 x 5.32	2 (114 x 135)	
Displacement $_{-}$ in $^{3}$ (litra)	505	(83)	
Compression Ratio	16 8.1	(0.0)	
Valves per Cylinder Inteke	1		
Valves per Cylinder - Intake	1		
- Exilausi	2045	(020)	
Mot Weight - Ib (kg)	2045	(920)	
Meximum Allewable Banding Memort @ Deer Fore of Black, the ft (N m)		(903)	
		(1350)	
Air Induction System			
May Townsethus Diss Debusen Ambient Air and Envire Air July 400	20	(10.7)	
Max. Temperature Rise Between Ambient Air and Engine Air Inlet - F (*C)		(16.7)	
Maximum Inlet Restriction with Dirty Filter - in. H <sub>2</sub> O (mm H <sub>2</sub> O)		(635)	
Recommended Air Cleaner Element - (Standard) Donaldson (CFP)	B105006	(8535)	
- (Optional)K&N (CFP)	RU5045	(9606)	
		N 10	
Lubrication System			
Oil Pressure Range at Rated - PSI (kPa)	40-60	(276-414)	
Oil Capacity of Pan (High - Low) - U.S. quarts (litre)		(18.9-15.1)	
Total System Capacity - U.S. Gal. (litre)	6.3	(23.8)	
Recommended Lube Oil Filter Fleetguard (Cummins	s) LF9009	(3401544)	
		13 14	
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)		(31.75)	
Coolant Water Capacity (Engine Side) - U.S. gal. (litre)	5.9	(22.3)	
Standard Thermostat - Type	Modulating	2	
- Range - deg F (deg C)		(82-95)	
Minimum Raw Water Flow			
with Water Temperatures to 90 °F (32 °C) - U.S. GPM (litre/s)		(1.89)	
Recommended Cooling Water Filter	s) WF2072	(4058964)	
	o)	(1000001)	
A jacket water heater is mandatory on this engine. The recommended heater wattage is	2250 down to 40	°F (4 °C).	
		- Ann and an	
Exhaust System			
Max. Back Pressure Imposed by Complete Exhaust System in in. H <sub>2</sub> O (kPa)		(10.2)	
Exhaust Pipe Size Normally Acceptable - in. (mm)	5.0	(127)	
Noise Emissions			
Тор	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.).			
. , , ,			

Data Sheet for CFP83-F40

Drawing No. 9745, Rev. G

Fuel Sumply / Dusin System	1470	1760
CED92 E40 Nominal Eval Consumption Cal /hr /l /hr)	11 9 (44	9) 14 5 (55 0)
CFP83-F40 Nominal Fuel Consumption - Gal./nr. (L/nr)	11.8 (44. Number 21	8) 14.5 (55.0) Disast Only
Minimum Supply Line Size in (mm)	Number 2 I	
Minimum Supply Line Size - In. (IIIII)	0.375	(9.53)
Maximum Dialit Life Size - III. (1111)	0.25	(0.33)
Maximum Fuel Line Length Between Supply Tank & Fuel Pump - It. (III)	40 90	(12)
Decemmended Fuel Filter Primery	00 F01051	(2032)
Recommended Fuel Filler - Filliary	Nono	(3260303)
Maximum Postriction @ Lift Pump Inlot With Clean Filter in Ha (mm Ha)	10	(102)
Maximum Restriction @ Lift Pump-Inlet - With Dirty Filter - in. Hg (mm Hg)	4.0 8.0	(102)
Maximum Restriction @ Lift Fump-Inter - With Dirty Filter - Int. Fig (Inter Fig)	10	(253)
Minimum Fuel Tank Vont Canability 4 <sup>3</sup> /br/m <sup>3</sup> /br)	10	(204)
	12	(0.30)
Maximum Fuel Temperature @ Lift Pump Inlet - 'F ('C)	160	(71)
Starting and Electrical System	<u>12V</u>	<u>24V</u>
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	
included are compressor, fan, optional equipment, and driven components. Data is based on op conditions of 300 ft. (91.4 m) altitude, 29.61 in. (752 mm) Hg dry barometer, and 77 °F (25 °C) in No.2 diesel or a fuel corresponding to ASTM-D2.	peration at s ntake air te	SAE standard J1394 mperature, using
Altitude Above Which Output Should be Limited - ft (m)	300	(01.4)
Correction Factor per 1000 ft. (305 m) above Altitude Limit	3%	(01.4)
Temperature Above Which Output Should be Limited $_{\rm o}^{\rm o}{\rm E}/^{\rm o}{\rm C}$	77	(25)
Correction Easter per 10 °C (11 °C) Above Temperature Limit	10/	(20)
	1 70	(270)
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

Data Sheet for CFP83-F40

Drawing No. 9745, Rev. G

### FM Approved and UL Listed Ratings for CFP83-F40

Engine Speed - RPM	<u>1470</u>	<u>1760</u>
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.

Data Sheet for CFP83-F40

Drawing No. 9745, Rev. G

Page 3 of 3



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.

"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.





Monitoring and Control System The user friendly Control Panel (housed in a weathertight enclosure) provides real time system information.

#### 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.



**Rotary Screw Compressor** Two-stage, fluid flooded. Cast iron housing is dimensionally stable, thick-walled and machined to close tolerances.

#### 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.



Sullair AWF Compressor Fluid Improved hot and cold weather lubrication. Longer compressor fluid life. Extended airend warranty

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



@ Rated			Rated Pressure		Designated Model	Weight (wet)	Length	Width	Height
Pressure		psig (bar)			<b>lbs</b> (kg)	<b>in</b> (mm)	in (mm)	in (mm)	
*750 / 900 0	<b>:fm</b> (355 L/S	/ 425 L/S)	<b>500 / 350</b> (34.5	5/24)	Open Frame	<b>13050</b> (5919)	<b>182</b> (4623)	<b>86</b> (2185)	<b>87</b> (2210)
**900 / 1150	cfm (425 L/S	5 / 543 L/S)	<b>500 / 350</b> (34.5	5/24)	Open Frame	<b>13050</b> (5919)	<b>182</b> (4623)	<b>86</b> (2185)	<b>87</b> (2210)
***1150 / 135	0 cfm (543 L/	'S / 637 L/S)	<b>500 / 350</b> (34.5	5/24)	Open Frame	<b>13050</b> (5919)	<b>182</b> (4623)	<b>86</b> (2185)	<b>87</b> (2210)
Engine Make	Engine Type	Engine Model	Displacement cu in (cc)	Cylinders	Cycles	Bore and Stroke in (mm)	Rated S rpm	Speed Ra hp	<b>ated Power</b> (kW)
*Caterpillar	Diesel	C-15 ACERT	928 (15.2)	6	4	5.4 X 6.7 (137 X 171)	1800	47	<b>/5</b> (354)
**Caterpillar	Diesel	C-15 ACERT	928 (15.2)	6	4	5.4 X 6.7 (137 X 171)	1800	54	<b>IO</b> (403)
***Catornillar	Diesel	C-18 ACERT	<b>1106</b> (18.1)	6	4	57X72 (145 X 183)	1800	61	0 (476)



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### DIESEL GENERATOR SET



Image shown may not reflect actual package

### 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<sup>™</sup> program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

# CATERPILLAR®

# 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.

- 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.

50 Hz 1500 rpm 400 Volts

# **CATERPILLAR**<sup>®</sup>

# FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	Light Duty Air filter	[] Single element air filter
	Service indicator	[] Dual element air filter
		[] Heavy-duty dual element air filter with precleaner
		[] Air inlet shut-off
Cooling	Radiator package mounted	[] Radiator duct flange
_	Coolant level sight gauge	[] Low coolant level sensor
	Coolant drain line with valve	
	Fan and belt guards	
	Cat® Extended Life Coolant	
Exhaust	Dry exhaust manifold	[] Industrial [] Residential [] Critical Mufflers
	<ul> <li>Stainless steel flex fittings with split-cuff connection</li> </ul>	[] Manifold and turbocharger guards
	Exhaust flange outlet	[] Elbows and through-wall kits
Fuel	Primary fuel filter with integral water separator	[] Integral single wall fuel tank base
	Secondary fuel filters	[] Integral dual wall fuel tank base
	Fuel priming pump	[] Fuel level switch
	Engine fuel transfer pump	
	Fuel cooler*	
	Flexible fuel lines	
Concenter	*Not included with packages without radiators	
Generator	Class H insulation     Solf evolted (SE)	[] Oversize generators
	Self excited (SE)	() Permanent magnet excitor (PWG)
	Class H temperature rise	[] Internal excited (IE)
	VR6 voltage regulator with 3-phase sensing with load	[] Digital voltage regulator (CDVR) with kVAR/PF
	adjustment module	[] Anti-condensation space heaters
	IP23 protection	[] Coastal Insulation Protection (CIP)
		[] Reactive droop
Power Termination	Power Center houses EMCP controller and	[] Power Center mounting option (right side)
	power/control terminations (rear mounted)	[] Multiple circuit breakers
	Circuit breaker, UL listed, 3 pole (80% & 100% Rated)	[] C.B. Shunt trips
	Circuit breaker, IEC compliant, 3-4 pole (100% Rated)	[] C.B. Auxiliary contacts
	Segregated low voltage wiring termination panel	
	IP22 protection	
-	Bottom cable entry	
Governor	• ADEM 111A4	[] Load share module
Control Panel	EMCP 3.1 (rear mounted)	[] EMCP 3.2 (can be RH mounted)
	Speed adjustment	[] Local annunciator modules
	Voltage adjustment	[] Remote annunciator modules
	Emergency stop pushbutton	[] Discrete I/O module
Lube	Lubricating oil	[] Oil temperature sensor
	Oil drain line with valves	[] Manual sump pump
	Oil filter and dipstick	
	Fumes disposal	
	Lube oil level indicator	
	Oil cooler	
Mounting	Formed steel narrow base frame	[] Oil skid base
	Linear vibration isolation-seismic zone 4	[] Formed steel wide base frame
Starting/Charging	24 volt starting motor	[] Jacket water heater
	<ul> <li>24 volt, 45 amp charging alternator</li> </ul>	[] 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	[] EU Certificate of Conformance
	gloss black	[] Weather protective enclosure
	Flywheel housing - SAE No.1	[] Sound attenuated protective enclosure

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2

50 Hz 1500 rpm 400 Volts

# CATERPILLAR

### **SPECIFICATIONS**

### CAT GENERATOR

985 - 9225	
Frame size	LC6114D
Excitation	Self Excitation
Pitch	0.6667
Number of poles	4
Number of bearings	Single Bearing
Number of Leads	012
nsulation UL 1446 R	lecognized Class H with
ropicalization and antiabrasion Consult your Caterpillar dealer fo	or available voltages
P Rating	IP23
Alignment	Pilot Shaft
Overspeed capability	125% of rated
Wave form Deviation (Line to Line	e)
Voltage regulator	Three phase sensing
Voltage regulationLess tha	n +/- 1/2% (steady state)
Less than +/- ½% (w/ 3% speed ch	ange)
Telephone influence factor	Less than 50
Harmonic Distortion	Less than 5%

#### CAT DIESEL ENGINE

C15 ATAAC, L-6, 4-stroke wate	er-cooled diesel
Bore	137.20 mm (5.4 in)
Stroke	171.40 mm (6.75 in)
Displacement	15.20 L (927.56 in <sup>3</sup> )
Compression Ratio	
Aspiration	ATAAC
Fuel System	MEUI
Governor Type Cater	pillar 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

3

- Vandal door
- Local annunciator module
- Remote annunciator module
- Input / Output module
- RTD / Thermocouple Modules
- Monitoring software

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50 Hz 1500 rpm 400 Volts

# CATERPILLAR

### **TECHNICAL DATA**

Open Generator Set 1500 rpm/50 Hz/400 Volts DM9185		9185
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 <sup>1</sup>		
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		Managerous as as
Combustion air inlet flow rate	33.0 m³/min	1165.4 cfm
Exhaust System		
Exhaust stack gas temperature	520.6 ° C	969.1 ° F
Exhaust gas flow rate	92.6 m³/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 <sup>2</sup>	and a second second	
Motor starting capability @ 30% voltage dip	923 skVA	
Frame	LC6114D	ACC 22
Temperature Rise	163 ° C	293 ° F
Lube System		
Sump refill with filter	60.0 L	15.9 gal
Emissions (Nominal) <sup>3</sup>		
NOx mg/nm3	1840.6 mg/nm <sup>3</sup>	
CO mg/nm3	347.8 mg/nm <sup>3</sup>	
HC mg/nm3	6.3 mg/nm <sup>3</sup>	
PM mg/nm3	12.8 mg/nm <sup>3</sup>	

PM mg/mm3
 12.8 mg/ma
 12.

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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.

4

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

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/b) 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.