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University of Hawaii at Manoa

Hawaii Natural Energy Institute
Holmes Hall 246 • 2540 Dole Street • Honolulu, Hawaii 96822

March 6, 1990

Mr. Manabu Tagamori
Dept. of Land & Natural Resources
1151 Punchbowl
P.O. Box 373
Honolulu, Hawaii 96813

Dear Mr. Tagamori:

Please find enclosed a draft copy of the Maui Scientific Observation Hole EA/NOP, which has been prepared by MCM Planning. I would appreciate any comments that you may have regarding this document.

Thank you in advance for your attention to this request.

Sincerely,

Laura Glenn for

Harry J Olson

M C M
PLANNING

703 Honua Street
Honolulu, Hawaii 96816
(808) 732-7143

March 2, 1990

TO: Harry Olson, HNEI ✓
Art Seki, HNEI
John Knox, CRI
Hallett Hammatt, Cultural Surveys Hawaii
Winona Char, Char & Associates
Ron Darby, Darby & Associates
John Mink
Bill Brewer, Brewer/Brandman Associates

FROM: Marilynn C. Metz

RE: Maui SOH
Environmental Assessmment/Notice of Preparation of EIS
--"In-House Draft"

Please review and comment on the attached EA/NOP; especially the sections dealing with your field of expertise. I would appreciate comments by the end of the month.

UNIVERSITY OF HAWAII

Hawaii Natural Energy Institute

ENVIRONMENTAL ASSESSMENT AND NOTICE OF PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT

SCIENTIFIC OBSERVATION HOLE PROGRAM

District of Makawao, Island of Maui

"In-House" Draft # 1

March, 1990

ENVIRONMENTAL ASSESSMENT AND
ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
March 1990

PROJECT: HAWAII NATURAL ENERGY INSTITUTE
SCIENTIFIC OBSERVATION HOLE PROGRAM (MAUI)

LOCATION: ULUPALAKUA, DISTRICT OF MAKAWAO
ISLAND OF MAUI
STATE OF HAWAII

PROPOSING AGENCY: UNIVERSITY OF HAWAII
VICE-PRESIDENT FOR FINANCE AND OPERATIONS
2444 DOLE STREET
HONOLULU, HAWAII 96822

ACCEPTING AUTHORITY: GOVERNOR JOHN WAIHEE
STATE OF HAWAII

CONTACT: MR. ART SEKI
UNIVERSITY OF HAWAII AT MANOA
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DETERMINATION

The University of Hawaii has determined that the proposed action will require an environmental impact statement under Chapter 343, Section 343-5, Hawaii Revised Statutes, because the proposed actions could possibly have a significant effect on the environment as defined in Title 11, Chapter 200, Section 11-200-12, of the Environmental Impact Statement Rules. Written comments on this Environmental Assessment/Notice of Preparation of EIS should be addressed to:

Ralph T. Horii, Jr.
Vice President for Finance and Operations
Attention: Mr. Art Seki
Hawaii Natural Energy Institute
2540 Dole Street, Holmes Hall 246
Honolulu, Hawaii 96822

With a copy to:

MCM Planning
Ms. Marilynn C. Metz
703 Honua Street
Honolulu, Hawaii 96816

Deadline for comments is xxxxxxx xx, 1990. All comments will receive written responses; those postmarked by the xxxxxxx xxxx deadline will be published in the draft EIS.

PART I: INTRODUCTION

A. OVERVIEW OF THE SCIENTIFIC OBSERVATION HOLE (SOH) PROGRAM

The University of Hawaii (UH), Hawaii Natural Energy Institute (HNEI), proposes to conduct a Scientific Observation Hole (SOH) program to evaluate the geology, hydrology, and subsurface thermal regime on the islands of Hawaii and Maui (Figure I-1). The initial four holes of the program are presently being drilled on the island of Hawaii, in the Kilauea Middle East Rift Zone and the Kamaili and Kapoho Sections of the Kilauea Lower East Rift Geothermal Resource Subzones (GRS). (A Negative Declaration for the Hawaii Island SOHs (UH HNEI, 1989) was published in the Bulletin of the Office of Environmental Quality Control (OEQC) in March, 1989.)

Two additional holes are planned to be drilled on Maui, within the Haleakala Southwest Rift GRS (Figure I-2). Although currently available geotechnical data indicate the presence of a geothermal resource on the island of Maui, only exploratory drilling is capable of positively identifying a subsurface geothermal system. It is estimated that due to the geologically young age of the recent 1790 eruption and results of deep resistivity soundings, the GRS has a 25 percent probability of containing high temperature geothermal resources (DPED, 1986).

It should be emphasized that the purpose of the Scientific Observation Holes is for scientific observation only. The holes will not be flow tested or produced. The information to be gained from the SOHs will provide an assessment of subsurface geological conditions, ground water level and composition, temperature, drilling conditions, an inventory of possible mineral and geothermal resources, and an eruptive history of the island to the depth drilled. The SOHs can also be instrumented to provide data relating to reservoir productivity.

The primary objectives of the project are to confirm the presence and extent of the geothermal resource and to inventory the State's energy and possible mineral resources. In addition, a major scientific objective of the program is to create a clearly defined methodology for analyzing geothermal resource characteristics based on geologic, hydrologic, geochemical and geophysical surveys when coupled with statistical methods applied to slim hole data.

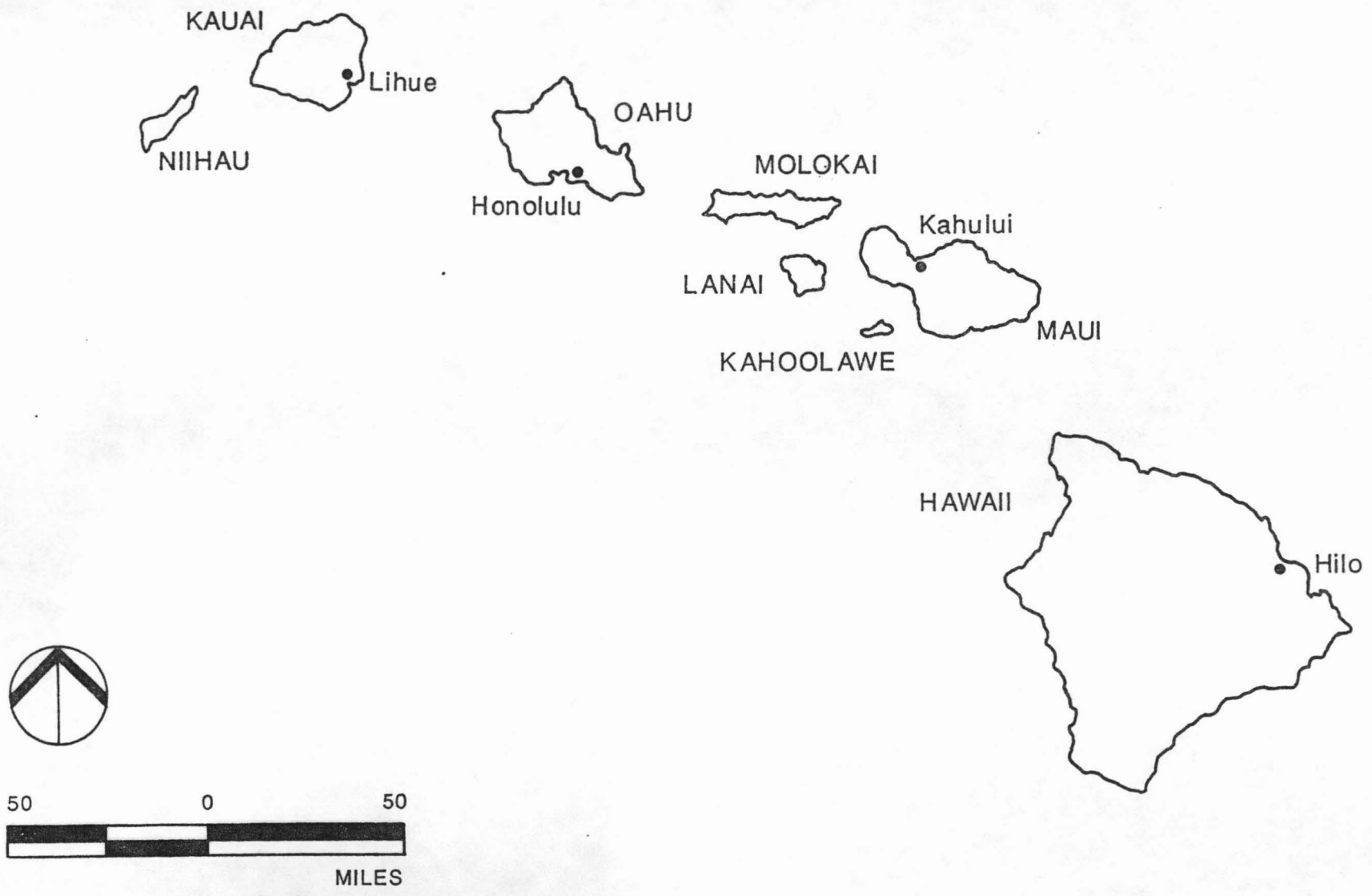

Figure I-1
STATE OF HAWAII

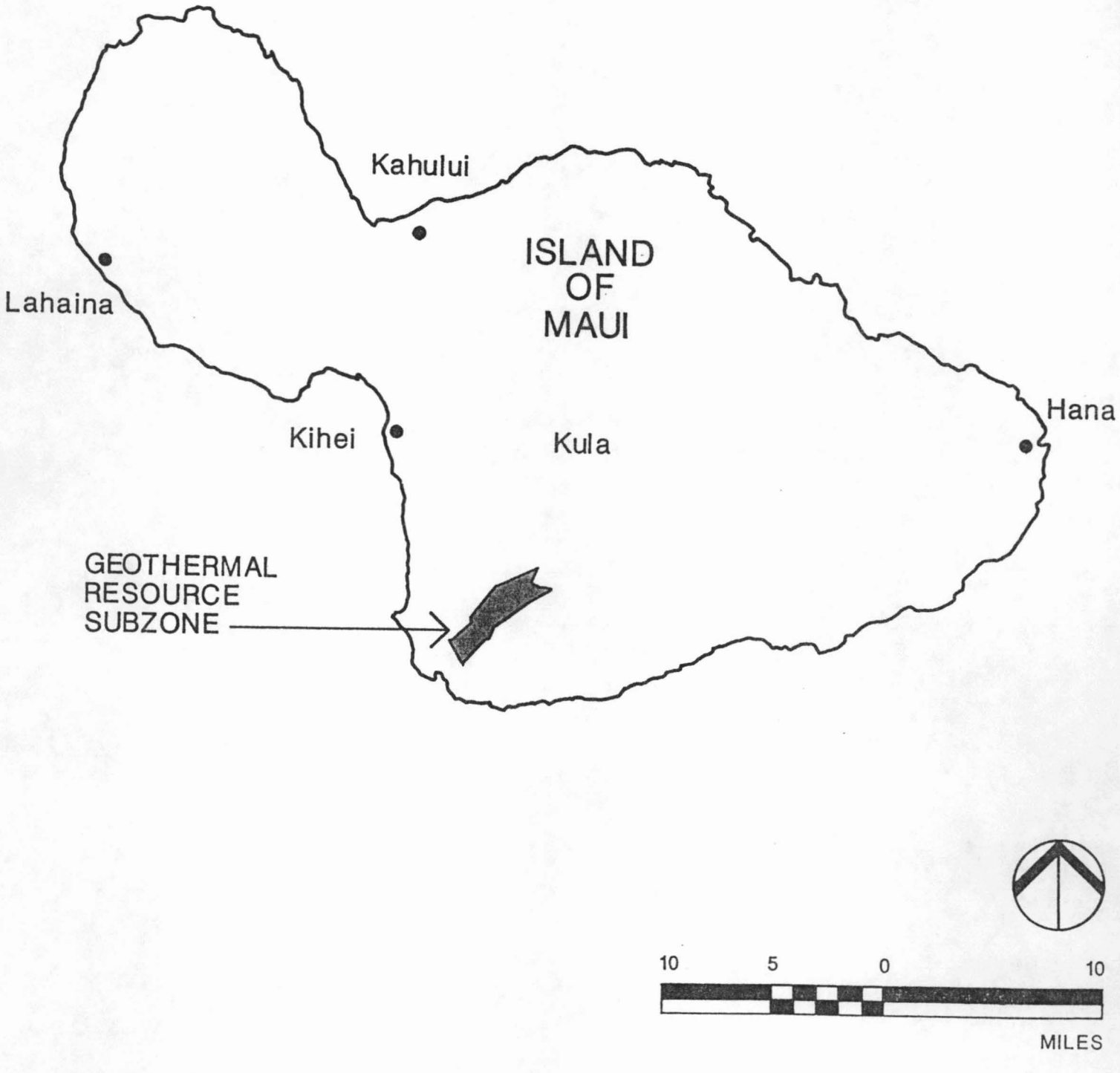

Figure I-2

LOCATION MAP

The SOH program is being undertaken in cooperation with the State of Hawaii, the University of Hawaii (HNEI), Hawaiian Electric Company (HECO), the County of Maui, and, two private geothermal developers: Puna Geothermal Venture and True/Mid-Pacific Geothermal Venture. The Hawaii State Legislature has appropriated $3 million for this effort with cost-sharing from the private developers, HECO and the Electric Power Research Institute. The total funding (which also includes the four SOHs on the island of Hawaii) will be in excess of $7.5 million over a one and a half to two year period.

B. BACKGROUND

Hawaii presently relies upon imported petroleum fuel to supply 90 percent of its electricity, making the State vulnerable to sudden shortages in supply or escalations in the price of this diminishing source of energy. A major policy of the Hawaii State Plan is to increase energy self-sufficiency (Section 226-18, Hawaii Revised Statutes). In recent years the State Legislature adopted a number of bills to facilitate the orderly development of geothermal energy in Hawaii. Among them:

Act 296, SLH 1983: the Geothermal Resource Subzone Act (amending Chapter 205, Hawaii Revised Statutes), which provides for the designation of geothermal resource subzones wherein proposals for geothermal development could be considered by appropriate State and County permitting agencies. This act authorizes subzones to be established by the State Board of Land and Natural Resources (BLNR) in areas of significant geothermal resources where the potential positive environmental, economic and social benefits of the development to the State as a whole outweigh the potential negative environmental and social impacts.

Act 138, SLH 1985: which requires the BLNR to fix the payment of royalties to the State for the use of geothermal resources at a rate which will encourage new and continued geothermal production and development.

Act 301, SLH 1988: which provides for a coordinated permitting process involving the various state and county agencies that must approve the development of geothermal energy and designates the State Departmentof Land and Natural Resources (DLNR) as the lead agency; and,

Act 390, SLH 1988: which authorized funding to finance construction for Geothermal Resource Development and provided funding for the exploration program which is the subject of this environmental assessment.

C. PURPOSE OF THIS ENVIRONMENTAL ASSESSMENT

This environmental assessment has been prepared to comply with Section 11-200-5 (b), Environmental Impact Statement Rules, which states that "..when an agency proposes to implement an action to use state or county lands or funds, it shall be subject to the provisions of chapter 343, Hawaii Revised Statutes, and this chapter"; and, Section 11-200-10 which states that "agencies..shall prepare an environmental assessment of each proposed action and determine whether the anticipated effects constitute a significant effect in the context of chapter 343, Hawaii Revised Statutes, and section 11-200-12."

PART II: DESCRIPTION OF THE ACTION

A. GENERAL CHARACTERISTICS OF THE PROJECT

The proposed project would involve drilling a slim (4-inch-diameter or less) scientific observation hole (SOH) to a nominal depth of approximately 4,000 to 6,500 feet at each of two locations within the Haleakala Southwest Rift Geothermal Resource Subzone (GRS) (Figure II-1). The scientific research undertaken would include: logging the core from the hole; taking temperature measurements during and after the drilling operations; collecting water samples where encountered; running downhole geophysical measurements; and, possibly performing potential reservoir analysis studies by injecting water into the holes. These holes are scientific observation holes only. They are not designed as production wells or to produce fluids, and the SOHs would not be flow tested or produced.

A combination of cable tool, rotary, and core drilling methods would be used to provide the maximum flexibility to handle the variety of anticipated drilling conditions. Two crews, consisting of two or three men plus a drilling foreman and drilling supervisor, would rotate on 12-hour per day shifts; a third crew would be available for relief. Rotary and core drilling would be conducted continuously, 24-hours a day, seven days a week until the hole is completed (between three and five months at each location). (A diagram of a typical rig is presented in Figure II-2). The hole would be completed by running geophysical logs, inserting casing or tubing to total depth, removing the blow-out prevention equipment (BOP), and installing a wellhead valve. Figure II-3 presents a profile of the completed hole.

Initial testing of the well would involve taking a series of temperatures at depth to determine the rate of increase of temperature with depth and the absolute bottom hole temperature. After testing of the hole is completed, a decision would be made as to whether or not to continue monitoring the hole, to cap the hole, or to plug and abandon it. When the hole is abandoned, the site would be restored as nearly as possible to its original condition.

The proposed SOH drill sites are designated 5m and 6m. As shown on Figure II-4, SOH 5m (TMK: 2-1-04:49 por.) is located at the 860-foot-elevation of Haleakala on land leased to

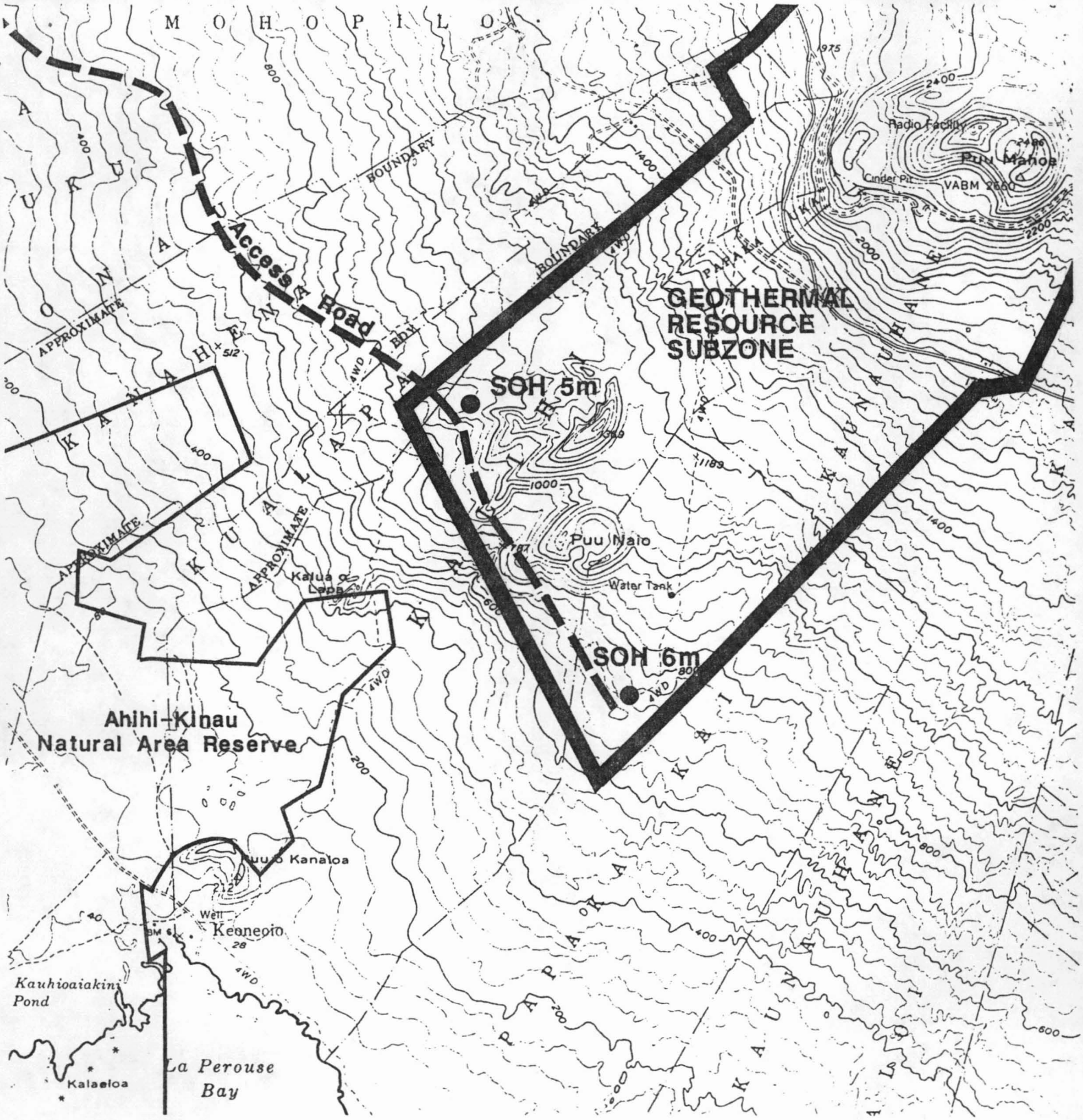

Figure II-1.

PROPOSED SOH SITES

WEIGHTS			
	F/A*	R/A	TOTAL
TRUCK ONLY	5.450 T	3.600 T	9.050 T
BASIC RIG	8.410 T	19.350 T	27.760 T
WITH COMPR	10.310 T	21.610 T	31.920 T

* FOR FIXED LEGS ONLY
ADD 0.143 T TO F/A AND TOTAL
FOR EXTENDABLE LEGS

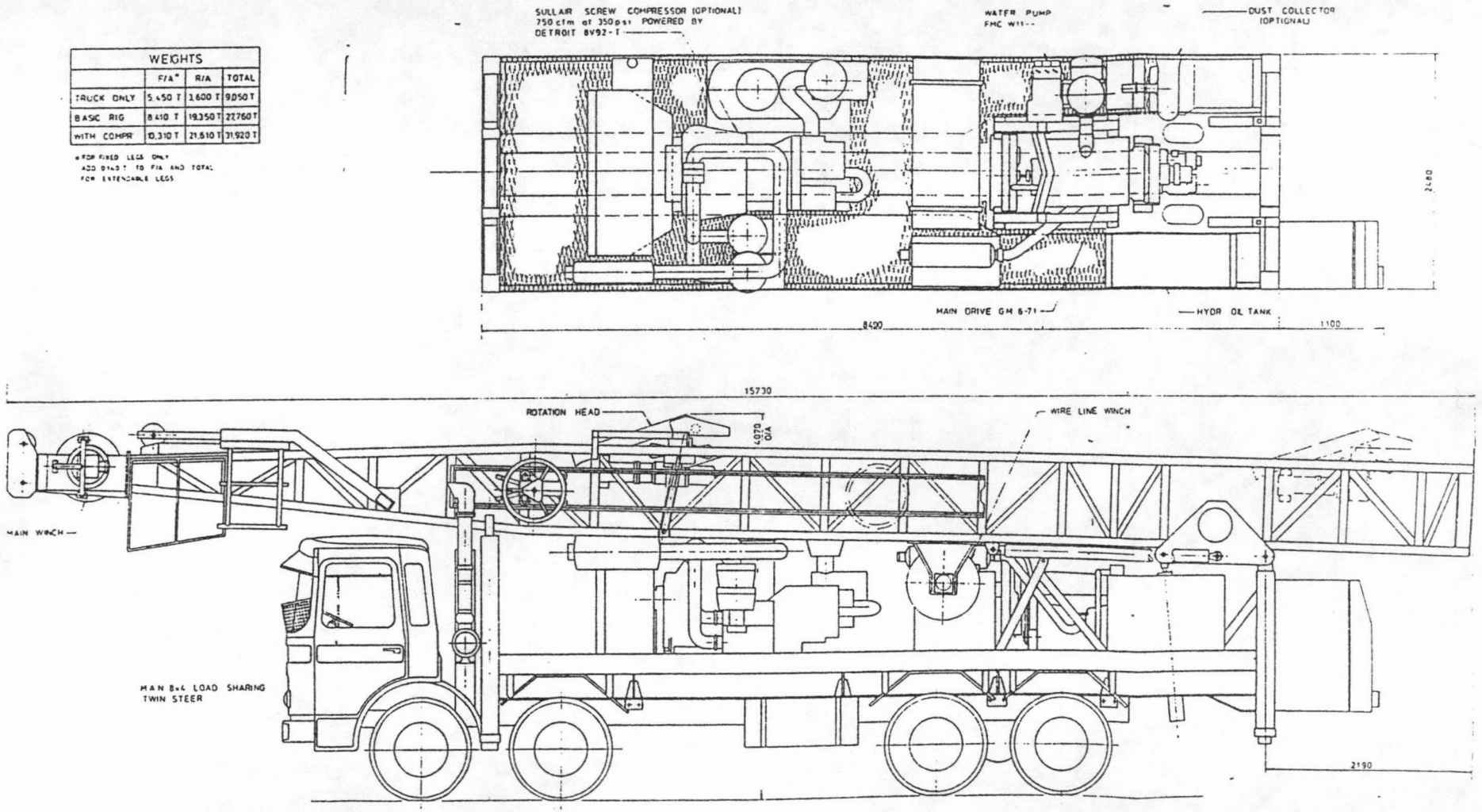

Figure II-2

DRILL RIG LAYOUT

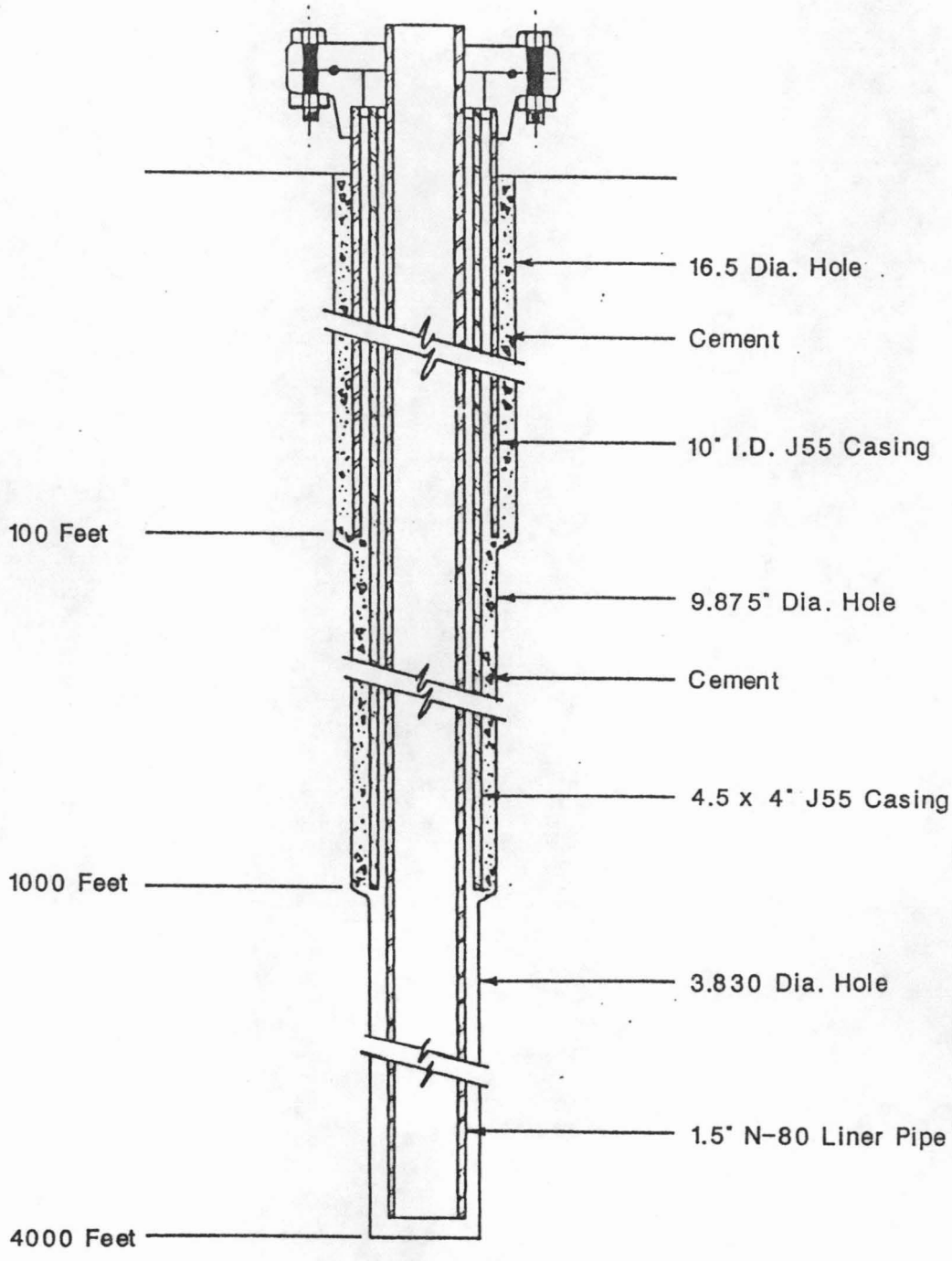

Figure II-3

PROFILE OF A COMPLETED SOH HOLE

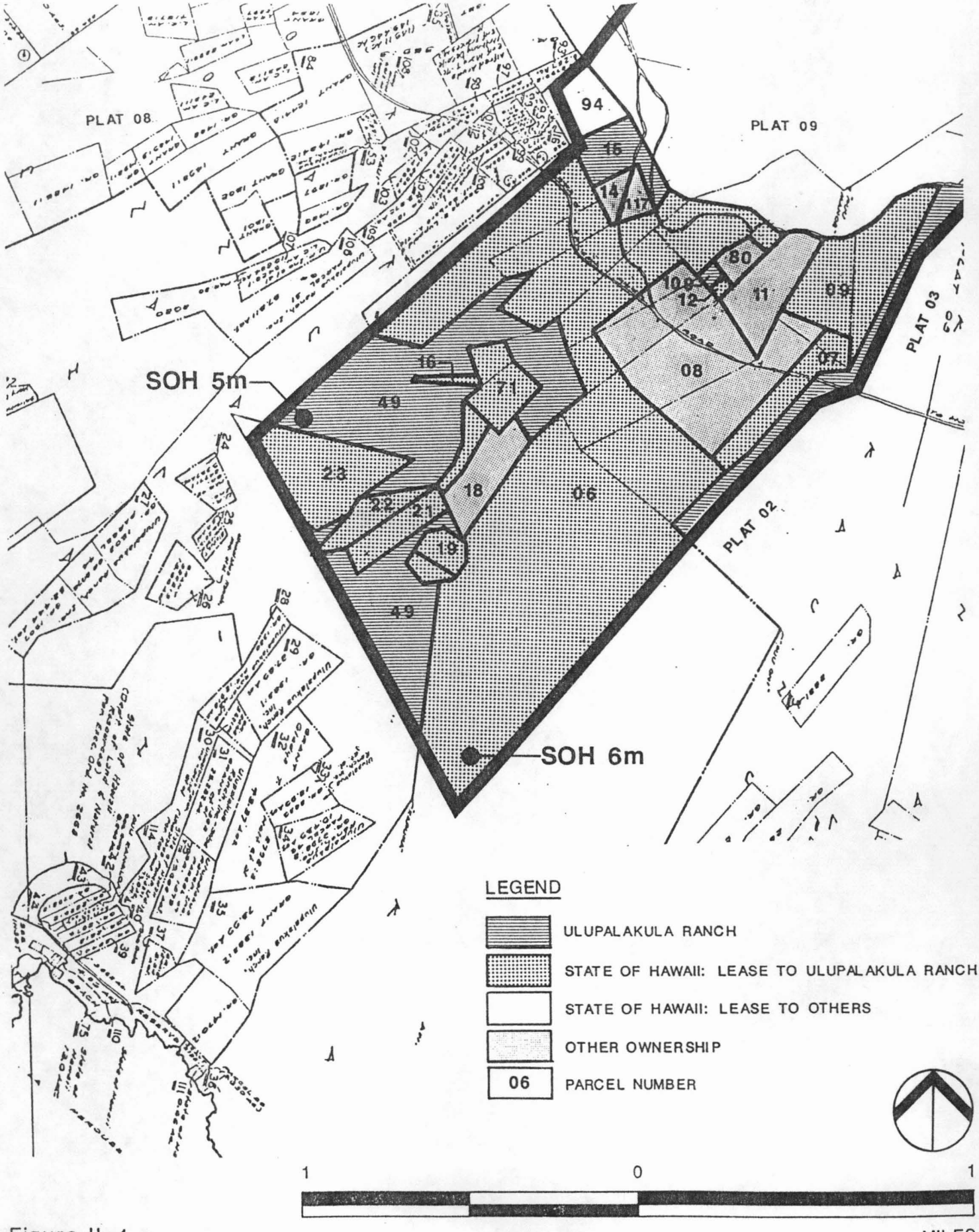

Figure II-4

LAND OWNERSHIP WITHIN THE GRS: TMK 2-1-04

Ulupalakua Ranch by the State of Hawaii; SOH 6m (TMK:2-1-04:06 por.) is located at about the 720-foot-elevation on land owned by Ulupalakua Ranch. Both sites are within the state Agricultural District. The geothermal development rights to both parcels are owned by True-Mid Pacific Geothermal Venture.

Site preparation activities for drill pads would consist of clearing and leveling an area of about 10,000 square feet. A mud pit lined with plastic sheeting would be constructed to collect any waste water and drill cuttings. No permanent structures would be constructed on the site; because the holes would not be produced there would be no brine collection and disposal systems, power plants, or electrical power distribution systems. A conceptual plan for a typical SOH drill site is presented in Figure II-5.

Access to the sites would be via an unpaved private ranch road entering from Highway 31 near Makena (Figure II-6). The road may be improved in sections in order to permit rig access.

During the drilling process, mud mixed with water would be pumped down the hole. It is estimated that a maximum of 7,500 gallons of water per day would be required to replace that which was lost down the hole. It is planned that this water would be provided from Ulupalakua Ranch sources.

The drilling rigs are self-contained and require no other source of electrical power. Communications would be via cellular telephone and/or mobile radio. Liquid and solid waste would be disposed of by various means. Drilling mud and rock cuttings are expected to be lost downhole. Any rock cuttings that may result from drilling operations would be pumped into the mud pit and permitted to dry. Accompanying fluids would be tested; if benign, they would probably be allowed to percolate into the ground. Trash and operational debris would be collected by the drilling contractor and hauled away to a disposal site. Chemical toilets would be used at the sites and maintained by the drilling contractor.

Three separate drill rigs would be used to drill one SOH. Once a drill rig is on-site, it would remain there until its portion of the work is done; it would then be moved to another SOH site. Every attempt will be made to move drill rigs at hours when the potential of obstructing traffic is low. Other construction equipment, which would be brought to the site and left there until the site preparation activities are completed, could include: bulldozers; graders; front-end loaders; and, cement mixers.

At the beginning of the project, large trucks would deliver pipes and other materials to the site. Additional materials may be delivered during the course of the project. It

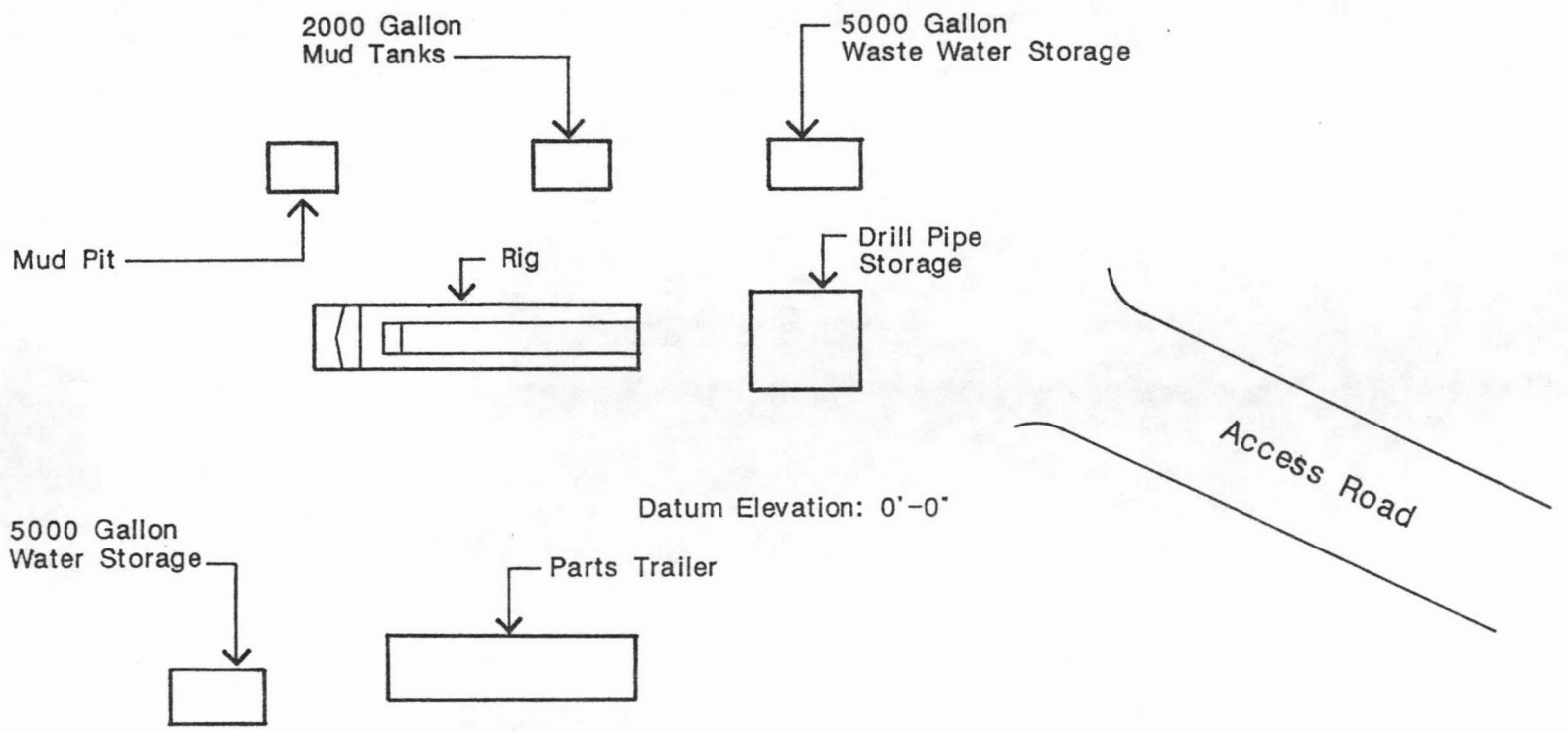

Figure II-5

TYPICAL DRILL SITE PLAN

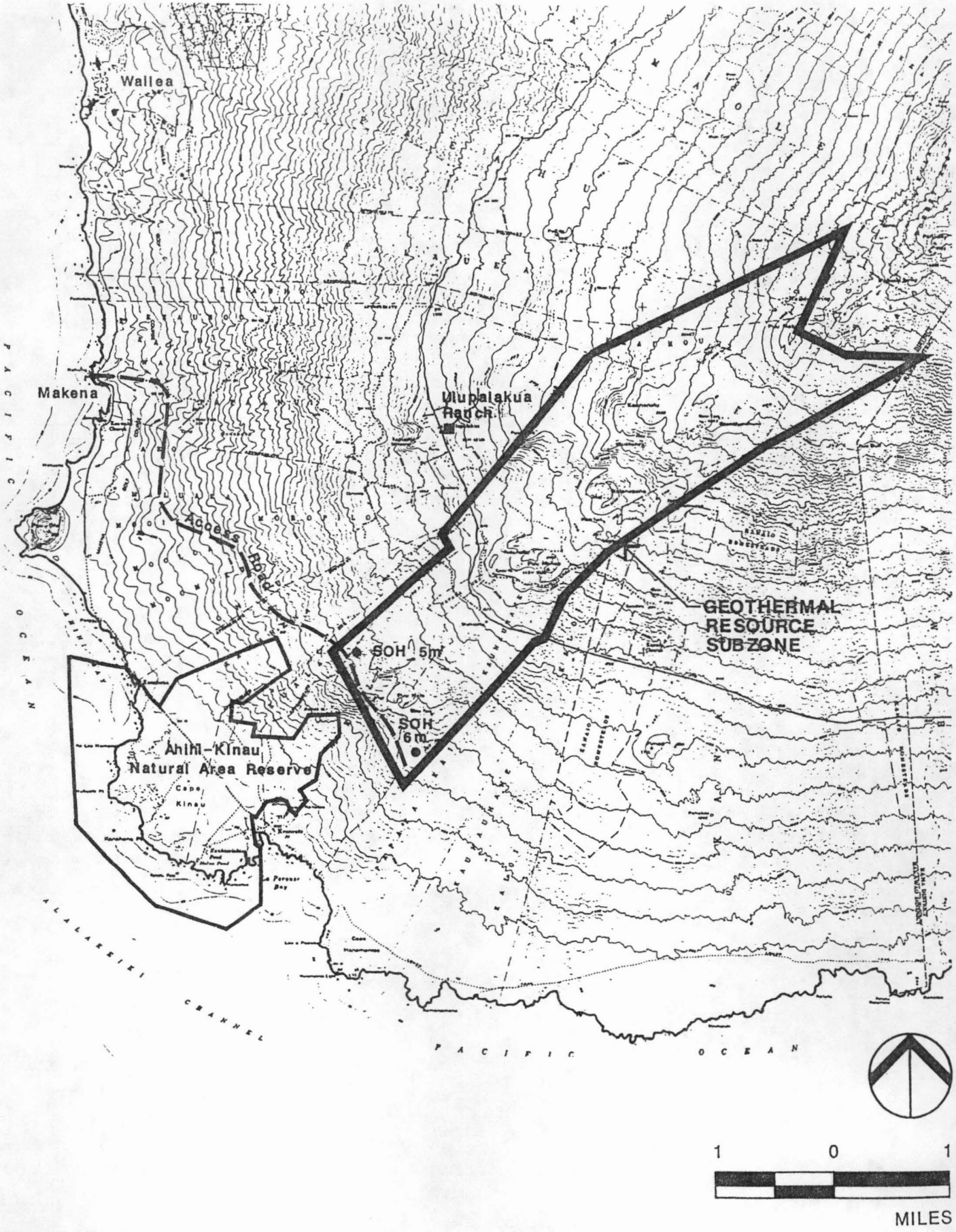

Figure II-6

REGIONAL MAP

is intended that diesel fuel would be brought in with the drillers at each shift change. It may be necessary, however, to have fuel trucks service the site two or three times a week during the three to five months duration of the drilling project. Vehicle round trips by drill crews, other technical personnel associated with the project and various suppliers and subcontractors would probably average ten to fifteen per day.

B. ALTERNATIVES TO THE ACTION

The following are among the alternatives that will be assessed in the EIS:

- Alternative Sites
- Alternative Means To Achieve Research Objectives
- No Project Alternative

PART III: DESCRIPTION OF THE ENVIRONMENTAL SETTING

A. THE REGION

The island of Maui (Figure I-2) is the second largest of the Hawaiian Islands, encompassing an area of approximately 729 square miles. Maui is made up of two shield volcanoes connected by an isthmus. West Maui -- 5,788 feet in elevation at its highest point, Puu Kukui -- is the older of the two volcanic systems; it has completed all of the recognized phases of Hawaiian volcanic activity (Feldman and Siegel, 1980). Haleakala, the massive volcano of East Maui -- 10,023 feet in elevation at Red Hill, its summit -- was constructed in three main stages. Three well-defined rift zones are present on Haleakala, trending southwest, east-northeast, and north-northwest from the summit. Haleakala, which is considered a dormant volcano, last erupted in 1790.

The contiguous towns of Kahului and Wailuku are located approximately 98 miles southeast of Honolulu; Wailuku is the seat for Maui County, which includes the islands of Maui, Molokai, Lanai, and Kahoolawe (Figure I-1). In the 1970s, Maui island -- 1988 estimated population 84,000 (DBED, 1989a) -- entered a period of economic and population growth that has continued to the present. This growth has been largely driven by the visitor industry. Areas in which the visitor industry is based have been particularly affected by this pattern of rapid growth.

B. PROJECT AREA

The proposed SOH sites are located within the Haleakala Southwest Rift GRS, about twenty statute miles from the Kahului airport and from thirteen to eighteen miles south of the Upcountry Maui settlements of Kula, Pukalani, and Makawao (Figure I-2). As shown on Figure II-6, the drill sites would be between four and six miles upslope from the coastal resort areas of Makena and Wailea. The area immediately surrounding the proposed SOH sites is lightly populated; Ulupalakua Ranch has been using the land where the project is to be sited for grazing. The Ranch also owns or leases some 26,000 acres in the surrounding area.

C. THE BIOPHYSICAL ENVIRONMENT

1.0 Climate

Wind speed, wind direction, temperature, and precipitation were measured on a continuous basis between August 1984 and August 1985 (HECO, 1985). The monitoring site was located in the approximate center of the Haleakala Southwest Rift Zone GRS (Figure III-1).

Winds measured during the late evening and early morning hours were generally from the NNW, shifting to WNW or ESE during the day. The average hourly wind speed recorded was 6.7 mph; maximum wind speeds were recorded during the hours of 0800 and 1800 with peak winds occurring during the early afternoon hours.

The diurnal temperature pattern was generally consistent from month to month, ranging from a low of 11.6°C (52.9°F) to a high of 24.2°C (75.6°F). Total rainfall recorded during the monitoring period was about 56 cm (22 inches). The wettest month was January when 10.1 cm (4.5 inches) of rainfall was recorded. August and March were the driest months, averaging less than 1.3 cm (0.5 inches) each.

2.0 Air Quality

In addition to recording meteorological data, continuous monitoring was conducted for sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) at the monitoring site for a one year period (HECO, 1985). Periodic sampling was performed for total suspended and inhalable particulates, mercury and radon. Periodic samples of rainwater were analyzed for pH, conductance, and elemental and anionic content. Due to the absence of rain catchment systems and wells in the area, water samples were taken periodically from a well in the vicinity of La Perouse Bay for constituent analysis.

Results of the air quality monitoring program are summarized in Table 3.1. The data indicate that there were no significant sources of naturally occurring SO_2 or H_2S in the vicinity of the monitoring site. The values recorded are primarily artifacts of the monitoring system, vehicular activity upwind of the site or volcanic activity on the island of Hawaii.

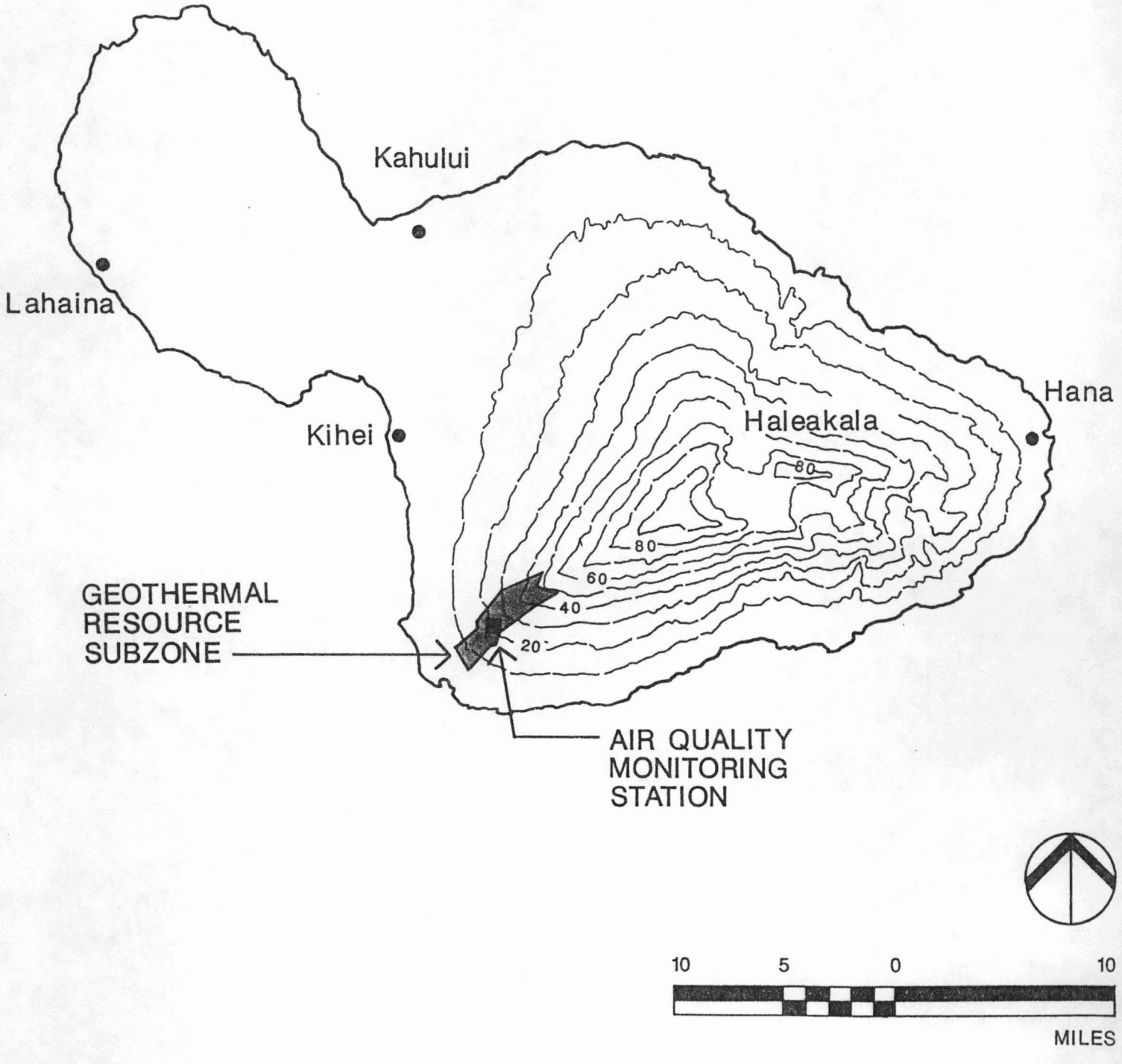

Figure III-1

AIR QUALITY MONITORING STATION

Source:
Hawaiian Electric Company (1985)

Table 3.1 AIR QUALITY STANDARDS AND MAXIMUM MEASURED VALUES
SITE 241 - ULUPALAKUA
August 1984 - August 1985

Pollutant	Standard	Standard Concentration Limits	Maximum Measured Value
SO_2	Annual Primary NAAQS (1)	140 ppb	0 ppb
SO_2	24hr Primary NAAQS	30 ppb	1 ppb
SO_2	3hr Secondary NAAQS	494 ppb	4 ppb
H_2S	1hr Hawaii AAQS (Proposed)	100 ppb	7 ppb
TSP	24hr Primary NAAQS	260 ppb	45 ug/m^3
TSP	24hr Secondary NAAQS	150 ug/m^3	45 ug/m^3
TSP	Annual Primary NAAQS	75 ug/m^3	18 ug/m^3
TSP	Annual Secondary NAAQS	60 ug/m^3	18 ug/m^3
TIP	24hr Primary	150-250 ug/m^3	21 ug/m^3
HG	DOSH (2)	1 ug/m^3	157 ug/m^3
RADON	NRC (3)	3 pCi/l	0.24 pCi/l

Unless otherwise indicated, the standards reflected are the most stringent federal standard. A Hawaii State Standard is provided in the absence of an appropriate federal standard.

(1) NAAQS - National Ambient Air Quality Standard.

(2) This value is 1/100 of the Hawaii Department of Occupational Safety & Health (DOSH) Permissable Exposure Level for an 8-hour period.

(3) Nuclear Regulatory Commission (NRC) continuous 7-day Exposure Level.

Source: Hawaiian Electric Company, Environmental Department (1985).

3.0 Geology and Soils

Lava flows within the Haleakala Southwest Rift Zone range from 200 to 20,000 years old. Six flows have erupted in this area within the last 1,000 years. During the latest eruption (1790), lava emerged from two vents and flowed into La Perouse Bay, where a small peninsula was constructed. In light of this eruption within historic times, renewed activity in the future is not improbable (Feldman and Siegel, 1980).

Soils at the proposed SOH sites are classified as Oanapuka extremely stony silt loam, 7 to 25 percent slopes (OED) by the U.S. Department of Agriculture, Soil Conservation Service (Soil Conservation Service, 1972). They are characterized as well-drained, very stony soils. Permeability is moderately rapid; runoff is low, and the erosion hazard is slight to moderate. These soils are used for pasture and wildlife habitat.

4.0 Hydrology

The Haleakala Southwest Rift Zone in the vicinity of the SOHs slopes toward the ocean, and is characterized by recent flows, small cinder cones, and vertical fractures parallel to the rift direction. Surface drainage is poorly developed, with most of the precipitation percolating downward through the porous soils and lavas and flowing slowly toward the sea.

Haleakala is underlain by a basal fresh water lens which is tapped in nearshore areas by means of inclined shafts. At higher levels, fresh water is retained on interlayered ash beds (Figure III-2). On rainy windward slopes of Haleakala, erosion has exposed these perched aquifers, allowing them to provide water to numerous perennial streams (Feldman and Siegel, 1980).

5.0 Vegetation

As described by Char & Associates, based on a one-day field trip to the proposed siting areas in July 1989, vegetation in the vicinity of the proposed SOH sites consists of koa-haole shrubland and grasslands with scattered, small shrubs. On areas with cinder and/or ash, vegetation consists of a mixture of grasses, small shrubs (subshrubs), and weedy, mostly annual, species. Common associates of this vegetation type are pitted beardgrass (Bothriochloa pertusus), Natal redtop (Rhynchelytrum repens), 'uhaloa (Waltheria indica), vervain (Stachytarpheta jamaicensis), lovegrass (Eragrostis tenella), and buffel grass (Cenchrus ciliaris).

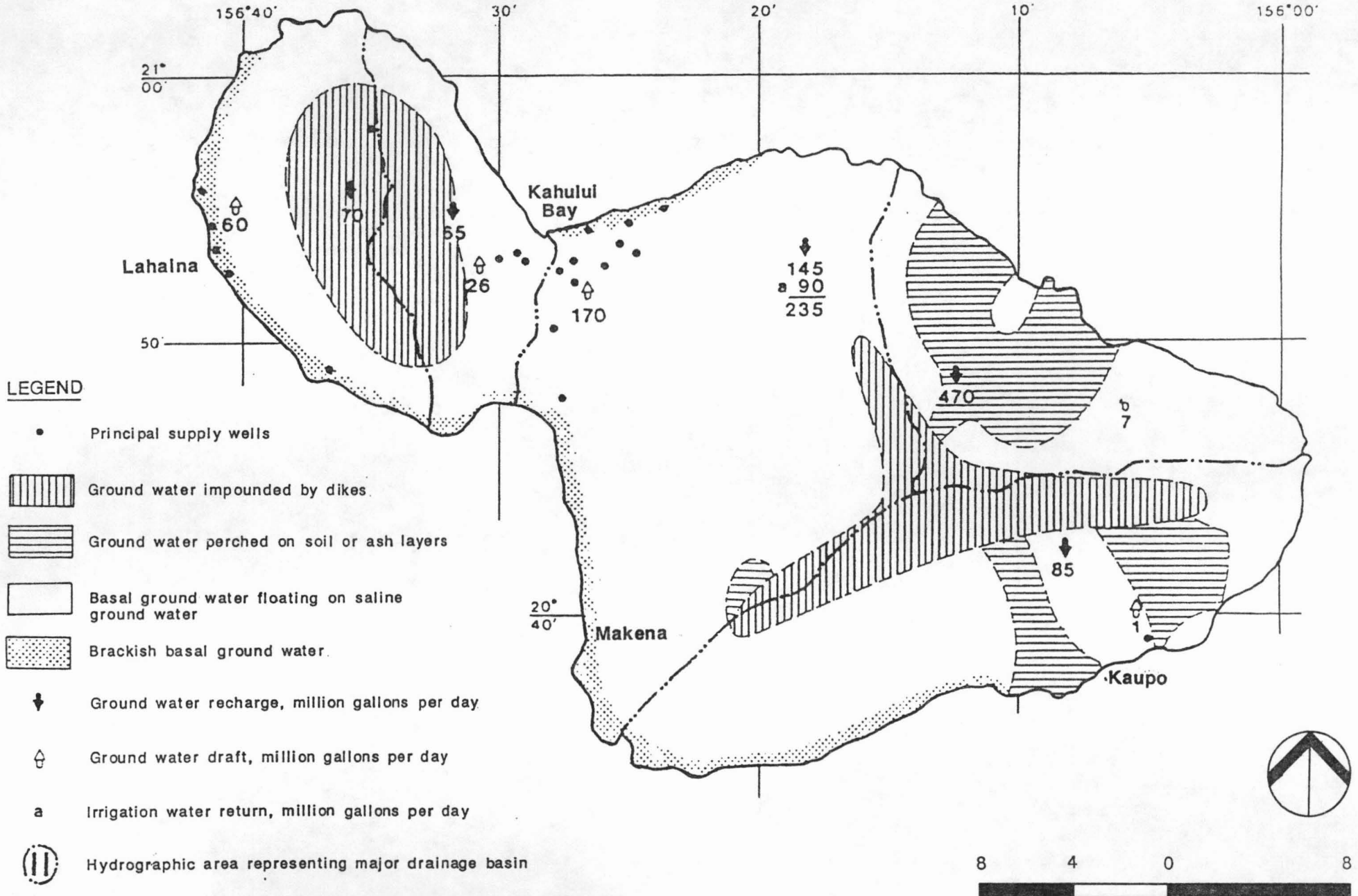

Figure III-2

WATER RESOURCES

Source: Feldman and Siegel (1980)

Koa-haole (Leucaena leucocephala) shrubs form the dominant cover on weathered, ancient pahoehoe substrate. Kiawe trees (Prosopis pallida) and klu (Acacia farnesiana) are scattered through this shrubland. Ground cover is composed primarily of sourgrass (Digitaria insularis) and weedy species such as coffee senna (Senna occidentalis), lion's-ear (Leonotis nepetifolia), false mallow (Malvastrum coromandelianum), and beggar's tick (Bidens pilosa). Rocky outcroppings support a few native species such as 'ala'ala-wai-nui (Peperomia leptostachya), kalamoho (Pellaea ternifolia), koali-'awania (Ipomoea indica), a'ali'i (Dodonaea viscosa), 'ilie'e (Plumbago zeylanica), and huehue (Cocculus trilobus).

6.0 Terrestrial Fauna

The study area is presently used for pastureland and much of the vegetation shows heavy damage from grazing cattle (Bos taurus). Axis deer (Axis axis) are also present in the area.

Game birds such as Gray Francolin (Francolinus pondicerianus), Black Francolin (Francolinus francolinus), Ring-necked Pheasant (Phasianus colchicus), and California Quail (Callipepla californicus) also utilize the area. Other avian species observed during the field reconnaissance included Northern Cardinal (Cardinalis cardinalis), Japanese White-eye (Zosterops japonicus), Zebra Dove (Geopelia striata), Spotted Dove (Streptopelia chinensis), and House finch (Carpodacus mexicanus) (Char & Associates, 1989).

7.0 Anchialine Ponds

Anchialine or mixohaline ponds are situated in areas dominated by lavas of recent origin and are generally within 500 meters of the shoreline; over twenty-three of these ponds have been located within the Ahihi-Kinau Natural Area Reserve (AKNAR), located about one and one half miles south-southwest of the proposed SOH sites (Figure III-3). Anchialine ponds have been generically described as follows:

> "...generally small (less than 100 square meters), shallow (less than 1 meter deep) and having rock basins. These basins are too porous to support ponded water above sea level and are filled with mixohaline water (average salinity 7 ppt), indicating an inland extension of the oceanic water table diluted by the outflow of subsurface freshwater. Consequently, the ponds are restricted to depressions in lava flows that extend downward into the water table". (Maciolek & Brock, 1974)

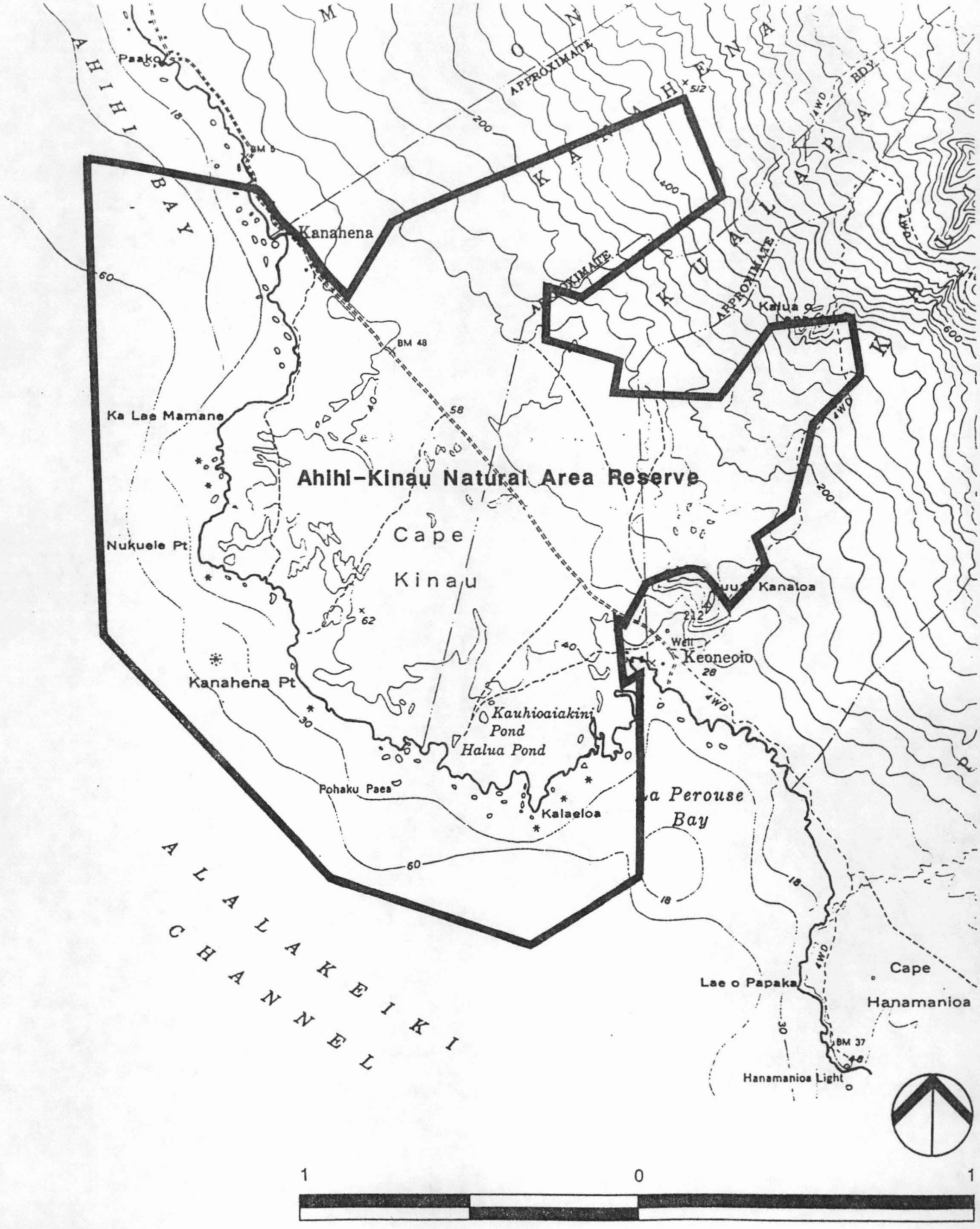

Figure III-3

AHIHI-KINAU NATURAL AREA RESERVE

Anchialine ponds are also characterized by an absence of surface connections with the sea, but contain saline water and undergo tidal fluctuations. They also harbor a distinctive biota. In Hawaii, anchialine ponds have only been reported from Maui and Hawaii, though one of the most characteristic anchialine pond organisms, the tiny red shrimp Halocaridina rubra (opaeula), has been reported on Oahu (or in the vicinity thereof) at Popoia Island in Kailua Bay, a borrow pit at Laie, Barbers Point, Campbell Industrial Park, and in a sinkhole near the proposed Ewa marina. Near Haleiwa, a wetland area known as "opaeula" is presumably named after this shrimp.

The anchialine ponds at Cape Kinau, south-southwest of the proposed project sites, are regarded by Brock (1985) as the most biologically interesting. Holthuis (1973) mapped 23 ponds on Cape Kinau but notes there are "dozens". In addition to the 23 mapped ponds at Cape Kinau, there may be many more in adjacent lava fields (M. Lee, Corps of Engineers; cited in Brock [1985]).

D. THE EXISTING SOCIAL, ECONOMIC AND CULTURAL ENVIRONMENT

1.0 Archaeological and Historic Sites

The boundaries of the Haleakala Southwest Rift Zone were drawn to avoid known archaeological sites (DPED, 1986). Sites in the area but not located within the subzone are:

Poo Kanaka Stone (Site #1021): located near the Kula Highway; the site has been placed on the State Register of Historic Sites.

Puu Naio Cave (Site #1009): located on the southwest rift zone boundary at an elevation of 1100 feet; the site is also on the State Register.

Kalua O Lapa Burial Cave (Site #1017): located on the eastern boundary of the Ahihi-Kinau Natural Area Reserve.

Maonakala Village Complex (Site #1018): a coastal village site, also within the Natural Area Reserve.

La Perouse Archaeological District: located at the southern boundary of the rift zone and on the State Register.

2.0 Community Characteristics

The population near the project area is highly dispersed. In upland areas, four homes are located within one mile of the project sites; none of them are closer than one-half mile to either site (based on unpublished information from Hawaii TMK Service, 1989). Near sea level, a few homes near La Perouse Bay and Ahihi Bay are within two miles of the sites. Except for Ulupalakua Ranch, all communities in the vicinity of the SOH sites are four or more miles away. A description of each of these communities follows:

Ulupalakua: Extensive and intensive agricultural activities take place at Ulupalakua Ranch, which was established in the 1800s. Traditionally, cattle have been the ranch's major product, however, since 1963 operations have been diversified and sheep and elk (as well as cattle) are raised there. The ranch also grows strawberries, avocados, proteas, and citrus fruits. The Tedeschi vineyard and winery are located within the ranch boundaries. The ranch and wine operation together employ about 30 persons. Over a hundred adults live in the Ulupalakua area. Ranch hands and their families form the greatest portion of this group.

Ulupalakua Ranch has proposed using ranch land for activities for tourists, including van tours, hikes, picnics, and hunting trips. Development is limited by lack of a major water source in the area.

Kula: This area includes a mix of farms, relatively affluent residential areas, and older residential areas. Small scale agricultural developments include a thriving protea industry. In addition, two lodges provide eleven rooms for tourists in Kula. Kula Lodge has obtained County Planning Committee approval to build an additional eleven rooms -- doubling the Upcountry Maui visitor inventory.

South Maui Coast: This area includes 5,219 visitor units and is the State's third largest resort area (Hawaii Visitors Bureau, 1988). The visitor plant in Kihei is primarily made up of condominiums; the major Makena hotel and the entire Wailea Resort are owned by large corporate investors.

A few island-born families have lived at Makena for decades. Development of the Wailea and Makena resort areas began during the 1970s. Makena has seen relatively little development, while Wailea has grown more extensively, to include a mix of hotel, condominium, and upscale single-family housing areas.

In the next few years, at least four new hotels are expected to open at Wailea and Kapalua. These should add more than 2,800 rooms to the Maui inventory, increasing it by nearly 20 percent (First Hawaiian Bank, 1989; Hawaii Visitors Bureau, 1988).

3.0 Outdoor Recreation

Recreation areas are located below and far above the proposed project sites; these include:

The Ahihi-Kinau Natural Area Reserve: established by the State of Hawaii in 1973. The reserve includes offshore waters and land on Cape Kinau and parts of the shores of Ahihi Bay and La Perouse Bay. The mauka boundary of the reserve is at the 800-foot elevation, about a quarter mile from the lower boundary of the Haleakala Southwest Rift Zone GRS (Figure II-6).

The reserve is open to the public but off limits for many activities (hunting, fishing, camping, removal of lava or coral, and use of motorized craft, for example). Relatively few people use the area, partly because it can only be reached on foot and no facilities are provided.

Oneloa (Big Beach) and Puu Olai (Little Beach) at Makena: most of the land comprising these beaches is state-owned and managed and maintained by the State Parks Division of DLNR. Amenities consist of portable toilets, trash cans and unimproved parking. These beaches are heavily used by both Maui residents and tourists.

Polipoli Springs State Park: located at the 6,400-foot-elevation of Haleakala, is a hiking and camping area used more by residents than visitors. Four-wheel drive vehicles are recommended for access to the area.

The Haleakala Summit: located about 9,000 feet above the project sites, the area includes observation points and trails. Some 1.36 million visits to Haleakala National Park were recorded in 1987 (DBED, 1988).

E. PUBLIC ISSUES AND CONCERNS INDEPENDENT OF THE PROJECT

Concern with development and the preservation of a valued way of life is widely shared on Maui (Harada-Stone, 1988; Hart 1988; Kanoho, 1989; DeLeon, 1989). Many residents see development in their communities and nearby areas as occurring too quickly, and are calling for a general slow-down or moratorium on new projects that would further burden existing infrastructure.

In a 1988 survey, about a third of Maui respondents felt that the quality of life in their community had improved over the last five years -- and a third thought that it had worsened (DBED, 1989b). Residents of resort areas, including South Maui, tended to voice greater dissatisfaction.

Residents of Upcountry Maui tend to see their area as a healthy place to live, away from urban congestion. When asked, in the 1988 survey, why they lived where they did, 48 percent of area residents surveyed mentioned climate and/or health while 34 percent of South Maui residents did. Residents of these areas gave this reason more often than residents of any other district in the state. Upcountry residents also mentioned traffic or congestion (36 percent) and the outdoor character of the area (21 percent) often. South Maui residents also mentioned traffic (28 percent) and outdoor character (21 percent) frequently.

PART IV: POTENTIAL IMPACTS AND MITIGATING MEASURES

A. INTRODUCTION

The proposed drilling program is for scientific observation purposes only. The holes will not be flow tested or used for production of geothermal or other fluids. Environmental effects are expected to be transitory in nature, and limited mainly to the time that the drilling rig is on site and drilling; about three to five months depending on the depth drilled and the type of rock formation encountered. The drill sites were selected on previously disturbed land, so as to cause minimum impact, and appropriate mitigating measures will be taken to reduce potential impacts.

B. DRAINAGE AND HYDROLOGY

Surface drainage in the area is poorly developed, with most of the precipitation percolating downward through the porous soils and lavas and flowing slowly toward the sea. The SOH sites will be constructed so that surface water runoff would drain into a mud pit.

Groundwater level, which normally follows the contour of the surface, is unknown in the vicinity of the proposed SOH sites but is expected to be at least 600 to 700 feet below the surface. There are no surface streams or ponds in the immediate vicinity of the proposed drill sites, however, there are some significant anchialine ponds approximately one and one half to two miles downslope from the project area.

The quality of the underlying groundwater in the vicinity of the proposed project is largely unknown; it will be determined during the drilling program. Geothermal reservoir fluids would be precluded from migrating into the overlying groundwater system, however, by cementing casing into the hole to a depth of approximately 1,000 feet before drilling into the geothermal reservoir.

During the EIS process, John F. Mink, the hydrological consultant, will identify potential changes in water quality and temperature that could possibly occur as a result of the SOH project and assess the potential effects of these changes on agriculture, resort, and other water uses in the area. In

coordination with a marine biologist, he will also assess potential effects on anchialine ponds. The potential impacts of catastrophic accidents at the SOHs on groundwater and surface water and their potential effects on other water uses in the area will also be assessed. Measures to mitigate potential adverse effects and suggested monitoring programs will also be recommended.

C. AIR QUALITY

Temporary effects of site preparation would include increased dust and particulate matter in the air from clearing and leveling the site and access road. A mud pit lined with plastic sheeting would be constructed to collect any waste water and drill cuttings. Dust disturbances from the working area would be minimal. Precautions would be taken to keep the dust level low; roads and working areas will be watered periodically if necessary.

The cable and core drilling would have little impact on air quality. The largest source of emissions would be diesel emissions from the drill rig, which are comparable to emissions from heavy earth-moving equipment. Appropriate emission control devices would be installed on all equipment on the site. Some additional vehicular emissions could also occur. Rock dust particles produced by drilling would be entrained in the drilling fluids and collected in the drilling mud tanks.

The SOHs will not produce any geothermal fluids. The holes will not be flow tested or vented, therefore, geothermal gases will not be vented into the atmosphere. Standard drilling practices and Blow Out Prevention (BOP) equipment will prevent unplanned venting. The SOH project should not adversely impact the ambient air quality in the project area.

D. NOISE

An analysis of the potential acoustical impacts of the proposed SOH project will be undertaken by Darby & Associates during the EIS process. The analysis will include potential noise impacts generated during the following phases of the project: construction operations; cable drilling operations (to be accomplished in daylight hours only); rotary/core drilling which will occur 24 hours/day and seven days per week for approximately one to one and one-half months (noise from this rig during drilling can be characterized by a steady sound due to the use of the hydraulic head drive); core drilling (which will also occur 24 hours/day and 7 days per week) for about two

months; and, monitoring and testing. Both the rotary/core and core drilling rigs will get noise control treatment and could be characterized as causing 60 to 62 dBA at a 100 foot distance.

The SOHs will not be flow tested or produced. As no geothermal fluids will be vented, there will be no associated venting noise.

E. FLORA AND FAUNA

The land within the study area is presently used for pasture; much of the vegetation shows heavy damage from grazing cattle and Axis deer. No endangered or threatened flora or fauna were located during a one-day field trip to the project area by Winona Char, Char & Associates, in July 1989. A site specific reconnaissance survey will be conducted as part of the EIS process; mitigating measures will be recommended and followed should any endangered or threatened species occur on or near the proposed project sites. The results of the survey will be incorporated into the draft EIS.

F. ANCHIALINE PONDS

Reconnaissance-level biological baseline surveys of anchialine pond resources within the Ahihi-Kinau Natural Area Reserve (AKNAR), located about one and one half miles south-southwest of the proposed SOH sites, will be conducted by Brewer/Brandman Associates. Species checklists will be developed encompassing aquatic plants, invertebrates (including aquatic stages of terrestrial insects), and fish. Waterbirds and waterfowl, including the presence of endangered species, will be identified if present. Potential environmental effects of the proposed project on the ponds will be evaluated in coordination with the project hydrologist; if potential adverse impacts are identified, appropriate mitigating measures will be proposed. The results of the analysis will be incorporated into the draft EIS.

G. ARCHAEOLOGICAL RESOURCES

Cultural Surveys Hawaii will conduct a complete ground survey of the proposed SOH sites; the area to be surveyed will include a 200- to 300-foot buffer zone on all sides. Sites in the immediate area, if present, will be located, mapped and described. A report will be prepared which will include: a topographic map of the survey area showing all archaeological

sites and site areas; descriptions of all archaeological sites with selected photographs, scale drawings, and discussions of function; historical and archaeological background sections summarizing prehistoric and historic land use as they relate to the archaeological features; and, a summary of expected impacts of the proposed project on archaeological resources and recommendations for mitigation (if any). The report will be appended to the draft EIS.

Continuous coordination with the DLNR Historic Sites Division will be maintained throughout the project. If significant sites are present, follow-up surveys and mitigation activities will be conducted under their direction.

H. SOCIO-ECONOMIC

The total number of workers actively engaged in drilling should average about twelve at any one time. The duration of the project (both holes) should not exceed twelve months. The impact of up to twelve additional workers on the local economy and local services for a short period of time would be minimal but generally positive.

A social impact assessment will be conducted by Community Resources, Inc. The results of this study will be incorporated into the draft EIS.

I. ACCESS AND TRAFFIC

Access to the SOH sites off of Highway 31 would be via an unimproved private road which crosses Ulupalakua Ranch to the project site (Figure II-6). Any improvements that would be required to handle the projected truck and vehicle traffic would be constructed with project funds or provided by the land owner. Because any necessary access roads and road improvements would be provided by the project, there would be no impact on County or State finances.

The relatively light traffic generated by the project should not impact existing traffic patterns in the areas near the SOH sites or cause delays to residents. Air quality and noise impacts would also be nonexistent or very low.

J. INFRASTRUCTURE AND UTILITIES

It is estimated that a maximum 7,500 gallons of water per day would be required for the drilling process. In addition, another 100 - 200 gallons per day would be needed for domestic use. The method of supplying water to the sites would be determined in coordination with Ulupalakua Ranch management and the Maui County Department of Water Supply. Because the use is for a short-period of time, the SOH program should not impact the water sources or distribution system of the County of Maui.

Chemical toilets, or other approved methods of handling human wastes, will be used at the sites and maintained by the drilling contractor. Liquid project wastes would be disposed of by various means. If any fluids must be disposed of they would be tested and, if not toxic, would probably be allowed to percolate into the ground. An alternative would be to pump the fluids into a tank truck and dispose of them at an waste disposal site acceptable to the County and the State Department of Health. Liquid waste disposal would not be expected to impact the groundwater quality of the area.

K. PUBLIC FACILITIES AND SERVICES

Trash and operational debris would be collected by the drilling contractor and hauled periodically to an approved site. Because there is no facility on Maui available exclusively for industrial waste, clearance will be obtained from the State Department of Health (Environmental Services) before any toxic fluids or solids would be disposed of in the existing landfills.

There will be no impact on schools or recreational facilities in the area from population growth due to drilling operations. Non-local personnel will be on temporary duty; they will probably not bring their families.

L. HEALTH, SAFETY AND PROTECTIVE SERVICES

There will be no impact on County Police and Fire services. Security for the site will be provided by the drilling contractor; drill personnel will be present 24-hours a day. Hawaii County Police will only be called in an emergency or when a criminal act has occurred.

In addition to fire extinguishers, water used in drilling operations can be used to extinguish any fires that may

develop. In addition, drilling muds can be pumped onto any fire that may develop in the vicinity of the rig. The Maui County Fire Department would be called only in a major emergency.

The drilling equipment will be roped off for safety reasons; signs will be posted at the site boundary restricting access to authorized persons only. The restricted area will be small; no existing public access is anticipated to be closed because of the project.

Although dangerous levels of hydrogen sulfide gases are not likely, a H_2S monitoring plan will be implemented to insure employee safety during drilling activities. Hydrogen sulfide monitors will be operable at the drill site during both rotary and core drilling operations.

M. AESTHETICS

The visual impact of the project will depend on the location, and the surrounding land forms and vegetation. The drilling sites will be located to utilize existing vegetation screens wherever possible and to reduce adverse impacts on residents and visitors. Any adverse visual impact will be temporary and will end when the drilling rig is moved off site.

N. LIGHT IMPACTS

As drilling will be conducted on a 24 hours-a-day, seven days-a-week basis once the core drilling commences, the drill site will be lighted at night in order to permit continuous operations and to provide safe working conditions. The rig will be sited so as to be as unobtrusive as possible; in the absence of lighting regulations specific to Maui, the project will conform to the stringent Hawaii County outdoor lighting regulations. Copies of these regulations will be provided to the drilling contractor to insure compliance.

PART V: AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED

The following were consulted by HNEI personnel and/or its consultants during the preparation of this environmental assessment:

State of Hawaii

Department of Business and Economic Development
Energy Division

Department of Health

Department of Land & Natural Resources

County of Maui

Planning Department

Department of Water Supply

Department of Public Works

Private Individuals and Organizations

Maui Electric Company, Inc.

Hawaiian Electric Company, Inc.

PLEASE ADD MORE NAMES OF PEOPLE WHOM YOU MAY HAVE CONTACTED.

PART VI: AGENCIES, ORGANIZATIONS AND INDIVIDUALS TO BE CONSULTED IN THE PREPARATION OF THE ENVIRONMENTAL IMPACT STATEMENT

FEDERAL

Department of Agriculture

- Soil Conservation Service

Department of Defense

- Department of the Air Force
- Department of the Army
  - Army Engineer District
  - Headquarters, Army Support Command, Hawaii

Department of Energy

Department of the Interior

- Fish and Wildlife Service
- Geological Survey
  - Water Resources Division
- National Park Service
  - Haleakala National Park

STATE

Department of Agriculture
Department of Accounting & General Services
Department of Budget & Finance
Department of Business & Economic Development
Department of Defense
Department of Hawaiian Home Lands
Department of Health
Department of Land & Natural Resources

- Chairman
- Office of Conservation and Environmental Affairs
- Division of Forestry and Wildlife
- Division of Water and Land Development
- Division of State Parks and Outdoor Recreation
- Historic Preservation
- Natural Area Reserves

Department of Transportation
    Highways Division
Office of Environmental Quality Control
Office of Hawaiian Affairs, Maui Island Trustee
Office of State Planning
University of Hawaii
    President
    Board of Regents, Maui Island Representative
    Environmental Center
    Water Resources Research Center

STATE LEGISLATURE

Senate

    Senators, County of Maui
    Senate Committees
        Business Development and Pacific Relations
        Housing, Hawaiian Programs and Natural Resources
        Planning and Environment

House of Representatives

    Representatives, County of Maui
    House Committees
        Planning, Energy, Ecology and Environmental Protection
        Water, Land Use, Development and Hawaiian Affairs

COUNTY OF MAUI

Mayor's Office
Fire Department
Maui County Council
Office of Economic Development
Parks and Recreation
Planning Department
Police Department
Public Works Department
Research and Development
Water Supply Department

ORGANIZATIONS AND INDIVIDUALS

Akahi, Irene, Samuel, James & Julia
Al, Agnes K.
Alexander and Baldwin
American Lung Association-Maui Council
American Trust Co. of Hawaii

Anna, Karen
Arbor, Kelly
Aruda, Alfred, Mary, Lisa & Frences
Awai, Lizzie
Baz, Chris
Blake, Steve
Bodden, Thomas
Bressler, Ronnie
Brush, Richard
Cameron, F.E.
Conservation Council
Corbian, Tom
Cowper, Al
Crouse, Jack G. & Dorothy
Daniels, John R.
Delima, Caroline K.
East Maui Irrigation Co.
Eloheim, Joseph
Fenn, Carol
Fleming, Wray D.
Gaffney, Constance H.
Gilman, Kenyavani
Goodness, Ned
Goodness, Stanley K., Juliette E. & Joseph
Goya, Kana
Goya, Dorothy H.
Gries, Herbert Jr.
Groode, Jason
Haake, Richard M. & Alvin M.
Haleakala Ranch Co.
Halemano, Herman, Jr.
Hawaii Aubudon Society
Hall, Dana Naone
Hew, Garret & Mary M.
Holt, Gladys T.
Hui Alanui O Makena
Hawaiian Electric Company, Inc.
Hawaiian Telephone Company
Hellinger, Walter
Ho, Nelson
Holmes, Sunny
Jacobs, Bruce
Jenson, Mr. & Mrs. Martin
Kaaii, Lilla Antone
Kanoa, Gladys
Kelema, Liloa
Kong, Ernest & Clement
Krafstow, Ellen
Kuloloio, Leslie
Leach, Willis E. & Margaret A.
Luppold, Ann
Lutich, Nancy

Mahalo, Genevieve K.
Makena Resort
Makimoto, Harold H. & Mildred
Manalo, Gracie
Mitchell, Sonja G.
Munoz, Jeffrey
Macdonald, Ruth
Maui Economic Development Board
Maui Electric Company
Maui Chamber of Commerce
Maui Hotels Association
Maui Hunt Club
Maui Ranch Land Co.
Maui Sportsmen Club
Millikin, L.J.
Moser, Steve & Kathy
Nickels, B.
Okerstrom, Abbie K.
Page-Papazian, John H. & Dale L.
Piltz, Hattie
Seibu Hawaii, Inc.
Safe Solutions
Sheehan, Mark
Sheets, Carl S. & Debbie R.
Sierra Club - Maui Group
Simeona, S.
Slater, Jette
Slater, Steve
Smith, Bill
Statton, Mr.
Swanander, Andrea
Tadeschi, Emil
Tamashiro, Haruko
Thorngren, Pater A. & Jane
The Hawaaian Nation of Hawai'i
Ulupalakua Ranch
Van Hartman, Paul
Wailea Resort
Wailea Development Company
Wender, Elaine S.
Wilcox, Edward J. & Margaret L.H.
Williamson, Jim

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