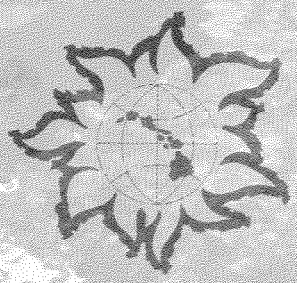
ENVIRONMENTAL IMPACT STATEMENT

FOR THE
NATURAL ENERGY LABORATORY
OF HAWAII
AT KE-AHOLE POINT, HAWAII

(PHASE I)



THE RESEARCH CORPORATION
OF THE
UNIVERSITY OF HAWAII

DECEMBER, 1976

PREPARED BY:

R.M. TOWILL CORPORATION
PLANNERS -ENGINEERS - SURVEYORS - PHOTOGRAMMETRISTS
HONOLULU, HAWAII

REVISED

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FOR
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OF THE UNIVERSITY OF HAWAII

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I. SUMMARY

The State of Hawaii has established, by Act 236 of the Session Laws of Hawaii, 1974, the Natural Energy Laboratory of Hawaii (NELH) at Ke-ahole Point on the Island of Hawaii. It was organized in 1974 as a new activity of the State of Hawaii with the active participation of the County of Hawaii.

The NELH is being planned as the site of a number of research projects for the development of alternate energy systems. The physical characteristics of the site are uniquely suited for several significant State and Federal energy programs. The success of these programs is of potentially high significance in the intensive, long-term development of energy source alternatives to fossil fuels.

The NELH site at Ke-ahole Point has been assessed by the State as the most desirable location for these energy programs. The laboratory site at the western tip of the island receives an unusually high amount of direct solar energy throughout the year. The percentage of cloud cover is much less at the coastline than in the inland mountainous areas. The temperature gradient between the warm surface ocean waters and the cold deep nearshore waters provides an ideal condition for development of an Ocean Thermal Energy Conversion (OTEC) program. In addition, the site is readily accessible as it is adjacent to the Ke-ahole Airport for commercial jet aircraft and the new coastal highway.

Phase I of the NELH development is the construction of essential site improvement and support facilities for future research projects. These include a 2-mile, 2-lane access road to the site from the Queen Kaahumanu Highway and corridors for water, sewage, electricity and telecommunications.

Future energy project developments at the NELH site are conceptually planned but are not presently funded.

The NELH site (approximately 240 acres) is presently unused except for the 7.745-acre Government-owned U. S. Coast Guard lighthouse facility at the point proper. The site is composed of undeveloped lava fields with relatively flat but rough topography. This harsh terrain and its remote location have limited public interest in the area, except for occasional use for shoreline recreation. The site is owned by the State of Hawaii. It is administered by the Airports Division, Department of Transportation, which operates the adjacent Ke-ahole Airport.

The direct impacts of the Phase I NELH development are minor. The impact of greatest significance will be the change in character of the land use, from unused to developed land. This change will result in minor losses of wildlife habitats and vegetation none of which are endangered. The proposed site access road will improve accessibility to the shoreline areas, providing additional recreational opportunities to Kona residents and tourists. Construction of the facility will give a small, but needed, stimulus to the Kona construction industry. The development will have little, if any, effect on agriculture, but may have a beneficial effect on tourism as an added visitor attraction. Increased human activity in the area may result in degradation of the several minor and two possibly significant archaeological sites located in the NELH area. This is balanced by the fact that, as a by-product of NELH activity in the area, potentially valuable sites will be surveyed and assessed for the public benefit.

The purpose of this Environmental Impact Statement (EIS) is to identify and evaluate the potential environmental impacts of the NELH Phase I support facilities which are to be funded by the State and developed in accordance with the NELH Master Plan. It also includes brief descriptions of the more likely future energy programs to be undertaken at Ke-ahole.

The presence of the NELH support facilities and the natural attributes of Ke-ahole Point will tend to attract and stimulate alternate energy research projects at the site. This is in accordance with the NELH objectives, so in itself the facility's growth is not an adverse impact. If the site is fully developed by the year 1990 as now envisaged, it is estimated that the proposed research projects would require a staff of 75 at Ke-ahole. Future projects are at present conceptual and the impact of each project cannot be completely defined at this time. Appendix A of this EIS provides a discussion of the proposed future projects and some of their potential environmental impacts. An EIS will be prepared, when required, prior to initiation of a proposed future research project to determine the impacts to the site and its surroundings.

II. PROJECT DESCRIPTION

A. Background

1. NELH Formation

In 1974, prior to the oil crisis, the Governor of the State of Hawaii initiated a program to assess potential alternate energy sources. The assessment resulted in a comprehensive work entitled "Alternate Energy Sources for Hawaii" (Ref. 1). This study identified solar energy as having the highest potential of the alternate energy sources, and being most desirable because of its minimal environmental impacts and applicability to the semi-tropical Hawaiian environment. The report also recommended that Hawaii, because of its limited human and fiscal resources, concentrate research and development activities in areas that take advantage of Hawaii's favorable geographic or climatic characteristics and/or because of a high degree of State engineering and scientific competence in the areas.

Act 236 of the Session Laws of Hawaii, 1974, established a Natural Energy Laboratory for the State of Hawaii. This legislation located the laboratory on a parcel of State land makai of the Ke-ahole Airport on the Island of Hawaii. The laboratory is under the direction of the Board of Directors, consisting of members from the State Department of Land and Natural Resources, the County of Hawaii, the Marine Affairs Coordinator, the University of Hawaii, and the State Department of Planning and Economic Development.

2. Purpose of NELH

The basic purpose of the NELH is to provide the essential support facilities for future energy research programs and to interest research organizations in using these facilities. By providing a centralized location with favorable development conditions, it is hoped that research

groups examining alternative sources of energy will select Hawaii as the location for their research and test facilities.

3. NELH Location

Ke-ahole Point, in the Kona District on the west coast of Hawaii, has been chosen as the site for the NELH (Figures II-1 and II-2). Several detailed studies have been completed which confirm the desirability of the Ke-ahole location. Two recent studies (Refs. 2 and 3) funded by the State of Hawaii and the National Science Foundation respectively, have clearly demonstrated that the site is especially suited for major OTEC programs. Some of the most important criteria for site selection were nearby availability of cold, deep ocean water; a warm ocean surface layer not subject to strong seasonal cooling; high annual solar radiation; accessibility to logistical support including major airports, harbors, and highways; and adequate quantities of undeveloped land suitable for mariculture and aquatic bioconversion research. Among the eight other sites investigated, the State-owned Ke-ahole Point site is unique in fulfilling all of these major criteria.

The environmental conditions at Ke-ahole are also suitable for solar energy, aquaculture and biomass conversion projects. Hawaii, because it is sub-tropical, receives a consistently high amount of solar energy. The land is relatively flat, facilitating development of solar and/or aquaculture research.

The site is adjacent to Ke-ahole Airport, which accommodates interisland jet travel. Direct connections to the mainland are available in Hilo, on the other side of the island, or in Honolulu on the nearby Island of Oahu. Kawaihae Harbor, a deep draft (35') port lies 25 miles to the north and the State's Honokohau small boat harbor is located 2 miles

to the south. Travel between the Kawaihae and Kailua-Kona areas is via a new high capacity coastal highway that is readily accessible from the NELH site (See Figure II-2).

B. NELH Development Program

1. Major Research Projects and Development Schedule

The following three natural energy programs are being considered for the NELH site:

a. OTEC

The major project is an Ocean Thermal Energy Conversion installation. An OTEC plant would utilize the thermal differential between the surface and deep ocean waters to generate electrical power. The general requirements for OTEC are deep, cold water close to shore with year-round warm surface water. The Federal OTEC project is a phased research and development program of the Energy Research and Development Administration (ERDA). The phases will begin with a first step of small scale experiments in existing facilities, then continue with construction of a land based or floating facility to test components and subsystems and finally develop a scaled prototype operation (land based or floating OTEC plant) to the proof-of-concept status. The anticipated schedule of OTEC development is shown in Table II-1.

b. Biomass

The Biomass Conversion Project would utilize the cultivation and harvesting of plant and animal forms either as a food source or for thermal conversion of the material to produce energy. This type of project requires flat land for the construction of ponds, access to basic nutrients, and a saltwater supply. Consistent temperature and sunlight conditions are mandatory.

c. Direct Solar

The NELH plans to use Ke-ahole Point as a test center for various direct solar energy systems that will be developed in the future. The three basic techniques of direct solar energy conversion are photovoltaic conversion, low temperature collectors, and high temperature collectors. All three methods require large, level areas for the installation of collection panels, and a high proportion of clear, sunny weather. With these natural attributes present at the NELH site, Hawaii should be a prime candidate location for future research.

The NELH scope of interest is not limited to the above projects, but they presently hold the most promise. Appendix A discusses these projects in greater detail. The NELH development schedule of ongoing and planned NELH activities is presented in Table II-2.

2. Pertinent Work Completed or in Progress

A considerable amount of work related to alternate energy development has been funded, and is either in progress or completed. The activities are summarized in Table II-3, which is taken from Ref. 4.

Several basic alternate energy research projects will be undertaken in the immediate future. The objective of these projects will be to collect basic data on currents, temperature gradation, water density stratification, biological and chemical analysis, ocean bottom geology, wave energy, meteorology, sea conditions, zones of mixing, mariculture, biofouling, corrosion, etc., at Ke-ahole Point, Hawaii. Data developed will be used for design of future major ocean thermal energy conversion (OTEC), mariculture, and solar energy projects. All facilities, pipelines, monitoring cables, etc., are to be temporary and are to be removed upon completion

of individual tests which will be conducted for periods of time ranging from a few months for most tests to more than one year in order to obtain the annual variations.

These research projects are described more fully below:

a. Current Circulation - to develop baseline current circulation data for determining seasonal variations of ocean waters to a depth of 400 fathoms at the test site. Recordings would be made from moored submerged self-recording current meters with recording cables to shore for continuous monitoring or from a temporarily moored surface platform or boat.

b. Ocean Temperature - to develop data showing ocean temperature variations to a depth of 400 fathoms. Data might, for example, be collected from moored submerged temperature recording floats at various locations within the research corridor. These recordings would be relayed to shore by electronic cable on the ocean bottom or could be taken from a temporarily moored platform.

c. Water Density Stratification - to develop baseline data on water density stratification and heat budget calculations at various locations within the research corridor off Ke-ahole Point. Tests and samples would be taken from a floating platform.

d. Biological/Chemical Analysis - to develop baseline benthic ecosystem data and water sample collection for chemical analysis to determine O_2, pH, nitrate, nitrite, phosphate, and other nutrient composition at various locations and depths within the research corridor.

e. Ocean Bottom Geology - to take samples and bathymetry data of the ocean bottom off Ke-ahole Point.

f. Wave Energy - to develop basic data, efficiency and techniques for determining feasibility of using floating wave pumps for power generation or deep water pumping.

g. Meteorological/Sea Condition - to collect basic meteorological data such as air pressure, temperature, wind speed and direction, solar radiation, etc.; install temporary wave and tide gauges at various locations monitored from shore to record wave and tidal conditions.

h. Deep Water/Shallow Water Mixing - to develop basic data on high-nutrient deep water and its effect on shallow water plant and animal life and to develop basic data on effect of mixing high-nutrient cold water with warmer surface waters.

i. Mariculture Studies - to develop basic data on effect of using high-nutrient deep water in shore test ponds or offshore submerged test racks using bottom laid pump lines to shore or floating platforms, and involving no ditching or dredging.

j. Biofouling - to develop basic data on the effect of pumping shallow and deep (400 fathoms) sea water through test heat exchangers of various materials to be located on shore, fed by bottom laid pump lines or located on temporarily moored platforms.

k. Corrosion Tests - to test corrosion effect on submerged test samples of various materials.

l. Solar/Wind Energy Tests - to study basic solar or wind energy potential from shore or floating platforms.

Projects involving temporary installations in the nearshore or shoreline areas require permits from the Army Corps of Engineers, the County of Hawaii and the State of Hawaii. One heat exchanger biofouling research project, already underway, required the anchoring of a test rack 50 feet below the surface in 350 feet of water, a portable diesel generator plant onshore, and a temporary power cable linking the two, and was the first NELH activity to require a permit. The Corps of Engineers and the State and County issued permits for this work. Similar tests have been conducted from a research vessel anchored off Ke-ahole Point.

The impact of these basic research and baseline data development projects is insignificant and temporary. In order to facilitate their timely implementation, the NELH is applying to the Corps of Engineers, the County of Hawaii and the State of Hawaii for permits covering such work. The applications will also include provisions for the use of a Baseline Data Research Area extending from Ke-ahole Point seaward, as shown in Figure II-3. The Department of Health has determined that the basic research and baseline data development projects do not require a permit or a zone of mixing, as no pollutants will be added to the coastal waters.

A temporary pole-mounted powerline is planned from the seaward edge of the Airport to the shoreward end of the corridor, in order to provide support for the basic research projects. Use of the corridor will be only for the basic research projects involving temporary installations. All evidence of the projects will be removed at their termination. The projects will not entail dredging or excavation. Archaeological sites in the corridor vicinity have been identified and located and can be easily avoided. The power poles, if installed, will have temporary visual impact. This impact will be mitigated by using the minimum number required, and by removing the poles at the termination of the projects.

C. Purpose and Scope of this EIS

The NELH Phase I Master Plan (Ref. 5) developed the plans for the support facilities essential to the future research projects. A 2-lane road, approximately 2 miles long, will be developed from the main coastal highway (Queen Kaahumanu Highway) to the center of the NELH site. Corridors from the Ke-ahole Airport are planned for water, sewage, electricity and telecommunications. This Phase I development will be funded by the State. These initial improvements will be developed only when one or more of the future major energy projects is funded for the Ke-ahole site. The more likely of these projects are described in more detail in Appendix A, with some preliminary identification and assessment of the environmental effects.

The purpose of this Environmental Impact Statement is to identify and evaluate the potential environmental impacts of the NELH support facilities as developed in the Master Plan - Phase I. It is intended for use in the State's decision-making processes which assess proposed projects in the context of their environmental impacts.

Future major energy programs at the NELH will each require an Environmental Assessment/Impact Statement.

D. Details of Phase I Development (Master Plan Summarization)

1. General

Phase I development at the NELH site will consist of an access road, corridors for water, sewage, electricity, and communications, and a central utility terminus at the site. The conceptual plan for the three major alternate energy projects being considered for Ke-ahole (OTEC, Biomass, and Solar) has allowed for preliminary estimates of the scale of the support facilities. Areas available for each major alternative energy program are shown in Figure II-3. Entry to these areas is to be via a

two-lane access road. The sizing of utility systems considered the daily population, the overnight population, and requirements placed upon the utility systems due to research operations in 1990, as presented in Table II-4. During the latter stages of operation, the three research projects may produce a surplus of energy. The Phase I utility system does not provide for power export.

The site layout, roadway, and utility access corridors are shown in Figure II-3. Cost of the Phase I support facilities, based on 1976 construction averages, is estimated to be $800,000.

2. Road

Access to the NELH site will be provided by a two-lane, 24-foot wide road, initially paved with rock chips and an asphalt sealer. Asphalt paving of the road will be deferred to reduce initial costs. If and when the NELH site is subdivided (e.g., subleases to specific program activities such as biomass, etc.), the Subdivision Code requirements of the County Planning Department would have to be met. Asphalt paving of the road would be one of the Code requirements. The road will intersect Queen Kaahumanu Highway approximately 1,200 feet north of the Airport's southern boundary line. At this point, an 80-foot section has been reserved for limited access to the highway. Other access points along the main highway are not as desirable and would require Department of Transportation approval. The intersection of the access road with Queen Kaahumanu Highway will be designed to meet Federal and State standards for limited access highways.

The road has an easement width of 170 feet, with total right-of-way encompassing 35 acres. The right-of-way includes a 50-foot utility corridor, set aside for possible future export of electrical power

from the site. The access road will be 10,700 feet long. A roadway cross section and rights-of-way are shown in Figure II-4.

3. Utilities (See Table II-4, page II-22 for assumptions underlying utility requirement projections for 1990.)

a. Electrical and Communications

Ultimate planned electrical service to the site will provide 400 kw peak at 12.47 kv, in accordance with Hawaii Electric Light Company (HELCO) standards. The new system will connect to the existing electrical substation located at the intersection of Queen Kaahumanu Highway and the airport access road.

A utility corridor will be developed from the substation to the NELH site to facilitate installation and maintenance of the electrical and telecommunication lines. The corridor will be 20 feet wide and 5,000 feet long. The power cables will be carried underground in two of four new 4-inch PVC conduits (leaving 2 spares) from the substation to the Airport Electrical Utility Building. A concrete encased conduit system of nine 4-inch diameter PVC conduits starts at the Airport Electrical Building, crosses under the runway and extends 71 feet past the runway. Six of these conduits were installed to provide electrical and communication lines for future runway expansion and are presently empty. The power lines will be routed through these available spare conduits. From the runway, a new underground conduit system will carry the lines to the planned central utility terminus at the NELH site.

At the central utility terminus, an electrical building will house the step-down transformers and centralized circuit panels. This building, roughly 10 feet by 15 feet, will also contain an auto-starting

standby generator for the provision of emergency power to the fire flow pumps, lift station and other essential on-site equipment. By installing the service in accordance with HELCO requirements, HELCO will take over the responsibility of this system and no submetering would be required by the Airports Division. All service connections and metering could then be made at the NELH electrical building by HELCO.

A communications capability of 60 channels would be made available, starting at the telephone equipment room in the existing airport electrical building just east of the airport control tower. The communication lines could be run through the available ducts in a fashion similar to the proposed electrical installation detailed above. At the termination of the ducts beneath the runway, separate conduits would have to be installed in conjunction with the electrical system. The communication lines would terminate in a telephone room located within the NELH electrical building. The Hawaiian Telephone Company will install (at its cost) the necessary transmission lines and switching gear. The telecommunications will be connected directly to the Hawaiian Telephone System.

b. Water

The provisions for water supply at the NELH site can be divided into three requirements: fresh water supply to the site (22,000 gallons per day); a three-day emergency standby fresh water supply (66,000 gallons) in the event of loss of the main feeder line and provision for on-site fresh water storage (225,000 gallons) for a fire protection system. The water line to the project site will be a 2-1/2-inch main feeding from the airport water supply system This connection will be made at an existing 12-inch fixture located 75 feet east of the existing electrical equipment room at the airport building complex. The 2-1/2-inch water line

will be routed around the existing runway. From the western side of the runway, the line will traverse the utility corridor to the central utility terminus.

An on-site water storage system for both domestic and fire demand will be installed. The airport is on the County of Hawaii domestic water system, which is presently inadequate to supply any substantial additional demand until the new Kahuluu Shaft is in operation in April 1977. No water usage is anticipated at the NELH site before that time. Flows available from the connection at the airport will be limited to 15 GPM.

This is inadequate to supply even the minimal peak domestic demands which would be placed on the system and therefore, an on-site storage tank and booster system will be provided. The recommended system includes a 300,000-gallon storage tank, a 1,000-gallon pressure tank, and booster pump systems. The large storage tank would be an inflatable rubber structure. This type of tank (for example, Firestone "Fabritank") would be the least expensive to install. The tank, made from neoprene-coated nylon fabric, would be 12 feet high and 77 feet square, and would be adequate for both fire flow and domestic water service to the project site users. A valve system would be used to control filling of the storage tank from the 2-1/2-inch feeder line connected to the airport system. A pressurized tank and booster pump system would be installed to provide normal service to the remainder of the project site. The booster system would be two alternating 50 GPM pumps to provide normal domestic service and two 1,500 GPM pumps for fire service. A float controller in the pressure distribution tank would operate the pumps. The on-site distribution network will be installed by the NELH tenants.

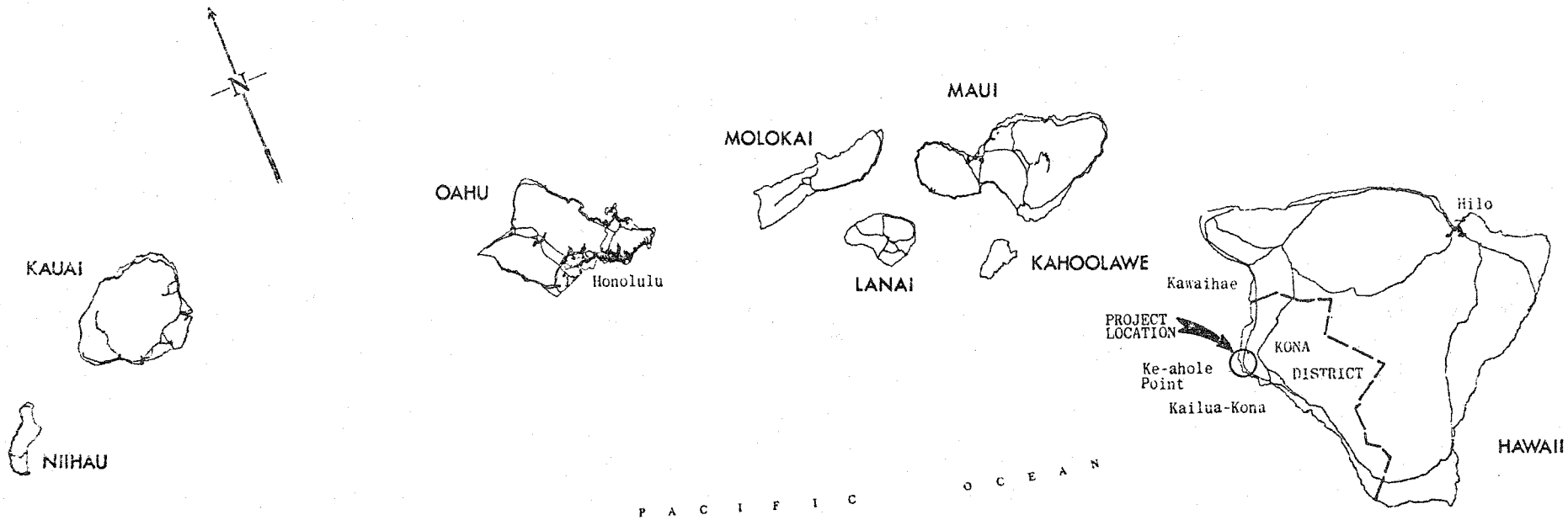
One alternative that will be considered in the final design is the installation of a larger water line that would eliminate the necessity of an on-site storage tank. The choice of the larger line is contingent upon the planned 1977 expansion of the County water system.

c. Sewerage

Sewage disposal from the NELH site will be handled through construction of a lift station adjacent to the central utility terminus. The lift station would be fed through a future on-site collection system. A duplex pump station with a 200-gallon wet well will discharge into a 3-inch force main. A small air diffuser will be installed within the wet well to provide odor control of the sewage prior to pumping. A force main will be routed along the water line corridor and will discharge into a sewer manhole located near the airport control tower. The manhole will tie into the sewage treatment plant. Chlorine or hydrogen peroxide will be injected to avoid septic conditions within the force main during transit to the manhole. A standby generator will provide emergency power to the lift station complex in the event of a power outage. Two overflow seepage pits will be installed adjacent to the lift station to provide emergency discharge in the event of a complete lift station failure.

The airport sewage treatment plant (STP) has a capacity of 40,000 GPD, which is presently used to only one-quarter capacity. The airport system uses the aerobic digestion process, with treated effluent discharged through two seepage pits. The estimated ultimate flow from the NELH site is only 11,700 GPD, so the existing sewage treatment plant can easily handle the flow for the foreseeable future. Should larger flows ever occur, the present sewage treatment plant can be expanded.

The State Department of Health authorization for the airport STP permits only airport generated waste to be processed. Action is being taken by the Airports Division to have this authorization modified to permit processing of NELH domestic waste.



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STATUTE MILES

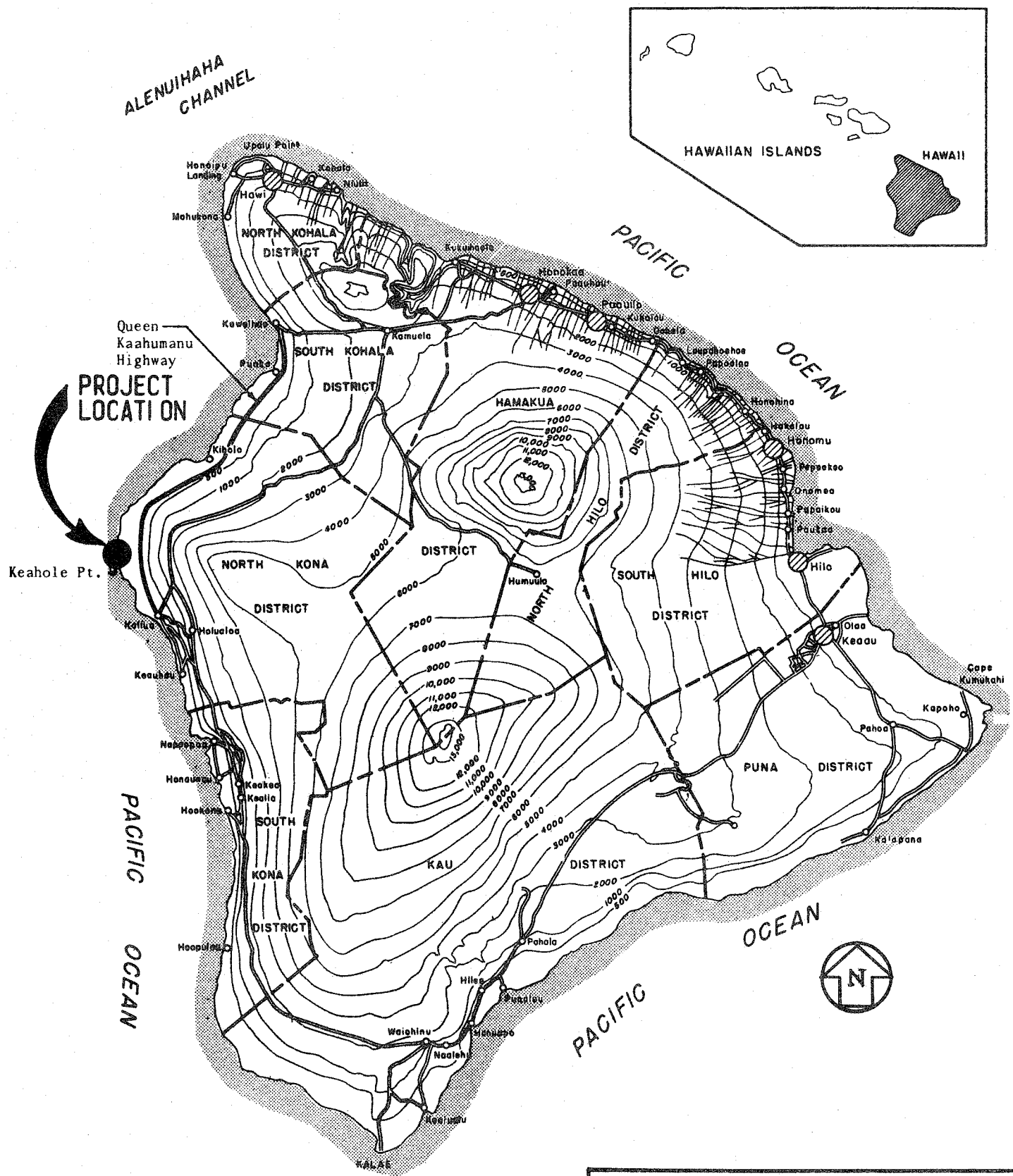
GRAPHIC SCALE

The Research Corporation
of the
University of Hawaii

LOCATION MAP

R. M. TOWILL CORPORATION
PLANNERS-ENGINEERS-SURVEYORS-PHOTOGRAMMETRISTS

FIGURE II-1



THE RESEARCH CORPORTION OF THE UNIVERSITY OF HAWAII
KE-HOLE POINT COUNTY OF HAWAII LOCATION ON ISLAND OF HAWAII
R. M. TOWILL CORPORATION PLANNERS-ENGINEERS-SURVEYORS-PHOTOGRAMMETRISTS

FIGURE II-2

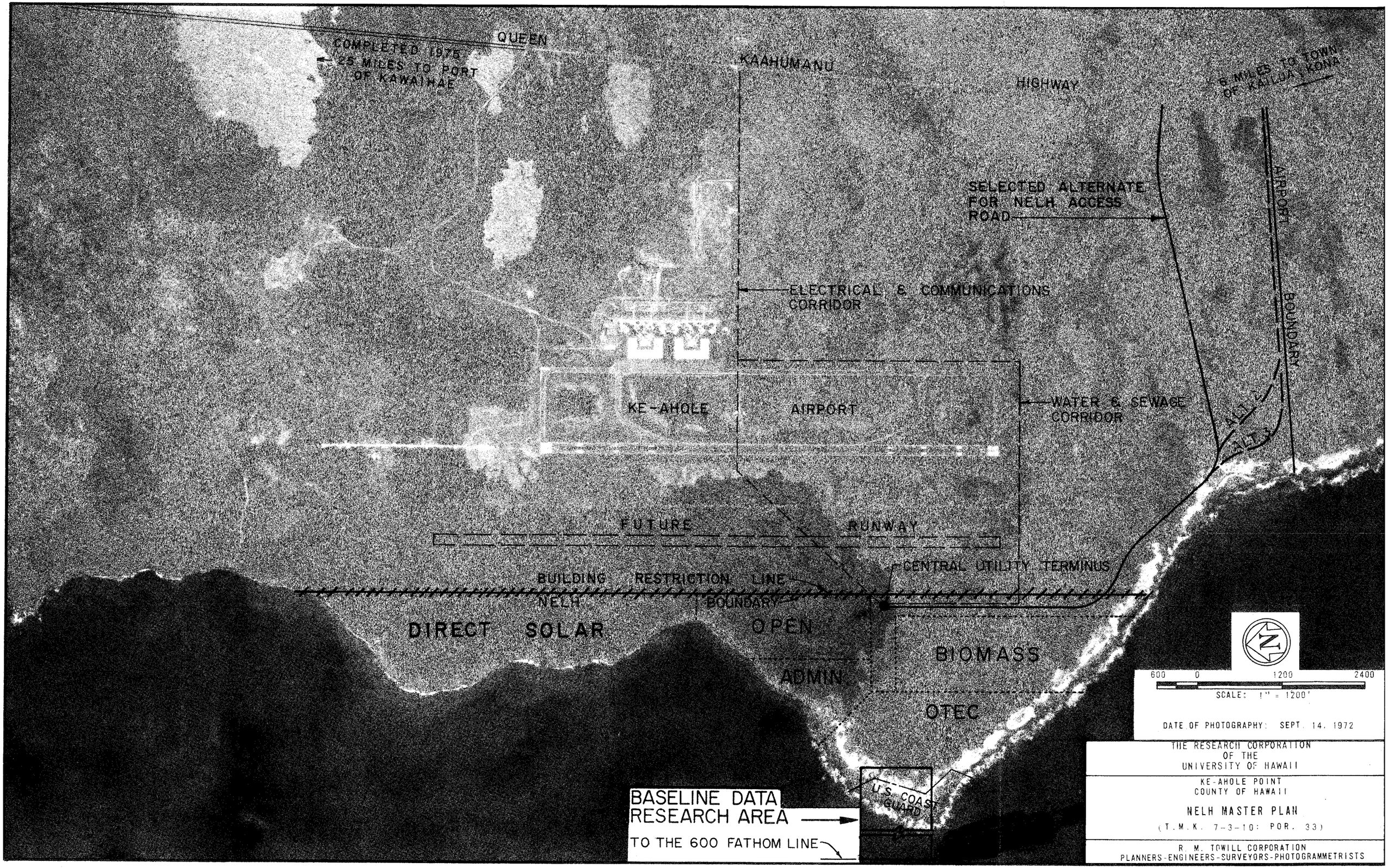
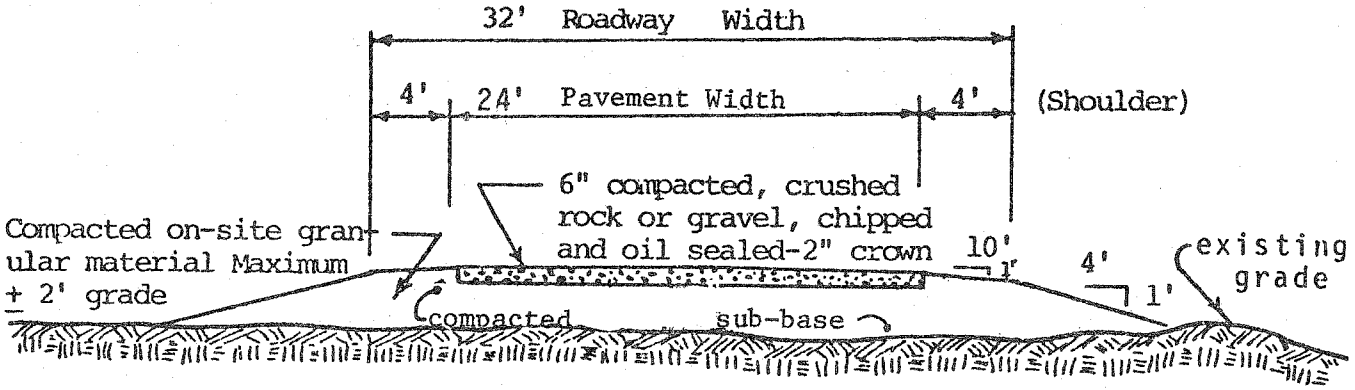
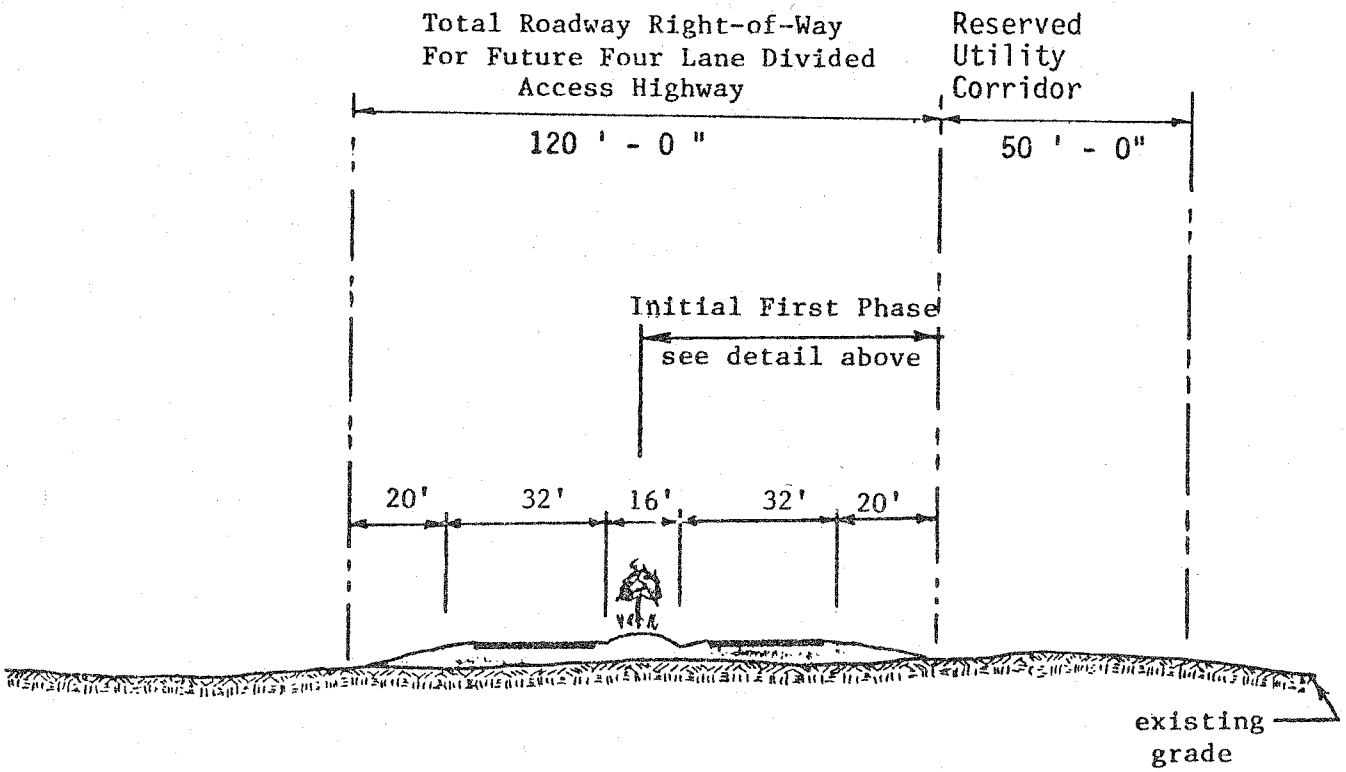

QUEEN
COMPLETED 1975
25 MILES TO PORT OF KAWAIHAE
KAAHUMANU
HIGHWAY
6 MILES TO TOWN OF KAILUA, KONA
SELECTED ALTERNATE FOR NELH ACCESS ROAD
AIRPORT BOUNDARY
ELECTRICAL & COMMUNICATIONS CORRIDOR
WATER & SEWAGE CORRIDOR
KE-AHOLE AIRPORT
FUTURE RUNWAY
CENTRAL UTILITY TERMINUS
BUILDING RESTRICTION LINE
NELH BOUNDARY
DIRECT SOLAR
OPEN
BIOMASS
ADMIN
OTEC
BASELINE DATA RESEARCH AREA
TO THE 600 FATHOM LINE
U.S. COAST GUARD
600 0 1200 2400
SCALE: 1" = 1200'
DATE OF PHOTOGRAPHY: SEPT. 14, 1972
THE RESEARCH CORPORATION OF THE UNIVERSITY OF HAWAII
KE-AHOLE POINT
COUNTY OF HAWAII
NELH MASTER PLAN
(T.M.K. 7-3-10: POR. 33)
R. M. TOWILL CORPORATION
PLANNERS-ENGINEERS-SURVEYORS-PHOTOGRAMMETRISTS

FIGURE II-3



PROPOSED INITIAL TWO LANE ACCESS ROAD

Scale : 1" = 10' - 0"



PROPOSED UTILITY CORRIDOR TO SERVICE NELH SITE

Scale : 1 " = 40' - 0"

The Research Corporation of the University of Hawaii

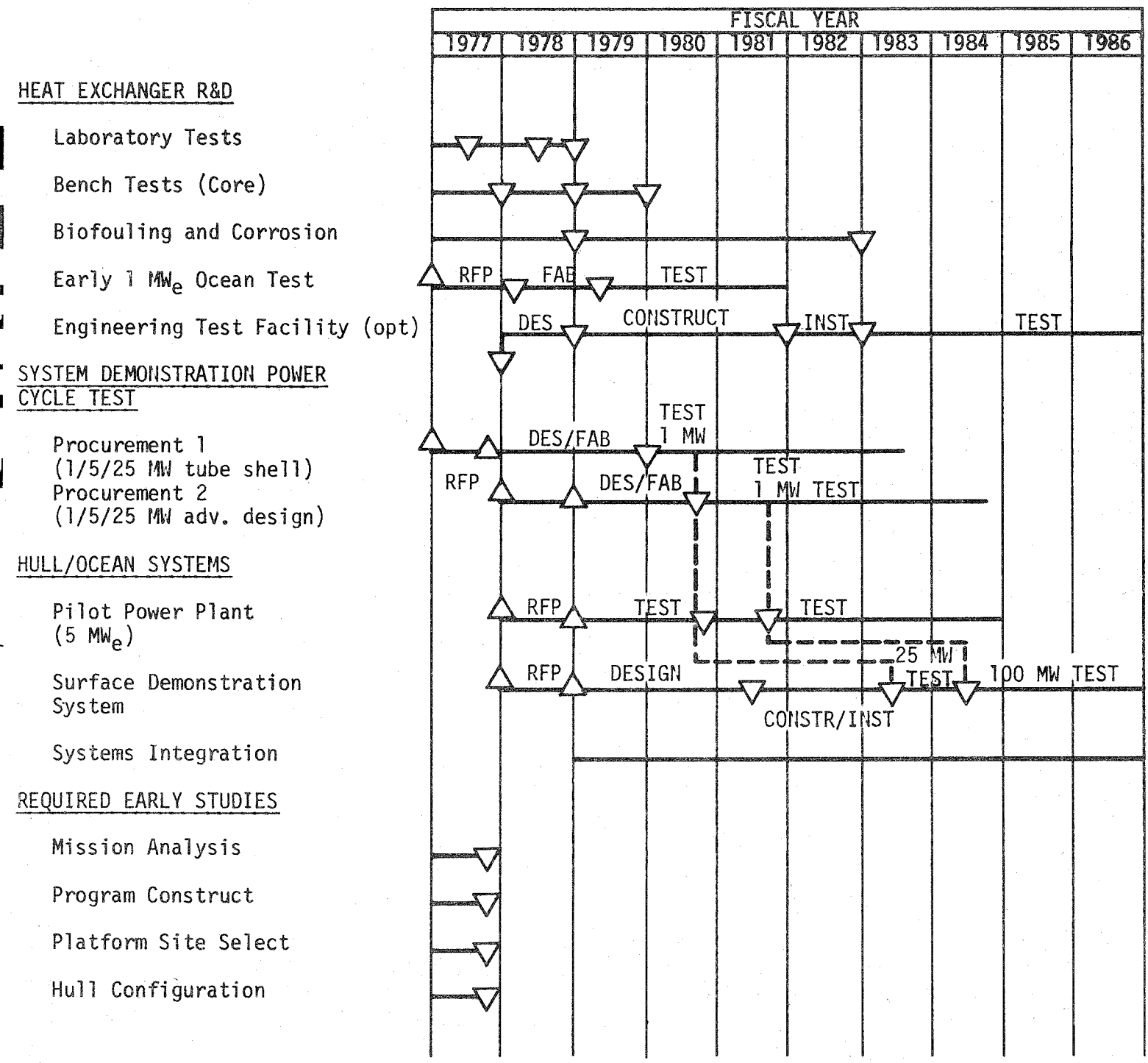
ROADWAY & UTILITY CORRIDOR DETAILS

R. M. TOWILL CORPORATION
PLANNERS-ENGINEERS-SURVEYORS-PHOTOGRAMMETRISTS

FIGURE II - 4 (FROM REF. 5)

TABLE II-1

OCEAN THERMAL PROGRAM ENGINEERING
DEVELOPMENT AND DEMONSTRATION MILESTONES



LEGEND: RFP - Request for Proposal
FAB - Fabrication
DES - Design
CONSTRUCT - Construction
INST - Instrumentation
TEST - Testing

TABLE II-2

NELH DEVELOPMENT SCHEDULE

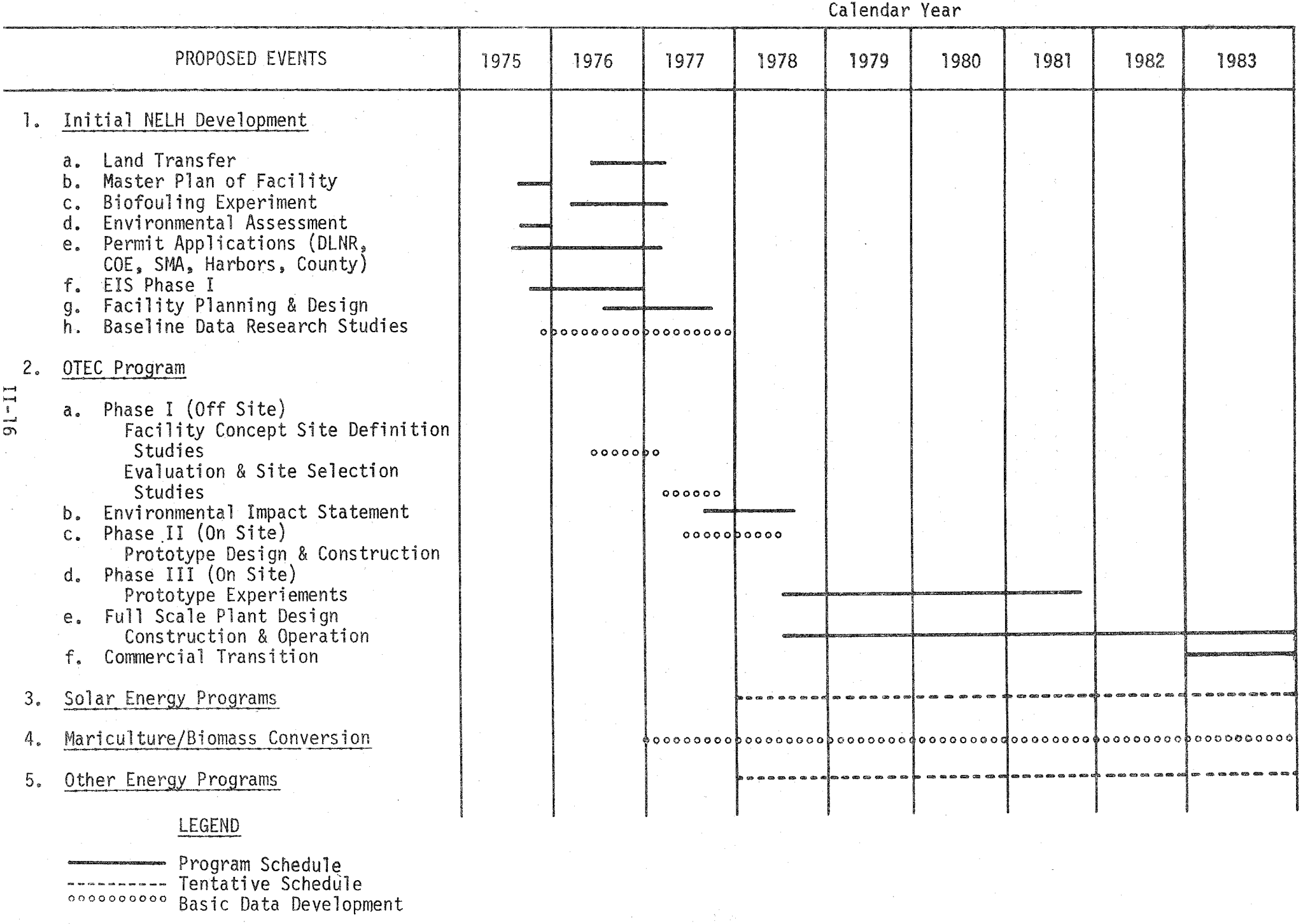


TABLE II-3. ENERGY RESEARCH PROJECTS AND PROGRAMS (From Ref. 4)

Alternate Energy Area	Project	Funding and Sponsor			Research Organization	Start Date	Status	Results & Comments
		Sponsor	Amount	Year				
OCEAN THERMAL ENERGY CONVERSION (OTEC)	ISLAND OF HAWAII AS OTEC SITE	COUNTY OF HAWAII STATE OF HAWAII (DPED)	$5,000 5,000 10,000	1972 1972	UNIVERSITY OF HAWAII	1972	COMPLETED	SELECTED KE-AHOLE POINT AS BEST SITE FOR OTEC PLANT.
	SITE STUDY ON ISLAND OF HAWAII	NATIONAL SCIENCE FOUNDATION	48,644	1974-75	UNIVERSITY OF HAWAII	JULY 1, 1974	COMPLETED	OCEANOGRAPHIC AND SOCIO-ECONOMIC IMPACT.
	FURTHER EVALUATION	STATE OF HAWAII (DPED)	10,000	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	EXTENSION OF ABOVE PROJECT TO 100 MW AND 240 MW FLOATING OTEC PLANT.
	PLANNING FOR SEA SOLAR POWER IN HAWAII	SEA GRANT OFFICE	8,250	1974	UNIVERSITY OF HAWAII	JUNE 1974	COMPLETED	STUDY OF CONCEPTUAL DESIGN AND CONSTRUCTION TECHNIQUES.
	OCEAN STRUCTURE SCALE MODEL	SEA GRANT OFFICE UNIVERSITY OF HAWAII OCEANIC INSTITUTE	111,594 9,625 4,907 126,126	1975 1975	OCEANIC INSTITUTE	1975	COMPLETED	HYDRODYNAMIC COUPLING TO ENCLOSED WATER MASS.
	OCEAN ENERGY WAVE STUDIES	SEA GRANT OFFICE MAC SEA GRANT OFFICE MAC	37,000 10,000 39,000 10,000 96,000	1975 1975 1976 1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	WAVE FORCES ON PIPELINES IN COASTAL AREAS.
	BIOFOULING AND CORROSION	NSF/ERDA	38,757	1976	UNIVERSITY OF HAWAII WITH CARNEGIE MELLON UNIVERSITY	1975	IN PROGRESS	BASIC EVAPORATOR DESIGN PARAMETERS.
	PILOT ENGINEERING STUDY OF OTEC	STATE OF HAWAII (HNEI)	6,686	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	DYNAMIC RESPONSE AND THERMAL DIFFUSION.
	CORROSION AND FOULING REMOVAL	STATE OF HAWAII (HNEI)	7,598	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	STRESS CORROSION CRACKING AND CREVICE CORROSION.
	SEA STATE AND DESIGN WAVE CRITERIA	ERDA	36,000	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	ENVIRONMENTAL DATA FOR OTEC DESIGN.
	BENTHIC SURVEY	STATE OF HAWAII (DPED)	25,625	1977	UNIVERSITY OF HAWAII	1976	FUNDING PENDING	REEF SURVEY AT KE-AHOLE TO 100' DEPTH.
	ISAACS WAVE GENERATOR	STATE OF HAWAII (DPED)	45,000	1977	UNIVERSITY OF HAWAII	1976	FUNDING PENDING	TEST IN HAWAII OF ISAACS-CASTEL WAVE POWERED GENERATORS.
	BIOFOULING EXPERIMENT	SEA GRANT OFFICE STATE OF HAWAII (MAC)	53,700 25,000 75,000	1977 1977	UNIVERSITY OF HAWAII	1976	FUNDING PENDING	TEST OF ALTERNATE HEAT EXCHANGER DESIGN CONCEPT.

TABLE II-3. ENERGY RESEARCH PROJECTS AND PROGRAMS (From Ref. 4) (Cont'd.)

WIND	A STUDY OF WIND ENERGY CONVERSION FOR OAHU	CITY & COUNTY OF HONOLULU STATE OF HAWAII (DPED) STATE OF HAWAII (HNEI)	$29,985 13,300 16,987 60,272	1974 1975 1976	U.H. CENTER FOR ENGINEERING RESEARCH	APRIL 1974	IN PROGRESS	MORE DATA NEEDED.
	WIND SURVEY FOR STATE	STATE OF HAWAII (DPED) NATIONAL SCIENCE FOUNDATION COUNTIES	60,000 40,000 15,000 115,000	1976 1976 1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	WIND POWER RESOURCE ATLAS.
	WIND POWER ASSESSMENT	LAWRENCE LIVERMORE LABORATORY	10,000	1976	U.H. CENTER FOR ENGINEERING RESEARCH	1975	IN PROGRESS	LOCAL PORTION OF NATIONAL PROGRAM TO DEVELOP LASER WIND MEASUREMENT.
	WIND ENERGY SYSTEM APPLICATIONS IN HAWAII	ERDA	245,000	1977	AEROSPACE CORPORATION		PROPOSAL IN REVIEW	A REGIONAL ELECTRICAL UTILITY APPLICATION OF SOLAR ENERGY STUDY FOR ERDA.
	WIND TURBINE GENERATOR	NSF/NASA	No value		HAWAIIAN ELECTRIC COMPANY		PROPOSED JAN. 1975; AGAIN APRIL 1976	WIND TURBINE GENERATOR DEMONSTRATION PROGRAM
BIOCONVERSION & SOLID WASTE	OCEAN FARM PROJECT	AMERICAN GAS ASSOCIATION ERDA	$200,000 70,000 270,000	1975 1976	NAVAL UNDERSEA CENTER, HAWAII LABORATORY	1975	IN PROGRESS	OCEAN ENGINEERING--PLATFORM, SUBSTRATE, NUTRITION, HARVESTING.
	ENERGY FROM ALGAE	STATE OF HAWAII (HNEI)	20,200	1976	HAWAII NATURAL ENERGY INSTITUTE	1976	IN PROGRESS	SYNTHETIC PETROLEUM PRODUCTS.
	BIOMASS STUDY	STATE OF HAWAII (HNEI) STANFORD UNIVERSITY	6,500 20,000 26,500	1976 1976	STANFORD UNIVERSITY, U.H. CENTER FOR ENGINEERING RESEARCH	1976	IN PROGRESS	MARINE AND TERRESTRIAL BIOMASS ENERGY OPTIONS.
	CONVERSION OF ORGANIC WASTE TO OIL	PACIFIC RESOURCES, INC. STATE OF HAWAII (OEQC)	24,700 2,500 27,200	1973 1973	BATTELLE RESEARCH INSTITUTE	1973	PROJECT TERMINATED	SURVEY OF TECHNOLOGIES--NO FORMAL FINAL REPORT.
	METHANE GENERATION FROM ANIMAL MANURE	BARBARA ANTHONY COX FOUNDATION	15,000	1974	U.H. ANIMAL SCIENCES DEPARTMENT	1974	TERMINATED	RAN OUT OF FUNDS.
	COMBUSTION OF SOLID WASTES FOR ELECTRICITY GENERATION	CITY & COUNTY OF HONOLULU AMFAC, INC. HAWAIIAN ELECTRIC COMPANY	50,000 50,000 10,000 110,000	1974 1974 1974	SUNN, LOW, TOM AND HARA, INC.	1974	COMPLETED	RFP FOR DISPOSAL PLANT NOW IN PREPARATION
	SOLID WASTE ENERGY AND RESOURCES TASK FORCE	STATE OF HAWAII EPA FEA	35,000 17,500 7,500 60,000	1976 1976 1976	SWERT	1975	COMPLETED	PRELIMINARY POLICY ASSESSMENT.
	SOLID WASTE AND BAGASSE	COUNTY OF HAWAII EPA	25,000 50,000 75,000	1976 1976	COUNTY OF HAWAII	1975	IN PROGRESS	FEASIBILITY OF BURNING SOLID WASTE WITH BAGASSE FOR ELECTRICITY.
	METHANE PRODUCTION	STATE OF HAWAII (HNEI)	10,869	1976	UNIVERSITY OF HAWAII	1976	IN PROGRESS	METHANE FROM ORGANIC WASTE.
	SIMULATION OF PYROLYSIS	STATE OF HAWAII (HNEI)	12,642	1976	UNIVERSITY OF HAWAII	1976	IN PROGRESS	COMPUTER MODEL OF SOLID WASTE PYROLYZER.

TABLE II-3. ENERGY RESEARCH PROJECTS AND PROGRAMS (From Ref. 4) (Cont'd.)

Alternate Energy Area	Project	Funding and Sponsor: Sponsor	Amount	Year	Research Organization	Start Date	Status	Results & Comments
SOLAR INSOLATION	MEASUREMENT OF SOLAR RADIATION IN HAWAII	STATE OF HAWAII (HNEI) STATE OF HAWAII (DPED) NATIONAL SCIENCE FOUNDATION COUNTIES	$9,020 50,000 30,000 15,000 104,020	1976 1976 1976 1976	UNIVERSITY OF HAWAII	1976	IN PROGRESS	STATE-WIDE SURVEY. MEAN RADIATION & VARIABILITY.
	SOLAR WATER HEATER	STATE OF HAWAII (HNEI)	15,322	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	DESIGN CRITERIA, PROMULGATION.
	SOLAR STILL AND GREENHOUSE	STATE OF HAWAII (HNEI)	5,855	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	SALT WATER DISTILLATION AND AGRICULTURE.
SYSTEMS STUDIES	OFFSHORE COAL-FIRED POWER PLANT	SEA GRANT OFFICE OCEANIC INSTITUTE	$70,000 35,000 105,000	1973-74	OCEANIC INSTITUTE	SEPT. 1974	COMPLETED	FEASIBILITY STUDY. FINAL REPORT FEB. 1975.
	ENERGY IN HAWAIIAN AGRICULTURE	U.S. DEPT. OF AGRICULTURE U.S. DEPT. OF AGRICULTURE U.S. DEPT. OF AGRICULTURE	15,000 10,000 5,000 30,000	1975 1976 1977	U.H. AGRICULTURAL ECONOMICS	1974	IN PROGRESS	METHODOLOGY OF ENERGY MANAGEMENT IN TROPICAL AGRICULTURE.
	ENERGY SYSTEM FOR HAWAII	STATE OF HAWAII (HNEI)	4,360	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	HVDC DISTRIBUTION BETWEEN ISLANDS.
	HYDROELECTRIC POTENTIAL, MT. WAIALEALE	STATE OF HAWAII, DEPT. OF LAND & NATURAL RESOURCES	124,000	1975	BELT, COLLINS & ASSOCIATES	1975	IN PROGRESS	KAUAI. 400 INCHES OF RAIN ANNUALLY.
	SOLAR-WIND APPLICATIONS	STATE OF HAWAII (DPED) NATIONAL SCIENCE FOUNDATION CITY & COUNTY OF HONOLULU	25,000 37,478 10,000 72,478	1976 1976 1976	U.H. CENTER FOR ENGINEERING RESEARCH	1975	IN PROGRESS	ECONOMIC FEASIBILITY AND SOCIAL IMPACT.
	HYDROELECTRIC POTENTIAL, W. HAWAII	STATE OF HAWAII (DPED)	49,000	1977	DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT		FUNDING PENDING	HYDROELECTRIC POWER FOR BIG ISLAND'S MAJOR POPULATION CENTERS.
GEOTHERMAL	HAWAII GEOTHERMAL PROJECT	COUNTY OF HAWAII STATE OF HAWAII NATIONAL SCIENCE FOUNDATION ERDA U.H. FOUNDATION HAWAIIAN ELECTRIC COMPANY MARINE AFFAIRS COORDINATOR OTHER	$100,000 100,000 469,000 119,000 17,649 9,000 5,000 7,351 827,000	1972 1972 1973-74 1975 1975 1975 1975 1975	UNIVERSITY OF HAWAII	1972	PHASE I EXPLORATORY SURVEYS COMPLETED.	SITE SELECTED IN PUNA AREA FOR THE RESEARCH DRILLING PROGRAM.
	HGP PHASE II	STATE OF HAWAII ERDA HAWAIIAN ELECTRIC COMPANY ERDA WATER RESOURCES INT.	500,000 1,064,000 45,000 150,000 60,000 1,819,000	1974 1975 1974-75 1976 1976	UNIVERSITY OF HAWAII	1975	WELL HGP-A DRILLING COMPLETED 27 APRIL 1976 TO 6445 FT. SLOTTED CASING TO BE INSTALLED.	MAXIMUM TEMPERATURE RECORDED TO DATE WAS 302°C AND RISING. WILL BE TESTED FOR PERMEABILITY.

TABLE II-3. ENERGY RESEARCH PROJECTS AND PROGRAMS (From Ref. 4) (Cont'd.)

	HGP PHASE III (FINAL PHASE THROUGH FY 77)	ERDA ERDA	258,560 300,000 558,560	1976 1977	UNIVERSITY OF HAWAII	1976	TENTATIVE APPROVAL, CONTINGENT UPON SATISFACTORY PROPOSAL.	FOR COMPLETION OF SCIENTIFIC ANALYSIS.
	HYDROTHERMAL SYSTEMS OF KILAUEA, HAWAII	NATIONAL SCIENCE FOUNDATION	747,600	1973	COLORADO SCHOOL OF MINES	1973	COMPLETED AUG. 1973	REPORT ISSUED 1974. BORE-HOLE DRILLED TO 1,262 METERS ON KILAUEA.
	SEISMIC PROSPECTING FOR MAGMA RESERVOIRS	NATIONAL SCIENCE FOUNDATION	37,500	1974	UNIVERSITY OF HAWAII	APRIL 1974	COMPLETED	TO INCREASE THE KNOWN GEOTHERMAL RESOURCES OF THE WORLD.
	STATE GEOTHERMAL ENERGY POLICY PROJECT	NATIONAL SCIENCE FOUNDATION STATE OF HAWAII	30,000 30,000 60,000	1975 1975	DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT	SEPT. 1974	COMPLETED	DEFINED THE STATE'S OPTIONS.
	REGULATIONS FOR GEOTHERMAL RESOURCES	STATE OF HAWAII	10,000	1974	DEPT. OF LAND AND NATURAL RESOURCES	1974	IN PROGRESS	DRAFT RULES IN CIRCULATION.
	NON-ELECTRIC USES OF GEOTHERMAL ENERGY	STATE OF HAWAII (HNEI)	4,761	1976	UNIVERSITY OF HAWAII	1975	COMPLETED	PAPER IN GEOTHERMAL ENERGY (11/75).
	CORROSION IN MAGMATIC ENVIRONMENT	SANDIA LABORATORIES ERDA	12,000 15,000 27,000	1975 1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	MATERIALS PROBLEMS IN MAGMA TAP POWER.
	CORROSION IN VOLCANIC ENVIRONMENT	STATE OF HAWAII (HNEI)	8,634	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	SUITABILITY OF METALS AND ALLOYS FOR GEOTHERMAL POWER.
	HELIUM CONTENT OF FUMAROLIC GASES	STATE OF HAWAII (HNEI)	5,198	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	PREDICTION OF GEOTHERMAL POTENTIAL.
	MASS SPECTROMETRIC STUDIES OF METAL-MAGMA REACTIVITY	STATE OF HAWAII (HNEI)	11,378	1976	UNIVERSITY OF HAWAII	1975	IN PROGRESS	SUITABILITY OF MATERIALS FOR MAGMA TAP.
CONSERVATION & DEMONSTRATION	CONSERVATION PROGRAMS	STATE OF HAWAII (DPED)	$52,100	1975	DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT	1975	COMPLETED	BASIC STUDIES AND PUBLIC EDUCATION.
	CONSERVATION PROGRAMS	STATE OF HAWAII (DPED)	100,000	1977	DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT	1976	FUNDING PENDING	LOAD CYCLING FOR PUBLIC BUILDINGS. STATE CONSERVATION PROGRAM.
	MASS TRANSIT EDUCATION PROGRAM	FED.-COMM. SERVICES ADMINISTRATION	32,600	1976	HAWAII COUNTY ECONOMIC OPPORTUNITY COUNCIL	1975	IN PROGRESS	FOR NEW COUNTY MASS TRANSIT SYSTEM.
	ENGINE TUNE-UP PROGRAM	FED.-COMM. SERVICES ADMINISTRATION	29,900	1976	HONOLULU COMMUNITY ACTION PROGRAM	1975	IN PROGRESS	TRANSPORTATION ENERGY CONSERVATION FOR RURAL RESIDENTS.
	ENERGY HOUSE	HAWAII HOUSING AUTHORITY UNIVERSITY OF HAWAII STATE OF HAWAII (HNEI)	65,880 7,370 6,189 79,439	1976 1976 1976	UNIVERSITY OF HAWAII	1976	UNDER CONSTRUCTION	DESIGN, DEMONSTRATION AND ANALYSIS OF INTELLIGENT, ECONOMICAL, TROPICAL ARCHITECTURE.

TABLE II-3. ENERGY RESEARCH PROJECTS AND PROGRAMS (From Ref. 4) (Cont'd.)

Alternate Energy Area	Project	Funding and Sponsor: Sponsor	Amount	Year	Research Organization	Start Date	Status	Results & Comments
CONSERVATION & DEMONSTRATION (CONT.)	ENERGY EFFICIENCY BROCHURE	STATE OF HAWAII (HNEI)	$15,000	1976	UNIVERSITY OF HAWAII	1976	IN PROGRESS	SPINOFF FROM ENERGY HOUSE DESIGN.
	SOLAR WATER HEATER DEMONSTRATION	STATE--SPNSC FED.-COMM. SERVICES ADMIN.	10,000 45,000	1976 1976	MAUI ECONOMIC OPPORTUNITY INC.	1975	TWO PROTOTYPES COMPLETED. 100 UNITS UNDER CONSTRUCTION.	LOW-COST SOLAR HEATERS. ECONOMIC STIMULATION OF DEPRESSED AREA.
	HOT WATER CONSERVATION	FED.-COMM. SERVICES ADMIN.	26,000	1976	MAUI ECONOMIC OPPORTUNITY INC.	1976	INSTALLATION PROCEEDING	INSTALL 300 TIMERS ON ELECTRIC WATER HEATERS.
OPERATIONS & FACILITIES SUPPORT	HAWAII NATURAL ENERGY INSTITUTE	STATE OF HAWAII (DPED) STATE OF HAWAII (DPED) STATE OF HAWAII (DPED)	$55,000 25,800 224,000 304,800	1975 1976 1977	UNIVERSITY OF HAWAII	1974	IN FORMATIVE STAGE	PROVIDES FOCUS FOR NATURAL ENERGY RESEARCH.
	NATURAL ENERGY LABORATORY OF HAWAII	STATE OF HAWAII (MAC) HAWAII COUNTY STATE OF HAWAII (DPED) STATE OF HAWAII (DPED)	50,000 50,000 100,000 900,000 1,100,000	1975 1975 1976 1977	RESEARCH CORPORATION OF THE UNIVERSITY OF HAWAII	1974	PRELIMINARY PHASE	PROVIDES SITE FOR SOLAR ENERGY RESEARCH AT KE-AHOLE POINT, ISLAND OF HAWAII.
	OCEAN THERMAL FACILITY DEVELOPMENT SUPPORT	STATE OF HAWAII (MAC) STATE OF HAWAII (MAC)	30,000 38,000 68,000	1976 1977	NATURAL ENERGY LABORATORY OF HAWAII	1975	IN PROGRESS	PROPOSAL PREPARATION AND ADMINISTRATIVE SUPPORT.

ABBREVIATIONS

DPED - Department of Planning and Economic Development
EPA - Environmental Protection Agency
ERDA - Energy Research and Development Administration
FEA - Federal Energy Administration
HNEI - Hawaii Natural Energy Institute
MAC - Marine Affairs Coordinator
NSF - National Science Foundation
OEQC - Office of Environmental Quality Control
OTEC - Ocean Thermal Energy Conversion
SPNSC - State Progressive Neighborhood Service Center
SWERT - Solid Waste Energy and Resources Task Force

TABLE II-4

NATURAL ENERGY LABORATORY OF HAWAII
PROJECTED PERSONNEL AND
UTILITY REQUIREMENTS FOR FULL SCALE FACILITIES IN YEAR 1990
(REF. 5)

OTEC

Estimated On-Line Date	1984
Daytime Personnel - Number	40
Fulltime Personnel - Number	5
Water, Domestic - GPD	3150
Water, Industrial - GPD	5000
Sewage, Total - GPD	5650
Elec., Domestic - KVA, Peak	60
Elec., Indus. - KVA, Peak	175

Biomass

Estimated On-Line Date	1985
Daytime Personnel - Number	20
Fulltime Personnel - Number	3
Water, Domestic - GPD	1650
Water, Industrial - GPD	10,000
Sewage, Total - GPD	4150
Elec., Domestic - KVA, Peak	20
Elec., Indus. - KVA, Peak	40

Solar

Estimated On-Line Date	1990
Daytime Personnel - Number	15
Fulltime Personnel - Number	--
Water, Domestic - GPD	900
Water, Industrial - GPD	2000
Sewage, Total - GPD	1900
Elec., Domestic - KVA, Peak	10
Elec., Indus. - KVA, Peak	20

Totals

Daytime Personnel - Number	75
Fulltime Personnel - Number	8
Water Demand - GPD	22,700
Sewage, - GPD	11,700
Elec., - KVA, Peak	325

III. DESCRIPTION OF THE ENVIRONMENTAL SETTING

A. Physical Environment

1. Site Description

Ke-ahole Point is situated on the western coastline of the island of Hawaii, the largest and most southerly of the Hawaiian Islands. Located in the district of North Kona, Ke-ahole Point is approximately six miles north of the town of Kailua-Kona. The Kailua-Kona area is the major urban center on the leeward side of the island with a 1975 population of approximately 12,000 people. The Ke-ahole NELH site consists of approximately 240 acres of land located immediately seaward of the Ke-ahole Airport. At the tip of Ke-ahole Point, 7.745 acres of land owned by the United States Government are used by the U. S. Coast Guard for the operation of an unmanned lighthouse. The lighthouse is battery-operated and serves as a navigational warning to ship traffic.

The eastern boundary of the Natural Energy Laboratory site is the same as the airport Building Restriction Line, approximately one-half mile west of the existing runway center line. The entire area (except the Coast Guard Lighthouse site) is presently owned by the State of Hawaii and is included within the project boundary of Ke-ahole Airport. Use of this property was authorized by Act 236 of the Session Laws of Hawaii, 1974.

Present access to Ke-ahole Point is via a jeep trail which is almost impassable in several locations. The trail runs from Ke-ahole Point southward and parallel to the coast for approximately 20,000 feet before turning inland for another 4,000 feet to connect with the existing coastal highway at a location near the Kailua-Kona sanitary landfill. Users

of the rough trail are primarily local fishermen, picnic enthusiasts, curiosity explorers, skin divers, campers, and U. S. Coast Guard personnel who maintain the lighthouse.

2. Climate

The climate of the west coast of the island of Hawaii is semi-tropical. The average temperature at the Kailua-Kona Airport is 75°F with a recorded maximum of 89°F and minimum of 54°F. The Ke-ahole Point area is arid, with an average annual rainfall of 16 to 17 inches per year. Although the monthly rainfall is fairly constant (with a slight increase during the summer months), local storms can produce heavy rainfall patterns.

The land masses of Mauna Kea and Mauna Loa block the prevailing northeast trades, and a land/sea breeze system predominates in the area. The resulting winds are gentle offshore breezes during the night, switching to onshore during the day due to heating of the land. Typical velocities range from 3 to 14 knots. The exception to this pattern occurs during the periods of so-called "kona" weather during the winter months when low pressure fronts may cause strong southerly winds.

Solar radiation at the site is constant, with the days cloud-free an estimated 95 percent of the year. No direct radiation measurements have been made at the NELH site. However, solar radiation has been extensively measured by the Hawaii Sugar Planters' Association in the Makiki area of Honolulu (believed to be a comparable location), and averages 2,019 BTU per square foot per day (Ref. 1).

3. Geology

Ke-ahole Point is located on the western slope of the mountain of Hualalai (elevation 8,271 feet). Hualalai is a dormant volcano with the last reported eruption occurring in 1801. Ke-ahole Point was formed by the progressive layering of the lava flows from Hualalai. The lava is primarily pahoehoe lava with layer thicknesses varying from 6 inches to 100 feet. The layers are very porous and contain numerous lava tubes, cracks, crevices, and fissures. Desiccation due to erosion, cracking, settlement and the overburden of subsequent lava flows has gradually compacted the underlying layers; however, the near surface layers are fractured with a very irregular surface.

The general topography of the Ke-ahole Point area is relatively level, with an approximate elevation of 20 feet. The shoreline varies from level beaches to elevations up to 15 feet which drop steeply into the ocean to depths of 10 to 20 feet. The nearly vertical shoreline has numerous caves and lava tubes extending horizontally under the shoreline. The existing surface is very irregular with numerous crevices and lava tubes. In general, the site has the irregular surface associated with uneroded lava flows. The surface material is very friable and can usually be graded using conventional earth moving equipment.

4. Flora

The project area can generally be classified as "ground cover sparse and conditions semi-desert" (Ref. 6) which is typical of the leeward side of most of the major islands in the Hawaiian chain. Three main zones are present in the project area. The beach zone, which is a narrow belt along the coast, has a diverse plant life. Species present

include mainly naupaka, along with hialoa, kiawe, beach morning glory, Bermuda grass and Christmas berry, among others. The northern part of the project site is covered with the pahoehoe lava flow of 1800-1801. This zone is characterized by sparse and scattered vegetation consisting of mainly fountain grass, caper (pua-pilo), sword fern and hialoa. The rest of the project area is the old lava zone which is characterized by sparse dry grasslands and herbs. Fountain grass is predominant, along with smaller amounts of hialoa, sword fern, klu, red-top grass and caper.

5. Wildlife

No endemic Hawaiian birds were observed during the recently completed wildlife survey conducted in November 1975, (Ref. 6). Two species, however, may be found in the area. The endangered Hawaiian stilt, known to be present in pond areas several miles to the north and south of the site may fly over the area. The other is the Hawaiian owl, which is known to be present in Kona and may feed on rodents in the Ke-ahole Point area. Indigenous birds observed during the survey were the golden plover, wandering tattler, and ruddy turnstone, which are all found elsewhere in the world. A number of other introduced species are present. They include the Indian grey francolin, barred dove, common mynah, Japanese white-eye, house-finch, house sparrow, cardinal and Brazilian cardinal, among other species. Most species were seen along the coastal zone and in some cases the old lava zone. None were observed in the new lava zone.

The Indian mongoose was the only mammal actually seen during the survey. However, the presence of other mammals, such as the common house mouse, roof rat, Polynesian rat, feral cats and goats was either indicated or suspected. The endangered Hawaiian hoary bat, known to be

present to the north and south of the site, probably feeds on insects along the coastal area of the old lava zone.

Other animal species present in the coast zone are insects, one species of gecko (Lepidodactylus lugubris), and the skink (Ablepharus boutoni poecilopleurus). No frogs or toads are expected to be found in this area. At least three kinds of mollusks (shells and snails) have been observed in the three brackish ponds located near the southwest edge of the 1801 lava flow; these include Assiminea sp., Melania sp., and Theodoxus cariosa. Two kinds of crustaceans (shrimp) are known to exist in the ponds; they are the Halocaridina rubra and the Macrobrachium grandimanus. No species found at the ponds are considered endangered.

6. Archaeology

An initial archaeological reconnaissance survey (Ref. 7) of the Ke-ahole Point NELH site and the proposed access road alignment Alternate No. 1, along the southern boundary, was conducted by the Bishop Museum in October 1975. An additional survey (Ref. 8) of the alternate road alignments and utility corridors proposed in the final NELH Master Plan was conducted by the Bishop Museum in May 1976. These alternative alignments for the access road are shown on Figure II-3, together with the utility corridor.

In general, the area appears to have been relatively unfavorable for human occupation; however, the surveys noted 14 localities of minor surface structural remains. The majority of the localities occur in the area referred to as the Beach Zone in the Flora and Fauna Survey, which is along the coast and the immediate inland areas of sand pockets not far behind the coastal line. Principal features include platforms,

enclosures, midden deposits and cave shelters. Few features are found further inland on the barren pahoehoe and aa lava. Those found were stacked-stone cairns and apparent foot trails, with both types being rated archaeologically insignificant.

Due to the kind of structures found in the two surveys, their location relative to the ocean and their close proximity to the brackish pools, the remains most likely represent ancient Hawaiian marine activities in the area.

Public access to the area via the existing jeep trail along the coast has resulted in disturbance of many of the 14 noted localities of surface structural remains. However, two of the localities were noted as containing "sufficient still undisturbed material to justify test and/or salvage excavations." (Ref. 7)

The first of these sites is referred to as Locality 4 in the Archaeologist Report (Ref. 7). It is located along the coast about 1,400 feet north of the southern airport boundary and is described as a cave shelter and enclosure. The second site is referred to as Locality 11 and is described as a habitation complex with a platform and enclosure on a lava dome with a small cave shelter. It is located near the coast about 1,400 feet southeast of the existing Coast Guard lighthouse.

The totality of archaeological remains noted during the reconnaissance survey of the Ke-ahole Point area suggests good potential for research into patterns of Hawaiian occupation and exploitation in a seemingly inhospitable environment (Ref. 7).

7. Marine Characteristics

Water depth increases rapidly with distance from shore off Ke-ahole Point, with depths of 2,500 feet within a mile of the coast.

Between the 900 and 2,500 feet depths, the bottom slope is approximately 30 degrees. Shallower than 900 feet, the slope angle decreases. Passages of white sand up to 30 feet wide occur between basalt outcrops running perpendicular to the shoreline. Echinoderms and pink coral are common. Lava from the 1801 Hualalai flow is present in beds up to 20 feet thick, down to depths of 420 feet. In shallow water (less than 100 feet) off the point, preliminary surveys indicate a high percentage (15-90 percent) of coral coverage.

The wave climate of the Kona coast is typically characterized by 2- to 4-foot waves with periods of 9-15 seconds. However, during the winter months larger waves occur frequently. These waves are generated by local "kona" storms and distant storms in the north Pacific. The highest recorded wave along the west coast of Hawaii over the past 20-year period was 25.5 feet. Refraction and shoaling of the deep water waves as they approach Ke-ahole Point results in an intensification of wave height at the location of the lighthouse. The same process results in a decrease of wave height at the small embayment located at the midpoint of the project site.

Although Ke-ahole Point is sheltered from the major tsunami generation centers for the Pacific (the Aleutians and Chile), tsunami runup can occur even on the sheltered side of the island of Hawaii. This factor must be considered in the design of facilities located along the shoreline of the NELH site. As a guideline, a tsunami height of 15 feet at Ke-ahole Point should be considered as a 100-year occurrence (Refs. 5 and 9). A 1 percent slope can be used to estimate the maximum water surface profile inland from the coastline (Ref. 5).

The waters off Ke-ahole Point are pristine, with no stream discharges, industrial wastes, or domestic wastes affecting the area. The water conditions, among the best in the State are an important asset to

the Kona area. The nearshore waters off Ke-ahole Point are classified as Class "AA" waters and discharges into these waters are prohibited. Nearshore waters are defined in the Public Health Regulations, Department of Health, State of Hawaii, Chapter 37A, as "all coastal waters lying within a defined reef area, all waters of a depth less than 10 fathoms, or waters up to a distance of 1,000 feet offshore if there is no defined reef area and if the depth is greater than 10 fathoms." The offshore waters beyond these boundaries are classified as Class "A" water into which discharges are permitted, providing such discharges are in conformance with the National Pollutant Discharge Elimination System.

B. Social Environment

1. Population

Based upon the 1970 census, the population for Hawaii County was 63,468. Within the Kona District, North Kona's population was 4,832 and neighboring South Kona was 4,004. According to State estimates, by mid-1975 the resident population of North Kona had risen to 7,700 while that of South Kona remained almost constant at 4,000. The rate of increase in the population of North Kona over the first half of this decade - approximately 60 percent - was the largest in the State of Hawaii.

The dominant demographic trends in the Kona District community are:

a. The number and percentage of children under the age of 15 years has been declining since 1960.

b. The number and percentage of elderly has been increasing.

c. The North Kona area has experienced more rapid decreases in children and increases of elderly persons than those experienced elsewhere in the County.

d. There are substantial increases in the number of persons between 25 and 44 years of age. The age group between 25 and 44 years has increased with the availability of housing.

The ethnic breakdown of the Kona area is characterized by a mix of: Caucasian-33 percent, Japanese--31 percent, Part-Hawaiian--17 percent, Filipino--16 percent, and Chinese--2 percent and others--1 percent Recent ethnic changes are characterized by:

a. A rapid increase in Caucasians, both numerically and percentage-wise, particularly in North Kona.

b. A numerical and percentage decrease in Japanese, Hawaiians and Part-Hawaiians.

2. Community Character

Kona has been characterized as a place of gentle, contrasting beauty; a place for peaceful relaxation. The dry, warm coastline areas of the village settlements and beach areas contrast with the cool, wet upland areas of ranching and orchard regions on the slopes of Hualalai and Mauna Loa. The volcanic lava flows and the colors of deep off-shore water provide a further contrast for a quiet and restful atmosphere.

However, the districts of North and South Kona can now be characterized as a peaceful agricultural area undergoing a rapid transition toward urbanization. Although still basically "rural" in atmosphere, the area is experiencing a major redirection from an agricultural to a tourism economy. These changes are most evident in the immediate vicinity of the town of Kailua-Kona.

The major changes in Kona can be seen by examining the population trends. As the region rapidly developed, the major employment

shifted to construction and tourism activities, and a major new population segment developed to meet the needs. Young Caucasians from the mainland have moved into Kona in large numbers. More transient and mobile, many of these recent arrivals have social attitudes and life-styles in sharp contrast to the long-term residents of the area. The percentage of Caucasians in Kona increased from 12 percent to 44 percent between the 1960 and 1970 censuses. During the same period, there was a numerical and percentage decline in residents of Japanese and Hawaiian/Part-Hawaiian ancestry (Ref. 10). The future trends for Kona are expected to be similar, with a decreasing rate of Caucasian inmigration. By 1990, the total population for Kona is expected to reach 18,000 persons.

Three identifiable social groups in the Kona area are the elderly, the young transients, and the low income families. Among the elderly subgroups are long-time residents, recently retired and more affluent residents, and the elderly poor. Young transients in their late teens, twenties and early thirties are drawn to the Kona area by the rural atmosphere, favorable climate and their short-time commitments to the Kona life-style. Low income families are most numerous in the rural, agricultural-based portion of the population, with a significant number of welfare recipients. Each of these groups would be affected differently by new economic development, notably with respect to employment and changes in the social environment.

3. Housing

Housing problems in the Kona area are typical of the entire State. There is a large surplus, at least for the time being, of high-cost land, houses and apartments. Low-cost housing is in generally poor condition and short supply. Although a decrease in the construction of high cost

subdivisions and housing units is expected (due to the existing oversupply), low cost housing will continue to be scarce, barring new and substantial public subsidies.

The housing subdivisions around the town of Kailua-Kona have a median family average income (in constant 1969 dollars) of $12,121. The remainder of North Kona's population has an income average of $8,663 per family. A major observation is the "people living in the newer subdivision areas have higher incomes than those in more rural areas, reflecting the need to have greater amounts of money to afford the new housing" (Ref. 10).

4. Recreational Resources

Recreational resources of the Kona District have been developed in recent years to provide both the residents and the visitor industry with recreational facilities and opportunities for cultural development which rank among the finest in the State. These activities include:

a. Fishing and boating.

b. Touring, golf, hunting and camping.

c. Exploring shoreline historic sites, wildlife refuges, and marine life areas.

Charter fishing off the Kona District is excellent. The charter operations are estimated to be busy 50 to 60 percent of the year. The major limitation to expansion of this form of recreation is the present limited capacity of Honokohau Harbor, which lies 2 miles south of the NELH site. The cost of chartering a boat also limits the local population's active participation. However, fishing from boats and from shore is a favorite recreation for both the visitor and local population.

Touring by car in the lower and upper regions provides a contrasting view of Kona region's dry, warm coastline, and the cool, wet mountain areas.

Golf has become popular in the Kona District for both local and visiting golfers.

Hunting for sheep and goats and camping are popular in the mountain regions. Along the shoreline, surf casting and camping are popular with the local residents, especially those with limited economic resources.

Exploration of shoreline historical sites, wildlife refuges, and marine life areas is popular with local residents and visitors.

C. Economic Environment

1. Kona Industries

Kona presently has only three basic industries--tourism, construction, and agriculture. The heavy reliance on these limited economic sources and the fact that many of the key economic determinants are not controllable by the County governmental officials or direct citizen involvement make planning for steady and orderly growth difficult. National and international factors are much more influential. For example, tourism depends on economic trends elsewhere, and Kona agriculture (basically coffee, bananas, and macadamia nuts) depends heavily upon unpredictable changes in the world prices.

a. Tourism

Tourism is presently the dominant industry in Kona, and has the greatest potential for the future. The construction and retailing industries are closely linked to tourism. Expenditures by visitors come to a substantial sum annually, and Kona's revenue from this source was estimated

at $80 million for 1975 (Ref. 11). This revenue is projected to rise to about $130 million in 1990. These figures are only the expenditures by visitors and not the related revenue resulting from the supporting construction industry and other related employment. The number of hotel employees in Kona is expected to increase from 1,220 in 1975 to 1,835 in 1990. Construction will also be affected. Hotel rooms and other visitor units are expected to increase from 3,423 in 1975 to 5,340 in 1990, despite a current excess supply (Ref. 10). Although the visitor count in the County of Hawaii was up 2.8 percent over the first nine months of the year 1975 - to 587,000, versus 581,000 in the same 1974 period - and the average length of stay rose fractionally, the hotel occupancy was a low 60.8 percent (60.5 percent in Hilo, and 61 percent in Kona). Seventy percent is estimated as a rough break-even point for an established hotel. The drop in occupancy was a result of a large room surplus, brought about by a heavy building program, especially in Kona, over the past several years.

b. Agriculture

Kona's agricultural efforts cover a wide variety of crops due to the unique climatic conditions, topography, and soils of the district. Despite Kona's favorable conditions, factors such as Hawaii's relatively small population, distance from markets, and the cost of production, including labor, have made many agricultural crops unprofitable. Of 8,500 acres of land available for cultivation, only 4,000 are being used. Local consumption offers only a limited market for the specialty crops of the district. The most important of these, coffee, produces $1.5 million annually, 48 percent of the total revenue produced by Kona's agriculture. The coffee industry has been on a continuing decline since 1957-58 when a peak of 18,496,000 pounds valued at $6.5 million was produced. The forecasts

indicate a continued long-term decline. However, a sharp reduction in the supply from South America has recently made the coffee industry much more promising. In fact, this season's coffee production and earnings are expected to be the highest recorded for a long time.

Other promising crops are macadamia nuts and avocados. Macadamia nut production rose 14 percent in fiscal year 1975, and by 1985 macadamia output is forecasted to be about $12.5 million. Overall, the agriculture of Kona generated $3.2 million of income in 1973. By 1980, this figure is expected to rise to about $8.6 million and by 1985 to $18.4 million -- keeping in mind the possibility of drastic revisions, upward or downward, as international market conditions change.

There is a possibility of an agricultural park being developed on the open land across the highway from Ke-ahole Airport, which provides access to markets throughout the State and, via Hilo and Honolulu, to markets overseas.

c. Construction

The construction industry is strongly interrelated with tourism and other businesses. It is difficult to put a monetary value on construction in terms of the amount of non-construction jobs it provides and the number of tourists new construction attracts. Hotels, housing, roads and off-site construction are continuously in progress to keep up with the increasing demands exerted by tourists and residents. As noted above, hotel units in Kona are expected to increase from the 3,423 in 1975 to 5,340 in 1990. Office floor space in the district is projected to increase from 65,000 square feet in 1975 to 121,500 square feet in 1990. Housing demands are expected to increase as the population increases. Multi-unit housing is expected to increase by 240-270 units from 1975-1980, by 300-350 units from 1980-1985, and by 170 units from 1985-1990. Single family units are

expected to increase by 790-880 units from 1975-1980, by 875-1,025 unit from 1980-1985, and by 510 units from 1985-1990.

The jobs generated through construction and their effect on the various retailing businesses of the area will definitely be significant. In 1970, earnings by employees of the construction industry totaled approximately $9 million. The current surplus of hotel rooms and condominiums has limited further construction until occupancy rates increase substantially (Ref. 12). According to building permit figures, the first three quarters of 1975 produced private projects worth $26 million, down 50 percent from $52 million logged at the same time the previous year. State and County funded projects increased 92.4 percent, to $16.5 million, from the first three quarters of 1974 to the same time in 1975. Nevertheless, total building permit valuations for 1975's first nine months still dropped 30 percent from $60.7 million to $42.6 million from the same time in 1974.

d. Retailing and Personal Services

The level of retail and personal services in Kailua-Kona is rapidly expanding. In 1975, 530,000 square feet of retail floor space was available. By 1990, this is expected to increase to 1,200,000 square feet. The level of restaurant, retail and personal services available in the Kona area is very high in relationship to the resident population. These services are maintained by the tourism industry at a level which a normal non-tourism community could not support.

2. Work Force Characteristics

The Kona economy relies on the three industries discussed above: tourism, agriculture, and construction. All other occupations are directly or indirectly related to these industries. Recent employment trends are:

a. A decrease in agriculture and farm work paralleling the long-term decline of the local coffee industry.

b. An increase in construction industry employment from 1960 to 1970, but a significant decrease over the past year.

c. The tourism industry employs a larger percent of the Kona work force than any other industry. This situation is expected to continue.

d. A work force increase in North Kona by 25 percent in 1970 over 1960.

Table III-1 lists occupations with the number of people employed by each industry for the years 1960 and 1970. Table III-2 shows the occupation characteristics for the population of both North and South Kona in 1960 and 1970. Average wages and other earnings for major categories of Kona employment are shown for 1972, 1973 and 1974 in Table III-3.

Unemployment rates in Kona for the years 1970 to 1975 were 4.0 percent, 6.3 percent, 6.9 percent, 7.8 percent, 9.2 percent and 9.0 percent, respectively. The monthly unemployment rates in 1975 from January to November were 8.3 percent, 8.0 percent, 7.2 percent, 7.6 percent, 8.0 percent, 9.9 percent, 9.8 percent, 9.9 percent, 9.9 percent, 10.0 percent, and 10.5 percent, respectively, and the number of unemployed people in the County increased by approximately 1,000 from 1970 to 1975. This high and increasing unemployment rate is viewed with concern by State and County officials.

3. Transportation Facilities

The Kona area is served by excellent transportation facilities. The coastal Queen Kaahumanu Highway passes the NELH site and connects Kailua-Kona with the Kawaihae deep draft harbor, 25 miles north of Ke-ahole

Point. The road is a two-lane, Class I State Highway, designed for a 70-mile per hour vehicle speed. It is a limited access highway with a 300-foot right-of-way. Connections of secondary roadways to this highway require approval of the State Department of Transportation. Five miles inland at an elevation of 800 feet is the Mamalahoa Highway (State Highway No. 19) which was formerly the main road between Kailua-Kona and Kamuela. The County of Hawaii operates a bus system which offers twice-daily service between Kona and Hilo. The bus route runs along the new coastal highway and passes the NELH site.

Ke-ahole Airport is a new jet airfield, presently utilized for inter-island airline service only. It does not have the capability of directly handling overseas flights, but Honolulu and Hilo, where overseas connections are available, can be reached by air within 40 minutes. The modern facilities at the airport consist of a terminal building complex and a single runway 150 feet wide and 6,500 feet long. A second runway is planned at some future date, as determined by demand placed on the existing facilities. In order to handle direct overseas flights, the existing 6,500-foot runway will be extended to the north for a total length of 12,000 feet. Details for the future expansion of the airport can be found in the approved Ke-ahole Airport Master Plan, prepared by the Airports Division, Department of Transportation, State of Hawaii (Ref. 13). There are very long range plans (for the year 2050) which consider the possibility of a General Aviation runway eventually being constructed seaward of the two main runways. However, the official Master Plan makes no reference to this runway.

Kawaihae Harbor, 25 miles north of the project site, has a 40-foot deep entrance channel and a 35-foot deep harbor basin with an area of 53.8 acres. The new harbor provides the only port facilities for deep draft vessels on the west side of the island. During the four-year period 1968-1971, Kawaihae handled an average of 336,223 short tons of cargo per year.

4. Public Utilities

Kona has an above average growth rate of electrical demand. The Hawaii Electric Light Company (HELCO), is the only public utility franchised to provide electrical energy on the Island of Hawaii. Its main generating facilities are located in Hilo, with several minor plants at locations around the island. HELCO generates its electricity by the use of oil-fired steam generators. In addition, three sugar companies supply electricity to the island power system with power generated by the burning of sugarcane waste (bagasse). Approximately 30 percent of HELCO's power comes from the sugar companies. The Kona substations have a capacity of 21.1 MW. Island-wide capacity is 124 MW with present peak demand for the entire island of 72 MW.

A 69 KV overhead transmission line is located 50 feet east of the main highway along the Kona coast. This line runs between Kailua-Kona and Waimea and connects to the major generating facilities in Hilo. A substation at Kailua-Kona, east of the main airport access road, reduces the line voltage to 12.47 KV and provides power to the airport complex at this voltage.

The Department of Water Supply, County of Hawaii, has installed a 12-inch ductile iron water line along the eastern boundary of

the main coastal highway. This system is supplied by a series of deep water wells located above Kailua-Kona. The main purpose of this line is to service the Ke-ahole Airport area and little additional capacity is available for the NELH site. The Department of Water Supply has indicated that the maximum service presently available to the NELH site would amount to fifteen gallons per minute through a 2-1/2-inch connection. The County expects to increase the supply capability of this line by April, 1977, which would allow the connection of an 8-inch service lateral. The available service at that time would be increased to 1,500 gallons per minute. To provide fire protection for the airport, a 500,000-gallon storage reservoir was constructed at an elevation of 280 feet above the airport complex and a 12-inch main was installed from the reservoir to service the airport building areas.

There are no municipal sewer facilities available within the Ke-ahole area. Although a sewer collection system along the highway is proposed in the North Kona Sewerage Master Plan, the construction of this network is not anticipated for 20 to 30 years. A 40,000 gallon per day secondary sewage treatment plant is located on the north side of the airport building complex. This facility treats the domestic sewage from the airport operations and is presently used to only one-quarter capacity.

TABLE III-1

INDUSTRY EMPLOYMENT CHARACTERISTICS
(Ref. 10)

	North Kona		South Kona	
	1960 #	1970 #	1960 #	1970 #
Construction	92	454	170	306
Manufacturing	76	54	62	48
Transportation	28	115	8	29
Communications	16	63	8	14
Wholesale	27	20	16	31
Retail	153	252	126	134
Finance, Insurance, and Real Estate		76		53
Business and Repair Service	19	55	4	24
Personal Services	275	414	69	245
Health Services	20	19	4	76
Educational Services	70	87	104	130
Other Professional and Related Services	41	44	4	69
Public Administration	48	80	24	55
Agriculture	545	141	904	192
Other	131	512	815	94
TOTAL	1,541	2,386	2,318	1,500

Sources: U. S. Bureau of Census, Census of Population, 1960, 1970.

TABLE III-2

OCCUPATIONAL CHARACTERISTICS
(Ref. 10)

	North Kona			South Kona		
	1960 %	1970 %	Difference	1960 %	1970 %	Difference
Professional & Technical Workers	7.5	8.5	+ 1.0	5.8	10.7	+ 4.9
Managers & Administrators	7.3	4.2	- 3.1	4.2	5.7	+ 1.5
Sales Workers	4.0	5.5	+ 1.5	3.9	4.9	+ 1.0
Clerical	4.7	16.6	+11.9	3.6	10.8	+ 7.2
Craftsmen	9.4	19.9	+10.5	6.3	18.5	+12.2
Operatives & Transportation	7.2	11.1	+ 3.9	6.6	6.5	- .1
Laborers	4.7	4.9	+ .2	6.0	14.1	+ 8.1
Farm Workers	36.5	7.3	-29.2	58.0	12.8	-45.2
Service Workers	15.6	18.6	+ 3.0	3.5	14.5	+11.0
Private Household Workers	3.1	.6	- 2.5	1.0	1.5	+ .5
	100.0	100.0		100.0	100.0	

Source: U. S. Bureau of Census, Census of Population, 1960, 1970.

TABLE III-3

WAGES OF MAJOR
KONA EMPLOYMENT CLASSIFICATIONS
(Ref. 10)

	Annual Income 1972	Weekly Incomes			Weekly Income Increase 1972-74
	1972	1972	1973	1974	
	$	$	$	$	%
Hotels	6,159	80.35	88.13	97.77	21.6
Construction	11,839	243.54	257.04	284.95	17.0
Retail Trade	4,993	91.08	99.21	100.52*	10.3
Non-Agricultural Private Employment	7,402	N/A	N/A	N/A	
Consumer Price Index Increase					19.1

*Estimated

Source: Records of State of Hawaii, Department of Labor and Industrial Relations.

IV. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES, AND CONTROLS FOR THE AFFECTED AREA

The proposed Natural Energy Laboratory site is presently owned by the State of Hawaii, with the property being administered by the Airports Division, Department of Transportation. The State of Hawaii Land Use Plan has designated the entire area as "Conservation." State Department of Health has designated the offshore waters as Class "AA." The County of Hawaii General Plan has designated the area as "Open." Under the new Shoreline Protection Act, effective December 1, 1975, the area between the shoreline and Queen Kaahumanu Highway is defined as a "Special Management Area" administered by the County.

Prior to any major development at this site, it will be required that the State of Hawaii reclassify this land as "Urban" and that the County of Hawaii rezone the site to "Industrial." These rezoning processes have been agreed to by the Department of Transportation and the NELH. The Department of Transportation is proceeding with requests to the appropriate State and County agencies for the required zoning changes.

V. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

A. Primary Impacts

1. Impacts on Physical Environment

a. Land Use

Construction of the Phase I NELH facilities will involve grading for the road, utility corridors, and the central utility terminus. This construction will result in a change in the land use from natural to improved land, particularly with regard to vegetation and wildlife.

Initially, the access road will be approximately 40 feet wide and 10,700 feet long, with an area of 10.5 acres. Eventually, the full 170-foot right-of-way may be cleared as the road is widened and utilities added alongside the road. This will result in the use of an additional 33.5 acres. The 20-foot wide utility corridors to the NELH site will require an additional 2.3 acres of land. The central utility terminus will have an area of 13,650 square feet, or 0.3 acres. In the event of project termination, which is not expected to occur, the site will be restored, as far as possible, to its natural condition. This restoration would primarily consist of removal of the central utility terminus. The utility lines will be underground, and will not be removed. The road will remain as an access route to the shoreline. The road and the utility corridor will be the only visual reminders of the project.

b. Vegetation

The construction areas in the rights-of-way for the road and the utility corridors will be cleared of vegetation in the old lava zone where vegetation is composed mainly of grasses and herbs. No trees are known to be in the areas that would be cleared. A certain small amount of

natural vegetation will be destroyed; however, the environmental effects are expected to be minimal. No endangered plant species were found or are known to exist in the area (Ref. 6).

c. Wildlife

Due to the small number of birds present in the area, and the availability of other open land nearby, the possible loss of bird nesting areas and animal habitats to site development will have a minimal impact. The endangered Hawaiian stilt, assumed to fly over the area, should not be affected. Its only interest in the area is probably the small brackish ponds which will be avoided in planning the NELH facilities. The three brackish ponds of interest are described in detail in a study by Maciolek and Brock entitled "Kona Coastal Ponds" (Ref. 14). These are located near the southwest edge of the 1801 lava flow in the vicinity of the boundary of the areas designated as Administrative and OTEC in the NELH Master Plan (Figure II-3). Although the ponds will not be affected by NELH construction activities, they will be more accessible should the area be open for recreational uses. The ponds are not listed as having "high natural value"; however, adverse impacts may be reduced by limiting access to the ponds. Feral goats were present and were hunted before the construction of the Ke-ahole Airport but have reportedly diminished since then. They are expected to continue to diminish as activity increases around the area. The endangered Hawaiian hoary bat, also expected to be found in the area feeding on insects in the air, would be virtually unaffected by this development.

d. Archaeology

The NELH site is essentially undeveloped, the only recent structure being the USCG lighthouse at Ke-ahole Point and the nearby foundation of the former lighthouse keeper's residence. Access is limited to an unimproved jeep trail.

The proposed route of the NELH access road will cross the remains of the historic Mamalahoa Trail 2,300 feet seaward of the main highway. There is no option for avoiding the trail, as all three route alternatives cross it. The impacts should be insignificant, considering the fact that just to the north the Ke-ahole Airport runways have obliterated large sections of the trail.

There are at least 14 known archaeological sites of minor significance in the area. These are located primarily along the shoreline. Presently only 2 of the 14 sites, Localities 4 and 11, remain with "sufficient still undisturbed material to justify test and/or salvage excavations." The archaeological reconnaissance completed as a part of the EIS preparation has located the known sites well enough to permit their avoidance, where possible, during development of the NELH. Where avoidance is not practicable, additional archaeological surveys will be conducted to determine the proper site disposition. The proposed utility corridors and central utility terminus are not in the vicinity of the known archaeological sites. The general alignment of the access road is determined by present airport operations and the proposed future runway and its associated clear zone. However, there is enough leeway to allow routing of the road around the known archaeological sites.

The proposed project will have a probable adverse impact on the archaeological sites due to increased human activity in the area. Disturbance and looting of sites can be expected and is already occurring. This is expected to continue with or without the construction of the NELH. As a result of the development of the NELH, the two potentially valuable sites (4 and 11) may be recognized and preserved. Precautions will

be taken to ensure that all contractors are alert to the possibility of encountering sites of archaeological interest and that such finds are examined by archaeologists before construction activity disturbs them.

e. Drainage

The NELH site is nearly level with no significant drainage channels in the area. The annual rainfall is approximately 20 inches (Ref. 10) and the highly permeable lava allows most storm rainfall to percolate into the ground. There is no record of flooding in the area (Ref. 10). It is apparent from the high permeability of the land, the low annual rainfall and the small scale of the development as compared to the surrounding open areas, that the facilities will not cause drainage problems. This is further supported by the much larger development of the adjacent Ke-ahole Airport which has not experienced any flooding or drainage problems.

f. Air Quality

Construction activities are expected to have some local and temporary adverse effects on air quality. Dust may be generated by the construction activities. However, due to the lack of any nearby residential or commercial areas and the generally light winds, it should not be a problem. Exhaust fumes from construction equipment should not create any significant problem. Odor control will be provided for sewage in the wet well prior to pumping.

No pollutants will be discharged into the atmosphere by the operation of the Phase I facilities, and there will be no effect on air quality. In light of the existing inversion characteristics of the Kona area atmosphere, future projects will be carefully analyzed in the EIS's for possible impacts on air quality.

g. Noise

Construction activities will generate a certain amount of noise. No blasting is planned; however, if exceptionally hard basaltic rock is encountered, some blasting may be necessary. As mentioned previously, there are no residential or commercial activities within 5,000 feet of the site that would be affected by noise. The nearby jet aircraft activity at Ke-ahole Airport results in higher on-site noise levels than most of the construction equipment to be used. Therefore, the additional noise from construction activities will not significantly affect the existing environment. Noise levels during operation of the NELH Phase I facilities will be negligible.

h. Aesthetics

The aesthetic effects will be significant. The construction activities and equipment will be visually obtrusive compared to the natural untouched land. This disturbance will diminish after construction is completed. Remaining, however, will be the adverse aesthetic impact of an access road through natural lava fields, and the central utility terminus.

i. Site Access

The completion and opening of the NELH access road will have significant impacts on the area. Recreational resources will be more accessible thereby increasing human activities in the area. While this increased use of recreational resources will be of overall benefit, some degradation of the area's natural environment is inevitable with this increased human activity. The minor wildlife activity at the site will probably diminish further as human activity increases. A potential impact of concern is the possible degradation of the small brackish ponds just north of the Point which are considered environmentally sensitive areas (Ref. 6).

3. Social Impacts

a. Impacts Upon Recreational Resources

One impact of NELH site development will be the opening up of Ke-ahole Point for recreational use. The development of access roads to potential recreational areas is in keeping with the recommendations of the Kona Community Development Plan (Ref. 10). The access road will parallel the coastline for approximately 3,000 feet, providing accessibility to an essentially unlimited length of coastline. It is the intent of the NELH and the County of Hawaii that the public will have access to all of the shoreline at Ke-ahole Point. The only possible exception to this would be areas that required restriction for purposes of public safety, for example, those which might contain exposed machinery or pipelines. The Phase I development of the NELH, described in this EIS, will result in no such restrictions. Future projects are still in the conceptual stage; however, any which might lead to restriction of shoreline access would be the subject of an EIS.

Improved fishing, hiking, diving, and exploration of shoreline historical sites are benefits of the improved access to the shoreline recreation areas. These opportunities will be available to local residents and to the visitor industry. The inevitable presence of additional litter and other evidences of human activity will be an adverse effect, but is outweighed by the increased potential for recreational use. A State-owned bikeway and hiking trail which would traverse the nearshore areas from the town of Kailua-Kona to Anaeho'omalu Bay has been proposed. If built, the trail would probably cross the NELH site; however, there should be no major conflict with the proposed Phase I facilities or future NELH projects. The NELH road would provide an additional access point for the trail.

b. Impacts on Population and Neighborhood Character

The initial NELH facilities are small enough in scale, both in physical size and in the number of personnel to be employed, that they will not noticeably affect the character or population of the Kona area. A construction effort costing approximately $800,000 will be required to build the Phase I facilities. This construction can be accomplished with resources of personnel and equipment from the Kona area. No major immigration of construction workers is expected.

Due to the limited staff requirements, the completed Phase I NELH facility will have negligible impact on population, age characteristics or ethnic mixture in Kona. Consequently, there will be no effect on the Kona character, the visitor industry, or public facilities such as schools.

4. Economic Impacts

a. General

Phase I NELH facilities require the initial expenditure of capital for the construction of a two-mile long, two-lane access road from the coastal highway and supporting utilities. Operation and maintenance costs of related Phase I activities will be minor because of the small scale of the initial facilities. Also, work at the NELH will be of an intermittent nature until the first of the major projects is established at the site.

A project of this size is not expected to have any significant impact on Kona's economy with the exception of the construction industry which will be affected for the 5- to 6-month construction period. Tourism and agriculture will not be affected. Retail organizations and businesses will also not be affected significantly by the development of the initial NELH facilities. Possible impacts on various sectors of the economy are discussed in more detail below.

b. Construction Industry

Building and road construction will provide local contractors and laborers with employment opportunities. Installation of utilities will require the services of local contractors. Local material suppliers will also benefit from the project. Although the project is not very large in comparison to other construction programs in the Kona area (less than 1 million dollars), it will provide some opportunity for the construction industry.

c. Tourism

Tourism, presently Kona's largest economic industry, will not be affected during the NELH construction, which will be confined to NELH site and the access road. After construction, the road will provide public access to archaeological sites, scenic coastline views, and shoreline recreation areas. Any additions or improvements to the existing Kona recreational opportunities are indirectly beneficial to the tourism industry. The opening of Ke-ahole Point coastline to the public falls into this category, but it is probably not of sufficient scale to stimulate additional tourism to Kona.

d. Agriculture

The economic impact of the Natural Energy Laboratory on agriculture will be negligible since the area of the project site is not zoned as agricultural and is lava with no unique agricultural potential. The beneficial effects can also be considered negligible, as there is no direct or indirect relationship between agriculture and the Phase I NELH activities.

e. Airport Development and Operations

The utilization of the area west of the airport's Building Restriction Line for the Natural Energy Laboratory of Hawaii will not interfere

with the proposed future expansion of the airport. Two modes of expansion are planned for the airport as the need arises. The existing runway can be lengthened to the north, and a second runway can be built to the west. The Phase I NELH facilities will be compatible with these possible future expansions.

Aircraft noise levels at the NELH site are not a problem due to the 2,300-foot distance from the runway. However, if a second runway is constructed, the sound source will move to within 960 feet of the site, extending the 85dB(A) noise contour almost to the site. The determination of noise effects is complex,but as a simplification, the 85 dB(A) level is considered the borderline between tolerable and intolerable noise. The NELH site is beyond the 85 dB(A) contour; however, even noise levels approaching 85 dB(A) may be undesirable for certain projects. Future major projects at the NELH whose life span may coincide with the operation of a second runway may choose to alleviate the higher noise levels.

Several relief measures can be taken, including:

(1) Locating buildings away from the eastern boundary of the NELH site,

(2) Planting trees or hedges as noise breaks,

(3) Designing the buildings for noise reduction.

Building heights at Ke-ahole Point are limited by FAA defined aircraft approach zones. The allowable height at the Building Restriction Line (Figure II-3) is 90 feet above mean sea level, or approximately 60 feet above the existing ground. Moving seaward from the Building Restriction Line, the allowable structure height increases 1 foot for every 7 feet of horizontal travel.

The airport is operating below capacity and any expansion is expected to take place in the distant future. The initial NELH development will not result in any significant increase in the use of Ke-ahole Airport, as the additional use by laboratory personnel will be minimal in comparison to the present level of activity.

The NELH development will not compromise FAA or DOT security or safety requirements for the airport. No electronic "noise" that could interfere with airport operations will be generated by the Phase I facilities. The airport perimeter security fence will not be affected by the project. With completion of the access road, more people will utilize the Ke-ahole Point shoreline area, but will be separated from the airport by the fence and the rough lava terrain. The distance from the NELH boundary to the airport fence is approximately 2,150 feet. The routing of the water and sewage lines around the runway will avoid airport lighting systems and power cables.

f. Shipping and Transportation Activities

Present shipping and transportation capabilities are more than adequate to accommodate the NELH's requirement, especially since the completion of the coastal Queen Kaahumanu Highway and the deep water port at Kawaihae. No additional improvements will be necessary. The initial development will not require much additional transportation or shipping activity and will have little economic impact on this industry.

g. Employment

Employment will not be affected in the Kona area after completion of the initial NELH development for the facility will be minimal until the first major project begins. Employment will increase temporarily during the construction phase, but not significantly.

h. Taxes

Tax monies should slightly increase at all levels of government through the economic activities of the NELH personnel and facilities. However, since the initial development is small and personnel requirements are minimal, the change in tax revenues will be insignificant.

B. Secondary Impacts

As discussed above, the main impacts of the Phase I NELH development would be generated during the construction phase. The proposed facilities are for the support of future energy research projects and will have very limited operational impacts.

However, there are significant secondary impacts of the Phase I NELH development. Completion of Phase I improvements is the first step toward NELH becoming a viable research and development institution. The existence and availability of such a unique site will attract and stimulate future energy research programs.

At this time, several alternate energy research projects are being considered for Ke-ahole Point. These projects fall into three general groups: land based test OTEC facility and large operational floating OTEC facility; solar energy research; and, aquaculture/biomass research projects. Specific impacts of the projects cannot be assessed until more detailed plans for the projects exist. The various projects and preliminary discussions of their impacts are included in Appendix A. Each significant research project will

have its own set of impacts which must be assessed before construction is permitted.

Some estimates of the secondary impacts can be based upon the projections of utility demand and personnel requirements for 1990, given previously in Table II-2. The Phase I facilities are designed to supply utility demand through 1990.

Approximately 75 people will be working at NELH in 1990, compared to the estimated 1990 Kona workforce of 7,300 (Ref. 10). Many of the job openings will be filled by highly trained specialists, who may not be available in the resident population. There should be some demand for skilled technicians and office workers, providing some diversification of the present limited Kona employment opportunities. However, the relatively small number of additional jobs will not have a significant impact on the Kona economy.

Construction of the major research projects should have a short-term effect on the local construction industry. Project components may be manufactured elsewhere; however, jobs will be generated by site preparation, assembly of components, construction of the buildings, and installation of the utilities. Construction of the intake and discharge outfalls for the land-based OTEC pilot plant may require a large marine construction effort.

Future projects must be analyzed with respect to their possible effects upon airport operations. Items to be considered include FAA height restrictions, visual interference, interruption of communications and the attraction of birds to the area. These problems are not insurmountable and will be taken into account in the design of future projects. Future NELH projects will have to be approved by the Federal Aviation Administration

and the State Department of Transportation to insure that the safety of airport operations is not compromised.

Future energy programs at Ke-ahole have the possibility of contributing to the area's economic potential. The creation of a major research center at Ke-ahole might encourage the development of related ("spin-off") industries in the region. In conjunction with the astronomical research at the nearby Mauna Kea Observatory, Kona could become a major research center for the Pacific. This possibility is in keeping with the recommendations of the Kona Community Development Plan (Ref. 10) for the establishment of "clean" industries in Kona. An indirect, long-term effect of the NELH could be the reduction of agricultural production costs, via cheaper energy from the NELH projects.

If initiated and successful, the energy research programs offer the opportunity for expansion of the NELH into a deep ocean research institute (Ref. 15). Such an institute would provide valuable research opportunities. This institute could also serve as a center for field work in oceanography and other marine sciences. The NELH and its associated projects are environmentally "clean" and would provide ocean-oriented jobs that should appeal to the Kona labor force. Most important, each project undertaken at NELH offers the possibility of reducing both the State and United States dependence on imported oil.

In summary, it is not anticipated at this time that any of the future NELH activities would overload the Kona public services or bring about an in-migration that could not be readily assimilated into the present Kona community. The physical impacts of future projects appear to be the ones that will require the most careful study. Future project details will allow an evaluation of these impacts in each project's Environmental Impact Statement.

VI. UNAVOIDABLE ADVERSE EFFECTS AND MITIGATION MEASURES TO MINIMIZE SUCH IMPACTS

The environmental impacts of the Phase I NELH development are believed minimal, due to the small scale of the project. However, there are some unavoidable adverse effects which will be mitigated by appropriate measures.

The Phase I development will result in an initial loss of 10 acres of sparse natural vegetation and wildlife habitat due to clearing and construction of the proposed access road. The right-of-way for the access road is 170 feet wide, and eventual clearance of the entire width would result in the loss of an additional 33.5 acres of vegetation. Clearing and trenching for the 20-foot wide utility corridors will result in the loss of 2.3 acres of vegetation. However, as the utility lines will be placed underground, the vegetation will reestablish itself.

The adverse effects of this loss of natural land and its associated vegetation and wildlife habitats are minimized by choosing the shortest practicable route, while keeping in mind the other environmental criteria such as minimum impact on the archaeology and aesthetics of the area. The site access road and utility improvements provided for in the Phase I development will be located to avoid the beach zone, with its more diverse plant life, and the three small brackish ponds.

The presence of the site access road and the Phase I utility network will cause an unavoidable adverse impact on the aesthetics of the natural untouched land. The adverse impact can be mitigated by considering aesthetic factors in the site structure design. Planned mitigation measures include:

1. Limitation of construction activity to the minimum essential to the NELH functions.

2. Construction of attractive, color-coordinated structures with continuity of design.

3. Landscaping around structures and access roads.

4. Adequate open spaces around structures.

5. Underground utilities to avoid a cluttered appearance.

6. Keeping the scale of the buildings such that they blend into the Ke-ahole environs. Heights are limited by FAA requirements as discussed in Chapter V. In addition, structure heights in certain sections of the NELH site may be limited by the requirement to keep the Ke-ahole Lighthouse beam unobstructed to seaward.

7. Rigorous control of construction activity to minimize permanent effects at the site.

Increased activity at Ke-ahole Point will result in some unavoidable degradation of the archaeological sites. Most areas of archaeological significance lie along the coast and for a short distance inland. Site development has been planned to avoid these areas. Any potential significant sites affected by the development will be intensively surveyed to determine their significance and for possible salvage value.

VII. ALTERNATIVES TO THE PROPOSED ACTION

A. No Action

No action on the proposed NELH development would be a major obstacle to research and development of alternate energy systems for Hawaii and the United States. No action would also tend to perpetuate Hawaii's dependence on imported fossil fuels. In addition, the development of a desirable scientific center in the Kona area consistent with State and County planning for the area would not be realized. Lack of such a research site with its unique physical characteristics would place Hawaii at a disadvantage in competition with other mainland locations for energy research projects. No action would also continue the restricted public access to the attractive shoreline site and would deny the construction and employment industry the resulting small but much needed boost.

B. Postpone Action Pending Further Study

There are several reasons why further study is not warranted for the Phase I improvements:

1. The Phase I developments have been well defined in the Master Plan (Ref. 5). Site investigations have confirmed the desirability of the site for the planned natural energy projects.

2. The adverse environmental impacts of the project are believed minimal.

3. Postponement of the project could result in potentially beneficial energy research projects being located elsewhere in the U. S.

C. Alternative Site Locations

Eight locations on the Island of Hawaii and one on Oahu (Barbers Point) were considered as possible sites for alternate energy and aquaculture programs. The site selection factors and the evaluation of potential sites

on the Island of Hawaii are shown in Table VII-1. The 1972 survey (Ref. 15) selected Ke-ahole Point as by far the most suitable of the alternatives on Hawaii. Barbers Point on Oahu was considered because of its proximity to an industrial park that could utilize power generated by the project. Disadvantages of the site that led to its non-selection included: non-availability of State land, a relatively great distance to deep water, and the predominant rough sea conditions.

Ke-ahole is particularly well suited for the OTEC projects, which will be the primary research projects at the NELH. Deep cold water is closer to shore than at other feasible sites in the United States. The temperature gradient between the warm surface waters and cold deep waters is ideal for development of the OTEC program. The leeward waters off Ke-ahole Point are protected from the persistent tradewinds and resulting rough seas. In addition, three submarine canyons offer the possibility of protection for offshore pipelines.

Choosing a site other than Ke-ahole Point would lead to several problems. A change in NELH location at this time would negate much preliminary work that has been completed, such as the site selection report (Ref. 15), the studies of OTEC impacts on Ke-ahole Point waters and the Kona economy (Refs. 2 and 3), the Master Plan for the Phase I development (Ref. 5), and the initial environmental assessment (Ref. 16). The majority of this work is site specific to Ke-ahole and not applicable elsewhere. Hawaii is actively competing with several other states to attract major energy research projects and a location change in NELH to a less desirable site would be a severe setback to these efforts. With approximately $610,000 committed so far to NELH related projects at Ke-ahole, government agencies would be unlikely to support a change in site location and the momentum gained to date would be lost.

D. Multiple Sites

Another alternative to the proposed action is to locate each of the major research projects at separate sites, with each site chosen specifically for a particular project. However, several of the projects proposed for the NELH are closely related and also dependent upon the OTEC project. These projects include biomass conversion, aquaculture, and mariculture which may make use of the deep, nutrient rich waters brought to the surface by the OTEC programs.

Moving the OTEC program is not feasible - as discussed previously in this chapter, there are few suitable sites, and Ke-ahole Point was selected as far superior to the others (Ref. 15). Because of the inter-relationship with OTEC, the biomass conversion, aquaculture and mariculture projects should remain at the same site.

The solar energy projects are therefore the only possible candidates for movement to a different location. There are two reasons why such a move would lead to a greater environmental impact, instead of a lesser one. First, the primary impact of the solar energy projects is anticipated to be its utilization of flat land. Such land is scarce in Hawaii, and generally in great demand. However, it would be difficult to identify another area where the impact of land use would be as slight as at the Ke-ahole lava fields. Secondly, use of a second site would necessitate the construction of a second set of support facilities, possibly including another access road (depending on the site), with the attendant environmental impacts.

E. Design Alternatives at the NELH Site

Several alternatives for site access and utilities were considered for the Phase I development. The recommended choices were described in Chapter II of this EIS. The other alternatives are described below.

1. Site Access

The existing rough jeep trail to the site is almost impassable, and obviously inadequate for the NELH development. The proposed improved roadway section is 24 feet wide, with crushed rock and oil sealer. Asphalt paving will not be provided until later phases of the project.

The only reasonable road access to the site is a connection to the main highway. The three alternative routes were examined for this roadway and are shown in Figure II-3. The recommended route, Alternate 1, is the shortest of the three routes. It begins 1,200 feet north of the airport's southern boundary, travels roughly parallel with this boundary, turns into the project site, then runs along the Building Restriction Line at the project site. Alternative 2 would begin at the southern property line, run parallel with the property line until 300 feet from the shoreline, take a right turn, run parallel with the shoreline until inside the Building Restriction Line and again terminate along this line. The beginning of this alternate would require special approval from the Department of Transportation since there is no access permitted at this point on the "limited access" highway. Alternative 3 is similar to Alternative 2, however, it continues closer to the shoreline before turning right and running into the project site.

The environmental considerations for the three routes are basically the same, and the impacts are described in Chapter III. Alternate 1 was chosen for economic reasons (the shortest, most economical route) and because access to Queen Kaahumanu Highway is permitted at the proposed intersection. In addition, the shortest route will have slightly less impact upon the environment.

2. Utilities

The projected utility demand for NELH was shown earlier in Table II-3. Due to the relatively small demands, the utility systems are designed for the peak 1990 demand. This approach is the most economical and the environmental stresses from construction activities will occur only once.

There are three basic options for providing utility service to the Ke-ahole site: bring the service in from Queen Kaahumanu Highway, connect to the Ke-ahole Airport system, or provide an on-site utility capability.

Bringing the utilities in from outside requires a utility corridor as described in Chapter II. Connecting the utilities to the Airport systems instead of at the main highway reduces the lengths of the installations by approximately one-half, and results in significant cost savings. For either of these alternatives, the environmental considerations were the same, therefore cost became a determining factor and the long connection of utilities to the main highway was eliminated from further consideration.

a. Sewage Disposal Options

The two choices for sewage disposal were on-site treatment and disposal or transmission of raw sewage to the airport secondary treatment plant for treatment and disposal in the existing system. On-site disposal at the NELH site would be difficult. The adjacent ocean waters are Class "AA," and discharge of secondary treated effluent into the coastal waters would not be permitted. Deep well injection is not permitted until an "affirmative demonstration" is performed to show the Department of Health that no adverse effects will occur in nearshore waters. This usually requires the

injection of dye into deep wells at the proposed site and then monitoring to determine if there is any seepage into the ocean.

Irrigation with secondary effluent is an acceptable method of disposal, although care must be taken with health considerations (the area should not be used for recreational or agricultural purposes). The treated secondary effluent would be sprayed over a landscaped area instead of discharged into the nearshore waters. For the ultimate flow rate of 12,000 GPD, a disposal area of one acre should be set aside. This could possibly be installed as landscaped planter areas around the NELH site.

The other possibility for on-site disposal is tertiary treatment, which is expensive to construct and maintain, followed by injection well disposal.

Disadvantages of on-site disposal are high cost and the possibility of some environmental degradation, while providing no environmental or economic advantage over connection into the airport system. Connection to the existing airport system was chosen as the most advantageous method.

b. Water Supply

An on-site water supply capability could be provided for NELH by a desalinization plant. Such a system would have no environmental advantages at the site, but it would be beneficial in that no water supply corridor would be required. However, the sewer corridor would still be required.

Advantages of on-site desalinization would be self-sufficiency for the facility and also the fact that the NELH would not place a demand on Kona water supplies. The NELH demand, however, is negligible compared to total water use in the region. Disadvantages

include the land required for the plant at the NELH site, the problems of brine disposal, the power required for plant operation, and the aesthetic effects of a desalinization plant as compared to an underground water line.

Connection into the Airport water system is the selected alternative because of its advantages in regard to aesthetic, environmental, and economic considerations.

c. Electrical

The selected electrical supply alternative will connect to the airport substation, with a separate metering service. On-site generation of electrical power by diesel generators was rejected for economic reasons, lack of resultant environmental benefits, noisy exhaust, and inefficient electrical generation. Installation costs of the two systems were approximately the same, but the cost of on-site generation was $0.15/ kilowatt hour vs. $0.06/kilowatt hour for HELCO power.

d. Central Utility Terminus and Utility Corridors

It was decided to terminate the utilities at a central location, primarily because of the interdependence of the utility systems. A central location also simplifies maintenance and security requirements. The choice of location was based on the following considerations:

(1) The terminus location should not limit the development options of the site;

(2) the sewage lift station must be positioned such that its elevation and location allow a reasonable flow collection network to be installed at some future date, and;

(3) the terminus should not be in an environmentally significant area.

With these criteria, the choice of locations was limited. The selected site is shown in Figure II-3.

With both ends of the utility corridors fixed, there were few alternatives for the corridor alignments. The shortest possible routes were chosen, for purposes of economy and minimal environmental impact. The sewer and water lines are routed around the runway because trenching across the runway was unacceptable to the Department of Transportation, Airports Division.

The utility lines will be underground. Properly installed, the environmental effects will be minor as vegetation displaced by the initial construction will eventually regenerate.

TABLE VII-1

EVALUATION OF POTENTIAL SITES FOR AN AQUACULTURE AND ENERGY PILOT OPERATION ON THE ISLAND OF HAWAII
(Ref. 15)

	Hilo	Leleiwi	Puna	Honuapo	Pahoehoe Ranch	Ke-ahole Point	Kawaihae	N. Kohala
Major Factors (0-10 points)								
1. Deep-Ocean Water	0	8	8	8	10	10	0	0
2. Climate	0	0	0	5	5	10	10	5
3. Pipeline Protection	10	2	2	2	8	8	8	5
4. Suitability of Land	10	8	6	10	3	10	8	10
5. Transportation, Services, etc.	10	5	3	3	3	8	8	7
TOTAL, MAJOR FACTORS	30	23	19	28	29	46	34	27
Minor Factors (0-5 points)								
6. Geothermal Potential	0	0	5	3	0	5	0	0
7. Power Plant	3	0	0	5	0	0	0	5
8. Expansion Potential	3	4	5	3	0	5	4	5
9. Existing Facilities	4	0	0	1	2	0	0	1
10. Security from Lava Flows	3	4	0	2	1	2	4	5
TOTAL, MINOR FACTORS	13	8	10	14	3	12	8	16
TOTAL, ALL FACTORS	43	31	29	42	32	58	42	43
RATING	2	5	6	3	4	1	3	2

VIII. THE RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Development of the NELH Phase I facilities will probably incur negligible short-term losses compared with the potential long-term gains. Short-term adverse effects are directly related to the construction of the two-lane access road and underground utilities across undisturbed lava fields to a little used shoreline area. Adverse effects include some loss of wildlife habitats and vegetation, and some degradation of the minor archaeological sites along the shoreline. These are balanced by a significant gain; access to the Ke-ahole shoreline for recreational purposes.

Construction of the Phase I facilities will commit the land area, with the exception of the recreational shoreline, to scientific use. It will not, however, foreclose future planning options. Each proposed research project will be judged on its own merits, with an EIS for each being prepared, and unacceptable projects will be rejected.

The primary long-term effect of NELH Phase I development will be its tendency to attract future energy research projects of State and National significance to Ke-ahole. Hawaii is presently engaged in active competition with other states to attract alternate energy research projects, particularly offshore thermal energy conversion (OTEC) projects. The Ke-ahole location has natural physical advantages. The presence of the proposed NELH facility will be another strong advantage. There is a definite possibility of the NELH becoming a major, internationally known center for alternate energy research. This proposed development holds the promise of decreasing Hawaii's, and possibly the rest of the world's, dependence on imported fossil fuels. The projects proposed for Ke-ahole are in the category of "clean" scientific industry. Development of a scientific center in Kona reflects the local community's development plan to support this type of activity.

IX. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Construction of the NELH Phase I facilities will irreversibly commit 43.5 acres of undisturbed land to the development of the access road, central utility terminus, and the utility corridor. This action also commits the resources of manpower, energy, materials, and finances ($800,000) necessary to complete Phase I of the NELH, as well as the time and energy needed to develop the research center.

The 240-acre site will be committed to scientific research purposes. However, the future projects are anticipated to occupy only a small fraction of the available site acreage. Many will probably be of temporary construction so that they can be easily removed when no longer required.

X. INTERESTS AND CONSIDERATIONS OF GOVERNMENTAL POLICIES OFFSETTING THE ADVERSE EFFECTS OF THE PROPOSED ACTION

The U. S. has urgent national requirements for the development of energy alternatives to fossil fuels. This urgency is accentuated in Hawaii, because of the almost complete dependence on imported oil and because of the abundance of potential alternate energy sources. The State has recognized these possibilities and has moved aggressively to develop its natural energy resources. The recent oil crisis of 1974 greatly accelerated the need for the development of alternative energy sources.

The State Legislative authorized the establishment of the NELH, as described in Chapter II. The laboratory is presently under the direction, and has the support, of the State, County, and University of Hawaii. Planning funds for the NELH were provided by the 1974 State Legislature and matched on a dollar basis by the County of Hawaii.

The Kona Community Development Plan (Ref.10), completed in 1975, presents a comprehensive assessment of the current, forecasted and planned Kona District community. It places emphasis upon the three basic Kona industries of tourism, construction and agriculture and the need to preserve the "Kona life style." The plan endorses the multiple values to the community in the establishment of the NELH at Ke-ahole. These values include a much needed contribution to the construction industry, an attractive "clean" industry, national recognition and potential employment opportunities. Further, the plan recommended that the County:

A. Encourage and work with the State to provide lands at economically feasible leases in the area around the airport for aquaculture ventures.

B. Encourage a Sea Grant Study of the possible use of existing coastal ponds for mariculture ventures.

C. Make the land use changes necessary to facilitate the proposed energy study. (At Ke-ahole Point.)

D. Encourage the development of educational and informational programs in conjunction with any energy facility laboratory to ensure the maximum exposure to the Kona residents and visitors.

The County of Hawaii has expressed its interest in making such programs a major part of its economic future and has shared the cost of funding the NELH facilities with the State. Also the County of Hawaii has within its governmental structure a Department of Research and Development which has aided the development of the national and international astronomical observatories on the Mauna Kea volcano rim and the accelerated exploration for geothermal power on the slopes of Kilauea.

The funds committed so far to energy related research in Hawaii demonstrate that the State and Federal Governments have a deep commitment to developing alternative energy resources. During the years 1973 and 1974 over $2.5 million was funded for projects in Hawaii on natural energy systems (Ref. 17). Half the amount was Federal support, but over $1.0 million of State funding was involved, with nearly $350,000 of additional support from the counties and business community. Geothermal energy has so far received the most financial support, but other forms of natural energy are now receiving more recognition. Funding for research projects related to the NELH development have so far totaled $750,000.

XI. ORGANIZATIONS AND PERSONS CONSULTED IN THE PREPARATION OF THE EIS

A. Federal

Agricultural Stabilization and Conservation Service,
U. S. Department of Agriculture

Soil Conservation Service,
U. S. Department of Agriculture

Forest Service,
U. S. Department of Agriculture

Director, Office of Environmental Project Review,
U. S. Department of the Interior

Department of Housing and Urban Development

Department of Health, Education and Welfare

Environmental Protection Agency

Federal Aviation Administration,
Department of Transportation

Advisory Council on Historic Preservation
Attn: Mr. Robert Garvey, Executive Director

Department of Commerce
Attn: Dr. Sydney R. Galler, Deputy Assistant

Mr. Ernest E. Sligh, Director
Environmental Impact Division
Office of Environmental Programs
Federal Energy Administration

U. S. Army Corps of Engineers

Energy Research and Development Administration

B. State of Hawaii

Department of Agriculture

Department of Accounting and General Services

Department of Defense

Department of Education

Department of Health

Department of Land and Natural Resources

Department of Planning and Economic Development

Department of Social Services and Housing

Environmental Quality Commission (EQC)

Office of Environmental Quality Control

Department of Budget & Finance

Department of Transportation

C. County of Hawaii

County Council,
County of Hawaii

Department of Planning
Attn: Mr. Raymond Suefuji

Department of Public Works
Attn: Mr. Edward Harada

Department of Parks and Recreation
Attn: Mr. Milton Hakoda

Department of Water Supply
Attn: Mr. Akira Fujimoto

Department of Research and Development
Attn: Mr. Clarence Garcia

Transportation Advisory Commission
Attn: Mr. Kazuto Takayama

D. University of Hawaii

Environmental Center

Water Resources Research Center

Hawaii Institute of Marine Biology

Sea Grant Marine Advisory Program

E. Public Utilities

Hawaiian Telephone Company

Hawaii Electric Light Co., Inc.

Gasco, Inc., Hawaii Division

F. Private

Kona Outdoor Circle
President - Pearl Rein
c/o Ron Burla & Assoc.
P. O. Box 1148
Kailua-Kona, Hawaii 96740

Kona Civic Club
c/o Rufus Spalding
Kailua-Kona, Hawaii 96740

Ms. Clara Kahumoku
Hawaiian Civic Club
RR #1, Box 2018
Kailua-Kona, Hawaii 96740

Mr. Claude Onizuko
Kona Jaycees
c/o Kona Credit Union
Kailua-Kona, Hawaii 96740

Mr. Jim Potter
West Hawaii Committee
P. O. Box 1761
Kailua-Kona, Hawaii 96740

Mr. Pete L'Orange, Chairman
Kona Soil and Water Conservation District
RR 1, Box 519
Capt. Cook, Hawaii 96704

Ms. Virginia Isbell
Kona Citizens Planning Council
Box 926
Kealakekua, Hawaii 96750

Mr. W. J. Paris, Jr.
Cattlemen's Association
Kealakekua, Hawaii 96750

Ms. Jenny Paris
Life of the Land
General Delivery
Pahoa, Hawaii 96778

Mr. Joe Tassil
Organizations Kona
RR #1, Box 249-B
Holualoa, Hawaii 96725

Mr. Dave Walker
Kona Board of Realtors
c/o McCormack Realty
P. O. Box 1360
Kailua-Kona, Hawaii 96740

Mr. Ken Michael, President
Kona Chamber of Commerce
P. O. Box 635
Kailua-Kona, Hawaii 96740

Mr. Fred Honda, President
Kona Hotel Managers Association
Keauhou Beach Hotel
Keauhou, Kona, Hawaii 96740

Kona Traffic Committee
c/o Joseph Bottero
Kailua-Kona, Hawaii 96740

William Hale
Kona Conservation Group
RR #1, Box 125
Captain Cook, Hawaii 96704

William Thompson
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Honolulu, Hawaii 96813

XII. COMMENTS AND RESPONSES MADE DURING THE CONSULTATION PROCESS

The letters included in this chapter are the comments and subsequent responses pertaining to the EIS Preparation Notice and the EIS. Those letters dated August 16, 1976 and earlier are the comments and responses pertinent to the Preparation Notice. The letters in the second half of the chapter, dated after August 16, 1976, are those relating to the EIS.

Honolulu Hawaii 96822 Telephone: 948-7872
955-6344

The Research Corporation of the University of Hawaii

NOTE: Distribution list for this letter was composed of organizations and individuals listed in Chapter XI.

SUBJECT: Request for Comments
Natural Energy Laboratory of Hawaii
Environmental Impact Statement
Preparation Notice

The Natural Energy Laboratory of Hawaii, an agency of the State of Hawaii, is in the process of preparing an Environmental Impact Statement for the First Phase of the Proposed Research Laboratory facilities at Ke-ahole Point, Kailua-Kona, Hawaii County.

Attached hereto is a copy of the subject notice with a copy of the previously prepared Environmental Impact Assessment Report. Should you want your comments incorporated into the EIS, the comments should be forwarded to us within 30 days from your receipt of this request in accordance with regulations.

To clarify any questions, please contact Mr. William Heaman, phone 948-7654 or by letter to the RCUH address.

Sincerely,

William B. Coops
Project Administrator

WRC/fac

enc.

400 Moncity Building, 1110 University Avenue, Honolulu, Hawaii 96814

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII

P. O. BOX 1820 • HILO, HAWAII 96720 • 25 AUPUNI STREET

March 5, 1976

The Research Corporation of the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, HI 96822

Re: Environmental Assessment of the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii

We have reviewed the assessment. At the present time, the Department of Water Supply is unable to meet the proposed water demands of the project but should be able to once the Kahaluu Shaft is in operation.

Although the proposed water system is private, please submit said construction plans to us so that we may be able to check that said installations will be in conformance with our requirements to preclude any adverse action on the existing public water system.

Please keep us up-to-date on the progress of this project, including changes in the timetable, for coordinating purposes.

Akira Fujimoto
Manager

JI/GK

cc: R. M. Towill Corporation

RECEIVED
MAR - 9 1976
RESEARCH CORP. OF THE

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Akira Fujimoto
Manager
Department of Water Supply
County of Hawaii
P. O. Box 1820
Hilo, Hawaii 96720

Dear Mr. Fujimoto:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/5/76

Based upon information in the "Master Plan for Ke-ahole Point - Phase I" it is our understanding that the Kahuluu Shaft will be in operation by April 1977. Since we do not anticipate any water demand at the site prior to that time, there should be no problem. All proposed construction plans will be coordinated with your office to ensure that they meet County requirements. Your office will be kept informed of the NELH status.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/08

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
440 Alexander Young Building, Honolulu, HI 96813

March 8, 1976

Mr. William R. Coops
Project Administrator
The Research Corporation
of the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, HI 96814

Dear Mr. Coops:

Re: Natural Energy Laboratory of Hawaii - EIS Preparation Notice

We have reviewed the above-mentioned draft EIS and have no comments to offer.

Thank you for the opportunity to review this statement.

Sincerely,

Francis C. H. Lum
State Conservationist

RECEIVED
MAR 10 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Francis C. H. Lum
State Conservationist
USDA, Soil Conservation Service
440 Alexander-Young Building
Honolulu, Hawaii 96813

Dear Mr. Lum:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/8/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/09

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

HAWAIIAN ELECTRIC COMPANY, INC.
Box 2750 / Honolulu, Hawaii / 96803

RICHARD E. BELL
MANAGER, ENVIRONMENTAL DEPARTMENT

March 15, 1976

Mr. William R. Coops
Project Administrator
Research Corporation of Hawaii
401 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

Subject: COMMENTS ON ENVIRONMENTAL ASSESSMENT FOR NATURAL ENERGY LABORATORY KE-AHOLE

We have reviewed the environmental assessment for the proposed Ke-ahole facility and suggest that the following minor corrections be included on Page III-30:

On Line 4 of Paragraph (c), change 10.5 MW to 21.1 MW.

On line 5 of Paragraph (c), change 80 MW to 124 MW.

On the penultimate line of Paragraph (c), change one-half to 30%.

Sincerely yours,

REB:jlp

cc: Mr. William MacKenzie

RECEIVED
MAR 16 1976
RESEARCH CORP OF THE UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Richard E. Bell
Manager, Environmental Department
Hawaiian Electric Company, Inc.
Box 2750
Honolulu, Hawaii 96803

Dear Mr. Bell:

SUBJECT: Responses to Comments Received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/15/76

Your corrections to the environmental assessment have been noted and incorporated into the EIS. Thank you for your interest in the project.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL9/21

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720

HERBERT T. MATAYOSHI
Mayor

RAYMOND H. SUEFUJI
Director

COUNTY OF
HAWAII

March 15, 1976

Mr. William Coops
Project Administrator, RCUH
Natural Energy Laboratory of Hawaii
1110 University Avenue
Honolulu, HI 96814

Re: First Phase of Proposed Facilities
Environmental Impact Statement

Thank you for the opportunity to review this assessment and to present the following comments and questions.

1. We concur with the recommendation of the consultant that an intensive archaeological survey of the project area be made prior to any construction. To insure the greatest flexibility for mitigating measures, we further recommend that this survey be conducted as early as possible, perhaps as part of the EIS preparation.

2. The draft Kona Community Development Plan recommends that the County should, in conjunction with state efforts, identify all Hawaiian trails and utilize them as part of a bicycle and pedestrian network. To support this suggestion, any Hawaiian trails on the site should be identified in the archaeological survey and, once found, they should not be obstructed by any construction. Of particular interest is the Mamalahoa Trail which follows the coastline in the vicinity of the proposed laboratory.

3. The state plan for hiking trails, Na Ala Hele, proposes the Ala Kahakai Trail and Bikeway which will follow the coastline from Kailua to the Puu Kohola Heiau near Kawaihae Harbor. Will the proposed project or further development of the facility interfere with the establishment of this trail?

4. Independent of any improved trail system, there should be unrestricted access along the shore for recreational uses. Will development of the facility interfere with this mobility?

5. While the NELH will enhance shoreline recreation by providing access to the area, will the existence of the research facilities detract from that kind of recreational use? For example, will the warm water intake pose any danger to swimmers or divers?

6. How will the parking needs of beachgoers be accommodated?

7. Is there any possibility of the bio-mass experiments producing foul odors which will be blown inland to the airport terminal by the prevailing west and southwesterly winds?

8. Are the power lines which are to be constructed onto the site capable of exporting power from the land-based OTEC plant? If not, will the necessary export lines be constructed above-ground?

9. In the assessment there is no discussion of the natural catastrophic events which could occur at Keahole. It should be included in the EIS.

10. What will become of the facility if few research projects are attracted to the site? How likely is this?

11. As a condition of plan approval, our Department may require the access road to be paved to meet county standards. A requirement of one or two paved parking stalls for maintenance personnel may also be imposed.

12. On page V-2, you report that an EIS is required pursuant to the County of Hawaii's Rules and Regulations Relating to Environmental Shoreline Protection. You also imply that this EIS is a document over and beyond other existing EIS requirements. The Rules and Regulations you cite do not require the preparation of a separate document, viz., Page 8, wherein it states, "an EIS that has been declared adequate under the National Environmental Policy Act or under Chapter 343, HRS, may constitute a valid filing under this section."

We are looking forward to receiving your response to these comments and to the opportunity to review the final EIS.

RAYMOND SUEFUJI
Director

NW:rfd

cc: Jack Keppeler

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Raymond Suefuji, Director
Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Suefuji:

SUBJECT: Responses to Comments Received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/15/76

The following comments are addressed to your letter of responses to the EIS Preparation Notice:

1. A second archaeological reconnaissance of additional areas affected by Phase I construction has been conducted. The findings are discussed in the EIS. The relatively high cost of an intensive archaeological survey is not believed warranted until a specific site is endangered by a future energy project plan. The location of future facilities is flexible and archaeological sites will be bypassed to the maximum extent possible.

2. The archaeological reconnaissance found some evidence of Hawaiian foot trails at the site. These foot trails are distinguished only by regularly spaced opihi shells and occasional coral pebbles and cobbles which mark twisted courses over the lava. The archaeological report rated these features as insignificant. The access road cuts across the historic Mamalahoa Trail 2,300 feet seaward of the Queen Kaahumanu Highway. This trail has already been severely cut by the Ke-ahole Airport development.

3. Development of the NELH site will not interfere with the proposed trail and bikeway along the coast. It will provide another access point to the trail.

4. The NELH access road will improve entry to the Ke-ahole shoreline areas. There will be essentially unlimited access to movement along the shoreline at the NELH site.

5. The land based pilot OTEC plant will have minimal impact on the recreational usage of the area, because of the associated intake and discharge pipelines. These impacts will be analyzed in future Environmental Impact Statements written for the specific projects. However, their installation and operation are not expected to interfere with present or future recreational uses of the area.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

6. The Master Plan for Phase I development discusses only the installation of utilities and construction of access road to the site. The Phase I design has no provisions for public parking.

7. Impacts of the biomass facility will be covered in a specific EIS for that project, when definite information is available. A constraint on the NELH development is that it not interfere with airport operations. Foul odors emanating from the facility would be an unacceptable impact.

8. The power lines are for incoming power only. Design of the export lines will depend on the size and capabilities of the future OTEC facilities and on the constraints of the airport environment.

9. Discussion of natural catastrophes has been included in the EIS.

10. The facility will expand only as new projects are attracted to the site. The future of the facility will always be dependent upon a demonstrated need for its unique resources. If the need does not develop, or is developed and later is lessened, the site would be reduced or closed, as deemed appropriate. In view of present government support and the increasing need for alternate energy sources, a phased development of the NELH is anticipated.

11. Final design of the Phase I support facilities will meet all County and State requirements.

12. Your comments on the EIS are noted. The EIS is being written to satisfy the EIS regulations of the Environmental Quality Commission, State of Hawaii.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/11-12

GEORGE R. ARIYOSHI
GOVERNOR

RECEIVED
MAR 18 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

E. ALVEY WRIGHT
DIRECTOR

DEPUTY DIRECTORS
WALLACE AOKI
RYOKICHI HIGASHIONNA
DOUGLAS S. SAKAMOTO
CHARLES O. SWANSON

IN REPLY REFER TO:
AIR-E
1412

March 15, 1976

Mr. William R. Coops
Project Administrator
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

Subject: Natural Energy Laboratory,
Ke-ahole Point, North Kona, Hawaii

This is in reply to your letter of January 20, 1976 transmitting the Master Plan - Phase I and Environmental Assessment for the Natural Energy Laboratory at Ke-ahole Point, Island of Hawaii.

Our comments are as follows:

Master Plan

The Airport Lands at Ke-ahole are expected to continue to be designated "Conservation." All airport improvements were accomplished under a variance. It is requested that no change to Land use be made and a variance be obtained from the Department of Land and Natural Resources.

We have no objections to the connections of the utilities to the airport facilities. However, the utilization of airport facilities must be subject to the following provisions:

1. The sewer and water lines shall be installed outside of the Airport Operating area. Crossing of the runway will not be permitted.

2. The spare ducts crossing the runway may be utilized by NEL for power and communications provided that if and when they are required for airport purposes, NEL shall provide their own facilities around the runway.

3. NEL shall provide its own facilities or pay for the expansion of the sewer and water facilities if and when future demands occur requiring expansion of the existing facilities.

It must be pointed out that the road from Queen Kaahumanu Highway to the NEL site must only provide access to the tenants of the airport. No connections to adjacent landowners of the airport lands will be permitted. The road should also be for limited use to the outside public to insure security of the airport facilities.

Environmental Assessment

The section regarding utilities should be revised accordingly to our comments above. Our primary concern is the interference with the airport operations during construction within the Airport operating area and during the operation and maintenance of the "completed" system.

With regards to the proposed Biomass conversion and/or aquaculture facility, will such a facility attract birds which could create an aircraft hazard? If so, what steps can be taken to discourage the birds from the utilization of the facility?

The Solar Energy Program should address itself to any possible interference with aircraft operation (pilots and/or comptrollers).

Attached hereto for your use is a copy of a letter from the FAA regarding the Master Plan and Environmental Assessment for the NEL. Should you have any questions regarding the master plan, do not hesitate to contact us.

Very truly yours,

E. Alvey Wright

E. ALVEY WRIGHT
Director

Enclosure

GEORGE R. ARIYOSHI
GOVERNOR

E. ALVEY WRIGHT
DIRECTOR

DEPUTY DIRECTORS
WALLACE AOKI
RYOKICHI HIGASHIONNA
DOUGLAS S. SAKAMOTO
CHARLES O. SWANSON

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

April 1, 1976

IN REPLY REFER TO:
STP 8.3580

Mr. William R. Coops
Project Administrator
The Research Corporation of
the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

Subject: EIS Preparation Notice
Natural Energy Laboratory of
Hawaii at Ke-ahole Point

Thank you for the opportunity to review the subject statement. We offer the following comments for your consideration:

1. Reference to Kailua-Kona Airport on page III-1 is incorrect. The airport is known as Ke-ahole Airport.

2. A discussion of the future runway at Ke-ahole Airport should be included in the statement.

3. Correct Figure 3 by indicating the location of the Kona Palisades Access Road onto Queen Kaahumanu Highway. The NEL Access Road should intersect Queen Kaahumanu Highway opposite the Kona Palisades Access Road.

4. A channelized intersection with left-turn storage lanes, deceleration and acceleration lanes, will be required at this access point.

Sincerely,

E. Alvey Wright

E. ALVEY WRIGHT
Director

RECEIVED
APR 08 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

PACIFIC-ASIA REGION
P. O. BOX 4009
HONOLULU, HAWAII 96813

MAR 1 1976

Mr. Owen Miyamoto
Chief, Airports Division
Department of Transportation
State of Hawaii
Honolulu, Hawaii 96819

Dear Mr. Miyamoto:

The Master Plan and Environmental Assessment of the National Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii, have been reviewed and we furnish the following comments:

Master Plan

We do not concur in the recommendation for trenching across the runway and taxiway for extension of utility lines from the existing system at Ke-ahole Airport. If the statement on page 46 that the existing airport systems are operating at three percent of maximum capacity and that connection of the NELH utilities should impose no additional strain on the airport system within the next twenty to thirty years is valid, we are not opposed to this connection provided the utilities are routed around the runway and taxiway complex.

Environmental Assessment

Concerning installation of the utility systems for NELH, the environmental impact statement should include a discussion of all the alternative routings covered in the Master Plan. Accordingly, in discussing the alternative of trenching across the runway and taxiway, the impact of this proposal on the operation of Ke-ahole Airport should be covered in detail. Some questions which arise are: (1) Will the airport be closed during this construction work? (2) If so, where will aircraft be diverted? (3) Detailed analysis of the existing airport utility system to serve the expected demands of NELH.

If any electronic devices are used at the Natural Energy Laboratory, their impact on the Instrument Landing System (ILS) at Ke-ahole Airport should be discussed in the environmental impact statement.

As indicated in our letter of October 31, 1975, the Airport Layout Plan should be revised to reflect the establishment of the proposed facility, including access to the site, utility right-of-way, and appropriate airway/road clearances, and submitted for our review and approval. Also, the draft lease agreement, including metes and bounds for the land parcel, access road and utility right-of-way, should be submitted for our review prior to execution. Please be aware that the changes proposed at Ke-ahole Airport must conform to the conditions and assurances of the existing grant agreements.

Thank you for the opportunity to comment on the Master Plan and Environmental Assessment Report.

Sincerely,

Herman C. Bliss

HERMAN C. BLISS
Chief, Airports Division, APC-600

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. E. Alvey Wright
Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Wright:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/1/76 & 3/15/76

The following comments are addressed to your letters and the included Federal Aviation Administration letter of March 1, 1976 concerning the EIS Preparation Notice:

1. A discussion of the future airport expansion is included in the EIS.

2. The intersection of the NELH access road with Queen Kaahumanu Highway will conform to Federal and State requirements for intersections with limited access highways.

3. Land rezoning has been discussed with the affected agencies and is included in the EIS.

4. Sewer and water lines will be routed around the runway as described in the EIS.

5. If and when future water and sewage demand requires, the NELH will provide its own facilities, or pay for the expansion of the airport systems.

6. Airport security is addressed in the EIS.

7. All development at the site will be coordinated with concerned agencies to ensure that airport operational and safety requirements are met.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

8. The effects of a biomass facility (e.g. attraction of birds) will be discussed in an EIS for that project, but at this time this does not appear to be a problem. The same holds for each future solar energy research project.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/03

HERBERT T. MATAYOSHI
MAYOR

EDWARD K. HARADA
CHIEF ENGINEER

BUREAUS AND DIVISIONS:
AUTOMOTIVE EQUIPMENT & MOTOR POOL
BUILDING CONSTRUCTION AND INSPECTION
PLANS AND SURVEYS
ROAD CONSTRUCTION AND MAINTENANCE
SEWERS AND SANITATION
TRAFFIC SAFETY AND CONTROL

COUNTY OF HAWAII
DEPARTMENT OF PUBLIC WORKS
25 AUPUNI STREET
HILO, HAWAII 96720

March 16, 1976

The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, HI 96814

ATTENTION: Mr. William R. Coops, Project Administrator

SUBJECT: NATURAL ENERGY LABORATORY OF HAWAII
E.I.S. PREPARATION NOTICE

Thank you for the opportunity to review the E.I.A.

General comments are:

1. Page III-5 (a) Proposed Road

   Initial road construction calls for rock chips and asphalt sealer. However, at top of page III-6, First Phase is noted as unpaved.

2. Page III-6 1 Sewerage

   Will 3-inch PVC force main be large enough? What about hydrogen peroxide for odor control treatment?

3. All structures shall conform to applicable codes pertaining to building construction.

for EDWARD HARADA
Chief Engineer

cc: Mayor
Planning Department

RECEIVED
MAR 18 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Edward Harada
Chief Engineer
County of Hawaii
Department of Public Works
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Harada:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/16/76

The first phase road will be unpaved, constructed of rock chips with a sealer, not pavement.

The 3-inch sewage force main was recommended in the Master Plan - Phase I as being sufficient to handle the sewage of the fully developed facility in 1990. At that time, the flow is estimated to be 11,700 GPD. The final design will recommend that hydrogen peroxide or chlorine be used for odor control, as required.

All structures and installations at the site will conform to applicable County of Hawaii Building Codes.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/07

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

University of Hawaii at Manoa

Water Resources Research Center

MEMORANDUM

March 22, 1976

MEMO TO: William R. Coops
Project Administrator

FROM: Frank L. Peterson
Acting Asst. Director, WRRC

SUBJECT: Review of "Environmental Assessment of Natural Energy Laboratory at Ke-ahole Point Hawaii"

Ed Murabayashi, James Moncur, and myself, all of the WRRC staff, have reviewed this Environmental Impact Assessment Report, and we have no pertinent comments.

FLP:jmn

RECEIVED
MAR 25 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Frank L. Peterson
Acting Assistant Director
Water Resources Research Center
University of Hawaii at Manoa
Honolulu, Hawaii 96822

Dear Mr. Peterson:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/22/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/10

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GASCO, INC.
A SUBSIDIARY OF PACIFIC RESOURCES, INC.

DIVISIONS:
Honolulu Gas Company
Hilo Gas Company
Maui Gas Company
Isle Gas
Honolulu Gas Equipment Co.

P. O. BOX 3379 / HONOLULU, HAWAII 96801

March 25, 1976

Mr. William R. Coops
Research Corporation, UH
1110 University Avenue, #402
Honolulu, Hawaii 96814

Dear Mr. Coops:

Thank you for this opportunity to comment on the environmental assessment of the Natural Energy Laboratory of Hawaii.

The project does not appear to have any adverse effect on the Gas Company.

Very truly yours,

Francis Tanaka
Environmental Coordinator

FT:jm

RECEIVED
MAR 29 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Ms. Frances Tanaka
Environmental Coordinator
Gasco, Inc.
P. O. Box 3379
Honolulu, Hawaii 96801

Dear Ms. Tanaka:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/25/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/11

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

JOHN FARIAS, JR.
CHAIRMAN, BOARD OF AGRICULTURE

YUKIO KITAGAWA
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
1428 SO. KING STREET
HONOLULU, HAWAII 96814

March 30, 1976

MEMORANDUM

To: The Research Corporation of the University of Hawaii

Subject: Request for Comments
Natural Energy Laboratory of Hawaii
Environmental Impact Statement
Preparation Notice

The Department of Agriculture has reviewed the environmental assessment for content which may have bearing on agriculture. The stated purpose of the assessment is to provide insight into future energy-related programs at the Natural Energy Laboratory of Hawaii (NELH). The laboratory site is remote from intensive agricultural activities, but could interact in the future with bagasse power-generating facilities. This interaction is noted on Page III-30.

There is a reasonable prospect that an increasing proportion of HELCO power requirements will be met by upgrading boiler and generating facilities at the present mills, further reducing demand for fossil fuels. Any significant level of power sales by a power unit in the Kona area would have to prove competitive before long-run success would be assured.

There is one major omission from the assessment--the potential use of thermal gradient for the physical separation and recovery of low-solids water. As water demands increase in coastal Hawaii, the potential benefit of water desalinization may become significant for the Kiholo region of Hawaii County. This anticipated temperature differential considered for conversion to electrical energy may be effectively exploited for fresh water recovery. Serious consideration of this alternative should be given before completing the assessment.

The biomass conversion and aquaculture aspect of the project gives further consideration of the regenerable fuel potential (page III-33). Such a use would require boilers and generator systems similar to bagasse facilities. The presence of salts would prove difficult in a combustion process, both from the standpoint of equipment life and from the control of emissions. Production of a food source may ultimately prove the greatest benefit, even with supplemental

fertilization. A food production and processing system could support a significant level of employment. Perhaps the greatest emphasis should be placed on bioconversion potential of this deep, cold-water resource.

Thank you for the opportunity to comment.

John Farias, Jr.
Chairman, Board of Agriculture

JF:d:e

RECEIVED
APR 14 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. John Farias, Jr.
Chairman, Board of Agriculture
Department of Agriculture
State of Hawaii
1428 South King Street
Honolulu, Hawaii 96814

Dear Mr. Farias:

SUBJECT: Responses to Comments Received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/30/76

We offer the following responses to your letter. The NELH is primarily oriented toward energy related projects. However, if the OTEC water temperature differentials can also be exploited for water desalinization, fresh water will be a useful by-product. At present, OTEC is in the conceptual stage and these various alternatives will be considered in future studies.

The biomass and mariculture operations at NELH are being considered for conversion both into energy and as a food source.

Your interest in this project is appreciated.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/10

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
Governor

HIDETO KONO
Director

FRANK SKRIVANEK
Deputy Director

DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

Kamamalu Building, 250 South King St., Honolulu, Hawaii • Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

March 31, 1976

Ref. No. 0666

Mr. William R. Coops
Project Administrator
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

Subject: Environmental Impact Statement Preparation Notice for the First Phase of the Proposed Research Laboratory Facilities at Ke-ahole Point, Kailua-Kona, Hawaii

Thank you for your letter of March 2, 1976, requesting our comments regarding the subject EIS Preparation Notice.

We are in agreement that the support facilities can be built now and that an EIS should be prepared for the various energy projects to insure full examination of the project's potential, beneficial and adverse environmental impacts.

Sincerely,

HIDETO KONO

RECEIVED
APR 05 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Hideto Kono
Department of Planning
and Economic Development
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Kono:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 3/31/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/12

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

RICHARD E. MARLAND, PH.D.
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

April 1, 1976

William R. Coops
The Research Corporation of the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

SUBJECT: Natural Energy Laboratory for Hawaii

Dear Mr. Coops,

This Office has reviewed the Environmental Impact Statement Preparation Notice for the Natural Energy Laboratory of Hawaii and offers the following comments for your consideration:

A discussion of alternate sites should be addressed along with reasons for not selecting the other sites.

We note the time table for proposed events (figure 1) has no listing for an EIS under the initial NELH development.

Data collection for temperature, rainfall and solar radiation might begin as soon as possible since little on-site data exists. Wind direction and velocity data for Keahole Point are probably different than that recorded at the old Kona airport. We refer you to the wind roses shown in the Atlas of Hawaii on page 59. Assessment of potential impacts on air quality should be based on the most relevant information.

Under recreational resources, reference should be made to the coastal trail with the NELH project site as a potential access route to the trail.

P. III-19. The principle site of geothermal exploration is on the flank of Kilauea, not Mauna Loa as stated.

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P. III-21. An indirect, long-term beneficial affect of the NELH on agriculture could be the reduction of agricultural production costs via cheaper, cleaner energy sources on the Island of Hawaii.

P. III-38, Table 5. We note no listing within this table for impacts on the flora and fauna of affected ecosystems. Consideration should be given to this item within any environmental impact statement.

P. IV-5. We suggest that the persons employed by the NELH are also human and may participate in the "inevitable degradation of the area's natural environment due to the presence of humans."

P. VI-1, Recommendations. The preparation notice states, "File with the State Department of Land and Natural Resources for a reclassification of this area from 'conservation' to 'urban'." This application should be filed with the State Land Use Commission if a change in the State Land Use District boundaries is required.

We would suggest that the Energy Research and Development Administation be contacted with regards to meeting any possible National Environmental Policy Act EIS requirements that may be coincident with obtaining federal funding for the various proposed energy programs.

Thank you for the opportunity for commenting on the Environmental Impact Statement Preparation Notice for the Natural Energy Laboratory of Hawaii. We look forward to the receipt of the Environmental Impact Statement.

Sincerely,

Richard E. Marland
Director

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Dr. Richard E. Marland
Director
State of Hawaii
Office of Environmental Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/1/76

The following comments are addressed to your letter of response to the EIS Preparation Notice:

1. Site selection, with a discussion of alternate sites, is included in the EIS, together with a revised figure (II-3) on NELH development which includes the EIS.

2. Data collection is dependent upon funding by County, State and Federal agencies. Up until this time, efforts have been concentrated on oceanographic data collection, since such data is required for the future OTEC work. Your comments concerning wind variation have been noted, however, the projects scheduled for the NELH should have little impact on air quality.

3. The proposed shoreline trail from Kailua-Kona to Anaeho'omalu Bay has been discussed in the EIS.

4. Table 5 in the Environmental Assessment is a summary table of environmental impacts taken from "Alternate Energy Sources for Hawaii, 1975" and was not all-inclusive. The impact of NELH development on the flora and fauna of the area is considered in the EIS.

5. Your comments concerning agencies involved in reclassification of the area from conservation to urban are appreciated. The rezoning process has been initiated and is discussed in the EIS.

6. Your comments on the long term indirect effects of the NELH on agriculture have been included in the EIS.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

7. The rezoning process for the NELH site has been initiated and the various State and County requirements will be met.

8. This EIS deals primarily with the Phase I support facilities that will be required for future energy projects. Any ERDA projects proposed for the site will require their own EIS.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/13/14

HAWAII HOTEL ASSOCIATION
SUITE 907
2270 KALAKAUA AVENUE
HONOLULU, HAWAII 96815
TELEPHONE 923-0407

April 1, 1976

Mr. William R. Coops
Project Administrator
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

Your letter of March 2 addressed to Fred Honda regarding the Natural Energy Laboratory of Hawaii Environmental Impact Statement Preparation Notice has been turned over to me for reply as I am presently the president of the Hawaii Chapter of the Hawaii Hotel Association.

I personally have no comments to make regarding this project and thank you for giving us the opportunity to do so.

Mahalo and aloha,

Adi W. Kohler
President
Hawaii Chapter

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RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Please reply to:
Mauna Kea Beach Hotel
P. O. Box 218
Kamuela, Hawaii 96743

American Hotel & Motel Association

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Adi W. Kohler
President
Hawai. Chapter
Hawaii Hotel Association
Mauna Kea Beach Hotel
P. O. Box 218
Kamuela, Hawaii 96743

Dear Mr. Kohler:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii a Ke-ahole Point, Hawaii - Your Letter of 4/1/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/13

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

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RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

2563 Date Street, # 101
Honolulu, HI 96814

2 April 1976

Mr. William R. Coops
Project Administrator
The Research Corporation of
the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, HAWAII 96814

Dear Sir:

I am making a personal response as a private citizen after review of the Environmental Impact Statement Preparation Notice and Environmental Assessment for the Natural Energy Laboratory of Hawaii (NELH) at Ke-ahole Point, Hawaii. Following are some of my thoughts:

1. You should determine whether or not the EIS will address only the NELH Support Facilities or also the energy projects to which its construction is tied. By including a discussion of the future projects and some of the possible impacts, the EA was hurt by its disorganized, scattered presentation of subsections dealing with baseline environmental data and potential environmental impacts. Moreover, there was often conflict and repetition between these subsections in Section III and in Section IV. An example of uneven treatment was the elaborate identification of potential economic impacts in Section III, but only a small paragraph of evaluation of these impacts in Section IV.

2. I suggest consolidation of the various project descriptions with accompanyment by tables and diagrams. Likewise the scattered subsections on "Potential Environmental Impacts" in Section III should be consolidated. Be sure to separate out identification of potential environmental impacts from their evaluation. All these suggestions will, I believe, make the EIS more readable and understandable.

3. The subsection dealing with "Neighborhood Character and Continuity" on Pages III-11 and III-14 is presently a discussion of landscape, land usage and land-use zone designations which should be in a separate subsection. I believe these sections on Neighborhood Character should rather be discussed using a social perspective by describing the types and social organization of people living there, their attachment to the place (i.e. transients or kamaaina), the age of housing, mention of subdivisions and the cultural landscape.

4. Finally I suggest the EIS address more fully the long-range impact of successfully operational energy and food-producing projects such as is touched upon on Pages IV-9, IV-12 and IV-14 . A regional economy producing

a surplus of non-polluting fuel and power (including the possibility of geothermal power) could not only attract research firms, but also metal processing and fabricating industries, including perhaps fabrication of floating OTEC plants at deep-draft Kawaihae Harbor. By the turn of the century there is definite potential of radically transforming the landscape and economic base of West Hawaii in the least, perhaps turning it into a new growth point for statewide economic development and population movement. Although admittedly these are conjectures, long-range planning deals with conjectures in large part and the EIS should address the possible further need to coordinate project development with regional economic and social development.

Thank you for the opportunity to provide comments.

Sincerely

David G. Sox
Geographer and Environmental Planner

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. David G. Sox
2563 Date Street, #101
Honolulu, Hawaii 96814

Dear Mr. Sox:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/2/76

The following comments are addressed to your letter concerning the EIS Preparation Notice:

1. The EIS is addressed primarily to the NELH support facilities. At present, there is not enough available information on the future projects to comply with the requirements of an EIS for any future project. Each future project will have its own EIS, based upon more detailed project plans.

2. Your points concerning the organization and consolidation of the EA are noted. The Preparation Notice included an Environmental Assessment, not an EIS as indicated in your letter.

3. Appendix A of the EIS briefly discusses some possible long range impacts upon the area. At this time, we have only conjectures to deal with, and these are not appropriate in an EIS written for a specific project, such as the Phase I NELH facilities. This project does not commit the area to future project developments; each project will be judged on its own merits and the long range impacts will be assessed at that time.

Your interest, as a private citizen, in this project is much appreciated.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/04

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BLDG. 230, FT. SHAFTER
APO SAN FRANCISCO 96558

PODED-PV

2 April 1976

Mr. William R. Coops
Project Administrator
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

We offer the following comments on the Environmental Impact Statement Preparation Notice and Environmental Assessment (EA) for the Natural Energy Laboratory of Hawaii (NELH) at Ke-ahole Point, Hawaii, for your consideration.

a. General Remarks.

(1) Since development of the NELH support facilities is contingent upon subsequent Federal funding for one or more of the future energy programs (see Page II-3), we believe it is necessary to fully address not only direct impacts ensuing from the NELH support facilities, but also indirect impacts that will occur as a result of construction and operation of the energy experiments.

(2) The summary of beneficial effects on Page I-2 should recognize that construction activity is also an adverse physical environmental effect. The potential adverse environmental effects described on Page I-3 should recognize the many significant impacts that are described in Section IV.

b. Comments on the Physical Environment.

(1) We suggest that the EIS address the probability of volcanic action in the area and the frequency of earthquakes, their past effects, and their potential effects on the proposed projects.

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(2) Tsunamis are also a significant environmental factor, especially on the low, flat point formation of Ke-ahole where structures could be severely damaged. According to the Catalogue of Tsunamis in the Hawaiian Islands, published by the U.S. Department of Commerce, Coast and Geodetic Survey, May 1969, a run-up height of 39-49 feet was recorded at Keauhou on April 2, 1868. Other recordings, although not as severe, show that the surrounding coastal areas of the proposed project are also subject to tsunami run-up. Damage from potential tsunami inundation should be addressed.

(3) Although the proposed site is not listed as a flood-prone area, the EIS should address the potential damage from overland flow.

(4) The EA should describe water quality and the marine environment of Ke-ahole Point, especially attempting to estimate the concentrations and loading of cold water nutrients to the shallow water marine environment, and to estimate the impact thereof on light penetration, productivity, and benthic life.

(5) We recommend that early coordination be made with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding potential impacts of thermal discharge (both warm and cold) on marine and land-based animals, and of the impact of biostimulation from nutrient-rich discharges on Kona sport fishing. One long-range ecological impact could be the attraction of surface-feeding birds to the bioconversion, aquaculture and OTEC facilities where food is likely to be in abundance. Large numbers of such bird populations could have adverse effects on air operations at the nearby airport.

c. Comments on the Social and Economic Environment.

(1) The EIS should more fully describe existing and projected water resources vis-a-vis the estimated demands for domestic and industrial water by the NELH support facility and future energy-related projects.

(2) Similarly, sewage treatment facilities should be fully described.

(3) The EIS should address the possible adverse effects of land-based and floating OTEC operations on shoreside recreation and offshore boating activities.

(4) The paragraphs "Neighborhood Character and Continuity" on Pages III-11 and III-14 should perhaps describe the social aspects of the local people and the "Kona" way of life.

2 April 1976

d. Comments on Possible Permit Activities.

(1) The preliminary bio-fouling experiments, mentioned on Page II-3, involve structures in navigable waters of the United States and will require a U.S. Department of the Army (DA) Section 10 permit (River and Harbor Act of 1899) before the experiment can commence. Contrary to the statement on Page III-2, third paragraph, the Corps has not yet issued a permit. An application is currently being processed as PODCO-O 1234-S. A Hawaii County Planning Department letter, dated 16 January 1976, states that two public hearings must be held, and construction plans must be reviewed and approved by the Planning Director, pursuant to Shoreline Setback Rules and Regulations. Because all other required approvals have been obtained, a DA permit (Letter of Permission) can be issued as soon as the Planning Director approves the project.

(2) In addition, Section 10 DA permits would be required for construction of supply and discharge lines for the land-based OTEC facility (Page III-25), the floating prototype OTEC plant (Page III-26), and any structures or work involving biomas conversion and aquaculture facilities that occurred in navigable waters.

(3) A DA permit under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 would be required to permit the use of fill for structures such as intake and outfall pipes.

Thank you for the opportunity to provide comments.

Sincerely yours,

for KISUK CHEUNG
Chief, Engineering Division

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Kisuk Cheung
Chief, Engineering Division
U. S. Army Engineer District,
Honolulu
Building 230, Ft. Shafter
APO, San Francisco 96558

Dear Mr. Cheung:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/2/76

The following comments are addressed to your letter concerning the EIS Preparation Notice:

a. General Remarks

1. Indirect impacts of the NELH development have been discussed in the EIS.

2. Beneficial and adverse impacts are extensively discussed in the EIS.

b. Comments on the Physical Environment

1. The possibility of catastrophic events was discussed in the EIS and the Master Plan, and the future design of the facilities at the site will take these occurrences into account.

2. The possibility of tsunami inundation is mentioned in the EIS. Design of the facilities will include protection against tsunami inundation.

3. There appears to be no potential for damage from overland flow and this has been stated in the EIS.

4. The EIS briefly describes the marine environment off Ke-ahole Point, but it will not be affected by this Phase I development. The loading of cold water nutrients on the environment has been discussed in Appendix A. More definite statements must await further research and design data on water flow rates and characteristics.

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5. Coordination with the suggested agencies will be made prior to any projects affecting the marine environment.

c. Comments on the Social and Economic Environment

1. Water resources and future demand has been discussed in the EIS.

2. Sewage treatment has been discussed in the EIS.

3. The effect of land-based and floating OTEC plants on shoreside recreation and boating has been discussed in Appendix A of the EIS.

4. The Kona community characteristics have been discussed in the EIS.

d. Permit Activities

1. The biofouling research permit has since been approved by the Army.

2. Future work at the site will comply with all Federal, State and County permit requirements.

Your interest in this project is appreciated.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH10/01-02

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL HOUSING ADMINISTRATION
HONOLULU INSURING OFFICE
P.O. BOX 3377
HONOLULU, HAWAII 96801

REGION IX
450 Golden Gate Avenue
P.O. Box 36003
San Francisco, California 94102

April 5, 1976

IN REPLY REFER TO:
9.7U (Sakamoto/
546-5554)

The Research Corporation of the
University of Hawaii
1110 University Ave., 402 Varsity Bldg.
Honolulu, Hawaii 96814

Gentlemen:

Subject: Request for Comments
Natural Energy Laboratory of Hawaii
Environmental Impact Statement
Preparation Notice

In accordance with your request dated March 2, 1976, we have reviewed the Environmental Assessment prepared by R. M. Towill Corporation dated January 1976 for the Natural Energy Laboratory of Hawaii proposed facility at Ke-ahole Point, Kona, Hawaii and have no comments regarding the First Phase of the project.

Sincerely,

Alvin K. H. Pang
Director

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RESEARCH CORP. OF THE
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Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Alvin K. H. Pang
Director, Honolulu Insuring Office
Federal Housing Administration
Department of Housing and Urban
Development
P. O. Box 3377
Honolulu, Hawaii 96801

Dear Mr. Pang:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/5/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/14

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

DEPARTMENT OF PARKS & RECREATION
COUNTY OF HAWAII

Herbert Matayoshi, Mayor
Milton Hakoda, Director

April 6, 1976

Mr. William R. Coops, Project Administrator
The Research Corporation of the University
of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

RE: Natural Energy Laboratory of Hawaii - EIS

We have no comments on the project/EIS as it relates to our programs.

We do recognize and support the beneficial effect of the project as it relates to increased accessibility to the Ke-ahole shoreline for public recreational use.

Thank you for the opportunity to review the project/EIS.

Milton T. Hakoda
Director

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RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

• 25 AUPUNI STREET • HILO, HAWAII 96720 • TELEPHONE 961-8311

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Milton Hakoda
Director
Department of Parks & Recreation
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Hakoda:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/6/76

Receipt of your letter regarding the proposed project is acknowledged.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/15

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
SAN FRANCISCO OPERATIONS OFFICE
1333 BROADWAY
OAKLAND, CALIFORNIA 94612

F:MHS-10-6

APR 8 1976

Mr. W. R. Coops
Project Administrator
Research Corporation of the
University of Hawaii
1801 University Avenue
Honolulu, Hawaii 96822

Subject: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE, NATURAL ENERGY LABORATORY OF HAWAII (NELH)

Dear Mr. Coops:

We have been asked by W. J. Stanley, Director of ERDA's Pacific Area Support Office, to review the subject document. We agree with the proposal therein that an EIS for NELH should be prepared since this could be a base from which an EIS of any ERDA funded Solar or Ocean Thermal Energy Conversion research at NELH would proceed. A good EIS now would thus expedite the decision making process and program implementation if ERDA work were to be considered for NELH. However, it should be kept in mind that ERDA has made no commitment to funding research at this site. With this in mind, we hope the following comments are helpful.

1. General: A more thorough analysis of alternative sites for the NELH.

2. General: More thorough consideration of other alternatives--don't have NELH, have only OTEC or only solar here, etc.

3. Page III-8: More specific FAA requirements that could impact on-site use. For instance, could solar receiver tower be built here; possibility of misdirected solar beam hitting a plane, etc.

4. Page III-16 and 17 (and elsewhere): Impact on agriculture from land use, process or potable water use, etc.

5. Page VI-1: Demonstration is needed of compliance with local and regional land use regulations listed on this page.

We hope these comments are useful to you in the context in which they are offered. We would like to review the EIS when it is prepared and would be pleased to provide you any other assistance we are able to in your energy development efforts for the State of Hawaii.

Sincerely,

A. A. Vergari

A. A. Vergari
Assistant Manager

cc: W. J. Stanley, PASO, Hawaii
M. E. Gates, NV
W. H. Pennington, Office of NEPA Coordination, HQ
J. W. Benson, Division of Solar Energy, HQ

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APR 13 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. A. A. Vergari
Assistant Manager
U. S. Energy Research &
Development Administration
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Dear Mr. Vergari:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/8/76

Regarding your comments concerning the EIS Preparation Notice:

1. The alternative site considerations have been discussed in the EIS, along with alternatives within the chosen site.

2. Requirements of the FAA and the Airports Division, State Department of Transportation, have been discussed in the EIS. At this time, there is no indication that solar beams or receiving towers would be a hazard to any activity at the site. Such aspects will have to be covered in a future EIS, with the understanding that airport operations and safety cannot be compromised.

3. The NELH impact on agriculture and water use has been discussed in the EIS.

4. Zoning changes for the NELH site have been applied for and the development will comply with local and regional land use regulations. As discussed in the EIS, the development is in accordance with the development plan for Kona.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/05

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

CHRISTOPHER COBB, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

April 9, 1976

Mr. William R. Coops
University of Hawaii
Research Corporation
402 Varsity Bldg.
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

We have reviewed the Environmental Impact Statement preparation notice for the Keahole Energy Laboratory and have the following comments to offer.

Wildlife aspects are adequately addressed by the assessment and project impact on wildlife will be minimal. However, several brackish ponds on the site should be protected from contamination during and after construction and retained in their natural state.

The assessment does not say what chemicals and fuels are to be used and stored at the site, nor are any amounts mentioned. It does not reflect concern for leakage or spillage of chemicals onto the shoreline or into shore waters as a result of accident or natural causes such as storms or tsunamis.

Construction of breakwaters or ramps will affect marine biota at Keahole. Likewise, trenching to lay cables will affect biota. Baseline surveys of aquatic organisms should be required and included in the EIS. The impact of construction should also be included.

Potential conflict between the proposed laboratory and public recreational use and public access to the shore should be addressed and alternative solutions explored.

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NIVERSITY OF HAWAII

In the event of project termination, scheduled or unexpected, restorative measures should also be considered.

The area of the project should be reclassified to urban use by the Land Use Commission. If the University's petition does not succeed, application for the use of Conservation land must be submitted to this department in sufficient time for processing before commencement of any activity or construction.

Very truly yours,

Edgar A. Haman

for CHRISTOPHER COBB
Chairman of the Board

cc: Fish & Game
Mr. Roger Evans

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Christopher Cobb
Chairman
Department of Land and
Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Cobb:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/9/76

We offer the following responses to the comments in your recent letter:

The several brackish ponds near the shoreline at the NELH site have been identified in the EIS as having potential environmental significance. and will be retained in their natural state.

The Phase I facilities will have no dangerous chemicals or fuels that could contaminate coastal waters in the event of a natural catastrophe. At this time, the question of chemical or fuel storage cannot be answered for future projects, because of lack of definite details. This question would be addressed as the EIS's of these future projects are prepared. This also applies to the subjects of breakwaters, ramps or trenched cables.

Since Phase I of this project does not directly affect the ocean, baseline aquatic surveys were not included in the EIS. Some marine research work has been completed and more is planned in order to obtain baseline data in the event of future marine-related energy projects.

The subject of public use of the shoreline area and access to the site has been addressed in the EIS.

The procedure for rezoning the land has been initiated and is discussed in the EIS.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:NEL10/07

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

ALBERT Q.Y. TOM
Chairman

TELEPHONE NO.
548-6915

STATE OF HAWAII
ENVIRONMENTAL QUALITY COMMISSION
OFFICE OF THE GOVERNOR
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

April 15, 1976

William R. Coops
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96822

SUBJECT: Natural Energy Laboratory for Hawaii

Dear Mr. Coops,

Attached is a request received from Rick Gaffney of the U.H. Sea Grant Office to be a consulted party for the Environmental Impact Statement for the Natural Energy Laboratory at Keahole Point.

Thank you for your attention on this matter.

Sincerely,

Allan Suematsu

Allan Suematsu
Commission Assistant

Attachment

RECEIVED
APR 22 1976
RESEARCH CORP OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Allen Suematsu
Commission Assistant
Environmental Quality Commission
State of Hawaii
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Dear Mr. Suematsu:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/15/76

Receipt of your letter regarding the proposed project is acknowledged. A copy of the environmental assessment has been forwarded to Mr. Gaffney.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/17

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

APR 15 1976

Dear Mr. Coops:

We did not receive our copy of your Environmental Assessment of the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii, until April 12th. Since this was sent March 2nd and comments were due 30 days after receipt, it appears that review now would not be timely.

Some of our Bureaus that might be of assistance are:

U.S. Fish and Wildlife Service
P.O. Box 3737
Portland, Oregon 97208

U.S. Geological Survey
National Center
Reston, Virginia 22070

Bureau of Outdoor Recreation
Box 36062
450 Golden Gate Avenue
San Francisco, California 94102

National Park Service
450 Golden Gate Avenue
P.O. Box 36063
San Francisco, California 94102

A brief review of the assessment does not indicate any Federal involvement at this time. Therefore, we suggest you work directly with our Bureaus in development of the proposal as well as preparation and review of the EIS. If, at a later date, there is Federal involvement we would appreciate receiving 12 copies of the EIS for a coordinated Department review.

Sincerely yours,

Bruce Blanchard, Director
Environmental Project Review

Mr. William R. Coops
Project Administrator
Honolulu, Hawaii 96822

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Bruce Blanchard
Director
Environmental Project Review
U. S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Blanchard:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/15/76

Receipt of your letter regarding the proposed project is acknowledged. The Federal Bureaus mentioned in your letter will receive copies of the EIS.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/16

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

URS RESEARCH COMPANY
A URS Company
841 Bishop Street ■ Suite 2108 ■ Honolulu, Hawaii 96813 ■ (808) 533-3861

April 16, 1976

Mr. William R. Coops
C/O Research Corporation of the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96822

Dear Mr. Coops:

Would you please include URS Research Company as a consulted party for the Environmental Impact Statement being prepared for the Natural Energy Laboratory of Hawaii at Ke-Ahole Point.

Thank you for your help.

Respectfully,

Linden Burzell, Ph.D.
Program Manager

LAB:lm

RECEIVED
APR 21 1976
RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Linden Burzell
Program Manager
URS Research Company
841 Bishop Street, Suite 2108
Honolulu, Hawaii 96813

Dear Mr. Burzell:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/16/76

A copy of the environmental assessment has been forwarded to your office.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/18

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

Advisory Council
On Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

April 21, 1976

Mr. William R. Coops
Project Administrator
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

Dear Mr. Coops:

This is in response to your letter of March 2, 1976 concerning the Environmental Impact Statement Preparation Notice for the First Phase of the Proposed Research Laboratory facilities at Ke-ahole Point, Kailua-Kona, Hawaii County, Hawaii.

It might be helpful to explain the role of the Advisory Council not only in fulfilling its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), but also its mandates from the Congress and the President. The Council was created by the National Historic Preservation Act of 1966 (80 Stat. 915, 16 U.S.C. 470) to advise the President and the Congress in the field of historic preservation. Section 106 of the Act directs the head of any Federal agency considering an undertaking which would affect cultural resources included in the National Register of Historic Places to afford the Council an opportunity to comment on the undertaking prior to its approval. The issuance on May 13, 1971 of Executive Order 11593, "Protection and Enhancement of the Cultural Environment," broadened the Council's area of responsibility. By that Order, Federal agencies were directed to work with the Council to insure that their plans and programs contribute to the enhancement and preservation of non-federally owned cultural resources. It further required the head of any Federal agency to afford the Council an opportunity to comment on all undertakings which would result in the sale, transfer, demolition or substantial alteration of a property under his agency's control or jurisdiction that had been determined eligible for inclusion in the National Register by the Secretary of the Interior. The "Procedures for the Protection of

Historic and Cultural Properties" (36 C.F.R. Part 800) set forth the steps an agency is to follow in obtaining Council comments. For your information, copies of the procedures, the Act, Executive Order 11593 and a flow chart illustrating the steps to be followed by a Federal agency in obtaining Council comment are attached.

The Council on Environmental Quality's "Guidelines for Preparation of Environmental Impact Statements" (40 C.F.R. Part 1500) directs Federal agencies to forward their environmental documents to the Advisory Council for review if the undertaking will affect properties included in or determined by the Secretary of the Interior to be eligible for inclusion in the National Register. The Council's review of these statements is limited to determining whether or not the responsible Federal agency has adequately demonstrated compliance with Section 106 and/or Executive Order 11593. Regardless of whether or not the particular Federal agency files an environmental assessment or impact statement under NEPA, it is responsible to demonstrate compliance with Section 106 and the Executive Order 11593 as applicable. The Advisory Council's comments on an environmental document should not be construed as comments pursuant to Section 106 or Executive Order 11593. The Council only provides those comments through the compliance process detailed in its procedures. Ideally, Council comments will be secured by an agency at the time it prepares the environmental assessment or statement and will be included in the agency's environmental documentation when it is sent out for review and comment by other agencies.

Therefore, as part of its planning process the Energy Research and Development Agency (ERDA) should arrange to have the areas that will be impacted by the undertaking surveyed to identify cultural properties eligible for inclusion in the National Register of Historic Places pursuant to Executive Order 11593, "Protection and Enhancement of the Cultural Environment" issued May 13, 1971, as implemented through the "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800). After the survey is complete, if the ERDA determines, in consultation with the Hawaii State Historic Preservation Officer, that the undertaking will result in an effect on any property included in or eligible for inclusion in the National Register it is required to afford the Advisory Council an opportunity to comment on the undertaking in accordance with the Council's procedures.

I trust the above information will be of assistance to you in the preparation of the proposed environmental impact statement. Should you have questions or require additional assistance, please contact Michael H. Bureman of the Council's staff at P. O. Box 25085, Denver, Colorado 80225, telephone number (303) 234-4946.

Sincerely yours,

Louis S. Wall
Assistant Director, Office
of Review and Compliance

Enclosures

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

August 16, 1976

Mr. Louis S. Wall
Assistant Director
Office of Review & Compliance
Advisory Council on Historic
Preservation
1522 K Street N.W.
Washington, D.C. 20005

Dear Mr. Wall:

SUBJECT: Responses to Comments received on EIS Preparation Notice for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii - Your Letter of 4/21/76

Thank you for the pertinent information concerning the Advisory Council on Historic Preservation. Two archaeological surveys have been completed at the NELH site, and the results are included in the EIS. This inclusion will permit review and evaluation of the area by the appropriate agencies.

Very truly yours,

William R. Coops
Project Administrator

RYR:NELH9/20

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

RICHARD E. MARLAND, PH.D.
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

October 8, 1976

William R. Coops
The Research Corporation of the
University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96814

SUBJECT: Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point

Dear Mr. Coops,

As of this date, this Office has received nine comments on the above subject. An attached sheet lists the responding agencies and/or organizations.

In our review of the EIS, we have found several areas in which the document should expand discussion. We offer the following comments:

1. On page I-3, the EIS states, "Future projects are at present conceptual and the impact of each project cannot be completely defined at this time." However, the EIS Regulations in section 1:12 c. states,

> A group of actions shall be treated as a single action when: (1) the component actions are phases or increments of a larger total undertaking; (2) an individual project is a necessary precedent for a larger project; (3) an individual project represents a commitment to a larger project; or (4) the actions in question are essentially the same and a single statement will adequately address the impacts of any single action.

The future projects should be discussed. For example, table II-1 shows that the OTEC program has been initiated. In addition, the biomass program has not beenadequately described. The table indicates that the program is scheduled for January of 1977. Thus, we recommend that expanded discussions be given to clarify the intent of the NELH and give

the reviewer as much information as possible in an overall view of the proposed energy programs that may or not occur.

2. The EIS indicates on page II-7, "The purpose of the Environmental Impact Statement is to identify and evaluate the potential environmental impact of the NELH support facilities as developed in the Master Plan - Phase I." We recommend that this Master Plan be summarized in the EIS in order for a reviewer to get a better scope of the proposed action. A copy to this would be very helpful.

3. Pages III-3 and 4 indicate that the Hawaiian Owl may inhabit the area. What mitigation measures will be implemented? What effect will the proposed action have on the specie?

4. The statement, "No endangered plant species were found or are known to exist in the area," should be documented.

5. What is the basis for the statement on page V-4, "Construction and operations of the initial facilities should not alter the natural drainage patterns or substantially increase runoff?" Can this be documented? A study has been published by the University of Maryland which examines surface run-off in relation to development. The study shows that surface runoff may increase at least five times more than vacant land. In addition, the water quality of the runoff will probably increase bacterial growth. What impacts will the proposed programs have on the water quality? It should also be noted that the impact on water quality may be a long-term effect. Thus, it is important to consider all future programs as a whole to adequately describe the environmental impacts.

6. Although alternate sites were discussed, has consideration been given to treating the energy programs as separate actions rather than consolidating all the programs at one particular site?

7. What mitigation measures will be implemented to reduce potential aircraft hazards during construction and operation on the action?

8. On page XIII-1, the EIS states that the discussion of unresolved issues will be included only in the Revised EIS. However, it is our contention that these be discussed in the EIS. One of the intents of the Environmental Quality Commission in writing of the EIS Rules and Regulations was to assure that an EIS be an adequate document by the time it is filed. This meant that unresolved issues should be solved or attempt to be solved prior to filing the document. Consequently, this is a content requirement in the EIS Regulations. In section 1:42, it states that "The EIS shall, at a minimum, contain...(a) summary of unresolved issues and either a discussion of how such issues will be resolved prior to commencement of the action, or what overriding reasons there are for proceeding without resolving such problems."

Thus, in our review of the consultation process, many issues were raised in which no resolutions resulted. For example, the Department of Land and Natural Resources indicated that in the event of project termination, restorative measures should be considered. Your response did not reflect this comment.

For brevity and fariness, our Office did not attempt to summarize other commentors. Instead, we strongly recommend that careful consideration given to each comment. In responding to comments during the review process, we also recommend that your responses be sent directly to the commentor with a copy to our Office. If reference is made to the revised EIS in your response, the response should be accompanies by the revised EIS or excerpts of the document to assure that an adequate response has been given.

Further, the EIS Regulations state that accepting authority need not consider responses after the fourteen day response period. However, in order to allow for a more comprehensive response, we will consider responses beyond the fourteen day response period.

We trust that our comments have been helpful to you in preparing the revised EIS. We thank you for the opportunity to comment on the EIS. We look forward to the revised EIS.

Sincerely,

Richard E. Marland
Director

attachment

cc: RM Towill

LIST OF RESPONDING AGENCIES/ORGANIZATIONS

Federal

*Dept. of the Army (Directorate of Facilities Engineering)	Sept. 14, 1976
Dept. of the Air Force	Oct. 5, 1976
Soil Conservation Service	Oct. 5, 1976

State

*Dept. of Social Services & Housing	Sept. 10, 1976
Dept. of Defense	Oct. 5, 1976
Dept. of Health	

County of Hawaii

Planning Dept.	Sept. 13, 1976
Dept. of Parks and Recreation	Sept. 23, 1976

Private Organizations

Hawaii Hotel Association	Sept. 28, 1976
*Shoreline Protection Alliance	Sept. 28, 1976

*comment forwarded by reviewer

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Dr. Richard E. Marland, Director
State of Hawaii
Office of Environmental Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/8/76

Receipt of your letter concerning the subject EIS is acknowledged. The following responses are addressed to the comments in your letter.

1. At this time, the future energy reseach projects to be conducted at the NELH are only conceptual. Because the scope and type of tne future projects depend so heavily upon the results of the basic research and federal funding, it would be futile to attempt to evaluate specific impacts at this time. The descriptions of the future projects and associated impacts in Appendix A of the EIS are general, but are based upon all the presently available information. It is for the above reasons that we have adopted the phased approach to the Environmental Impact Statements. The Phase I NELH development is the subject of this EIS but the concepts for future NELH projects are also included, to the extent of our present knowledge. Future projects of significance will each require an EIS.

   Table II-1 in the EIS has been revised. The original table indicated that the biomass project would begin in 1977. Actually, the first one or two years will be devoted to the basic research necessary to develop data for design and environmental purposes. This basic research will be the primary activity at the NELH site for the first few years, and the section describing it in the EIS has been expanded. Some of the basic research projects, such as the biofouling experiment, have already begun.

2. The Master Plan for the NELH - Phase I is summarized on Pages II-7 to II-12 and Figures II-3 and II-4 of the EIS. It was thought that discussions and summations of the various systems as developed in the Master Plan were adequately covered. The Master Plan is referred to in the EIS as Reference 5.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

3. The reconnaissance study of the flora and fauna of Ke-ahole Point (Reference 6 in the EIS) concluded that the area might be inhabited by the Hawaiian Owl. This conclusion was based upon the habitat observed over part of the area - open grassland with a rodent population. No owls were observed during the field reconnaissance. The initial NELH development will result in a slight loss of the grassland habitat. The loss is negligible, particularly since there will still be extensive areas of grassland, both inside and beyond the project boundaries. Therefore, the proposed action should not have any significant effect on the species and therefore no mitigating measures should be required.

4. The statement on Page V-1 of the EIS, "No endangered plant species were found or are known to exist in the area," was based upon a reconnaissance field survey of the project area, performed in support of the EIS. This source was referenced in the EIS (Reference 6) and has also been noted on the page in question.

5. The statement concerning drainage on Page V-4 of the EIS was not rigorously documented, but all indications are that runoff will not be a problem. The "Kona Community Development Plan" (Donald Wolbrink & Associates, 1975) discusses flood control and drainage problems of Kona. Quoting from the report for the part of the district from Ke-ahole Point northward, "Rainfall for this area reaches a maximum average of forty inches per year, but most of the area receives less than twenty inches per year. The soils of the area are extremely permeable and there is no record of flooding in this area."

   It is apparent from the high permeability of the land, the low annual rainfall, and the small scale of the development as compared to the surrounding open areas, that the facilities will not cause drainage problems. There is no evidence now that a drainage problem exists on the site. This is further born out by the much larger development of the adjacent Ke-ahole Airport which has not experienced any flooding or drainage problems.

   The University of Maryland report mentioned in your letter was most likely addressed to mainland soil conditions. Care should be taken in applying the results to unique conditions, such as the extremely porous and hard lava rock of Ke-ahole Point.

   With no or little increase in surface runoff, there should be no significant impacts upon water quality. Even considering the worst possible case, that of runoff into the ocean during heavy rainfall, the impacts on coastal waters should be insignificant. The occurrences of storm rainfall at Ke-ahole are intermittent and infrequent. Any resultant runoff into the ocean should not result in a chronic, long-term degradation of coastal water quality.

6. Each energy program proposed for the NELH is a separate action, but there are definite advantages to consolidating the various programs at one site. A brief discussion of this subject has been added to Chapter VII of the EIS.

7. The Phase I NELH facility will not affect the operational or safety requirements of the Ke-ahole Airport, therefore, no mitigation measures are required. Future projects will be subject to review and approval by the FAA and the State Department of Transportation.

8. At the time the EIS was filed, it was believed that there were no unresolved issues, and that any such issues would be generated during the public review period. In reviewing the response letters to date, there appear to be two unresolved issues, and these have been included in the appropriate chapter of the EIS. The restoration of the area if the project is terminated has been discussed in Chapter V, and the remaining unresolved issues are:

   a. Parking - The issue of parking for beachgoers was raised by the County of Hawaii Planning Department. At present, the NELH has no provisions for public parking, so vehicles will have to park along the roadway shoulder. The degree of usage of the access road can be observed, and future plans can be made accordingly.

   b. Scope of the EIS - There have been some questions, primarily from the Office of Environmental Quality Control, concerning the scope of the EIS. The main question is the extent to which the EIS for the NELH Phase I facilities should describe the impact of future projects. It is not believed possible at this time to define environmental impacts of projects that are still conceptual. The approach of the NELH is to undertake an EIS for each major project at the site, at the time when enough information is available to allow the EIS to be developed. This approach has been supported in a review letter (October 8, 1976) from the Environmental Center of the University of Hawaii. This issue is also discussed in paragraph 1 of this letter.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYS:W2/1-3

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
APO SAN FRANCISCO 96558
DIRECTORATE OF FACILITIES ENGINEERING

AFZV-FE-EE

14 SEP 1976

Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Gentlemen:

Reference is made to the Environmental Impact Statement (EIS) for the Natural Energy Laboratory of Hawaii at Ke-Ahole Point, Hawaii (Phase I).

We have reviewed the EIS document and have no comments to offer.

Thank you for the opportunity to review the document.

Sincerely yours,

CARL P. RODOLPH
Colonel, CE
Director of Facilities Engineering

CF:
William Coops
The Research Corp of the Univ of Hawaii
402 Varsity Bldg
1110 University Avenue
Honolulu, Hawaii 96822

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Colonel Carl P. Rodolph
Director of Facilities Engineering
Headquarters United States Army
Support Command, Hawaii
APO San Francisco, California 96558

Dear Colonel Rodolph:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 9/14/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/12

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15th AIR BASE WING (PACAF)
APO SAN FRANCISCO 96553

REPLY TO ATTN OF: DEEE (Mr. Nakashima, 4492158)

5 OCT 1976

SUBJECT: Environmental Impact Statements

TO: Environmental Quality Commission
555 Halekauwila St., Room 301
Honolulu, Hawaii 96813

1. This Headquarters has no comment to render relative to the following Environmental Impact Statements:

Natural Energy Laboratory of Hawaii
Ke-Ahole Point, Hawaii

Mountain View Drainage Improvements
County of Hawaii

Proposed Windward Civic Center
Kaneohe, Oahu, Hawaii

2. We greatly appreciate your cooperative efforts in keeping the Air Force apprised of your development projects throughout the State and the opportunity to review the subject statements.

THOMAS L. HEDGE, Colonel, USAF
Director of Civil Engineering

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Telephone: (808) 955-8344

The Research Corporation of the University of Hawaii

November 9, 1976

Colonel Thomas L. Hedge
Director of Civil Engineering
Department of the Air Force
Headquarters 15th Air Base Wing (PACAF)
APO San Francisco, California 96553

Dear Colonel Hedge:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/5/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/09

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

TO: Richard E. Marland, Interim Director,
Office of Environmental Quality Control

RE: Natural Energy Laboratory of Hawaii at Ke-Ahole Pt.

☑ NO COMMENTS.

☐ EIS returned: project does not pertain to SCS activities and/or responsibilities.

☐ EIS received: undergoing review.

Francis C. H. Lum
State Conservationist

10/5/76
Date

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
440 Alexander Young Bldg.
Honolulu, HI 96813

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

HONOLULU, HI 968
PM
5 OCT
1976

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR-101

GIVE
U.S. MAIL

OFFICE OF ENVIRONMENTAL
QUALITY CONTROL
550 HALEKAUWILA ST.-RM. 301
HONOLULU, HAWAII 96813

SCSA-SCS-PORTLAND, OREG. 1973 M7-L-23136

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. Francis C. H. Lum
State Conservationist
U. S. Department of Agriculture
Soil Conservation Service
440 Alexander Young Building
Honolulu, Hawaii 96813

Dear Mr. Lum:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/5/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/5

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

ANDREW I. T. CHANG
DIRECTOR OF SOCIAL SERVICES & HOUSING

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
P.O. Box 339
Honolulu, Hawaii 96809

September 10, 1976

Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Re: Natural Energy Laboratory of Hawaii
at Ke-Ahole Point, Hawaii

Dear Gentlemen:

We have reviewed the subject Environmental Impact Statement and have no comment to offer relating to our program areas.

We are returning the EIS for your usage. Thank you for the opportunity to review and comment on this EIS.

Sincerely,

Andrew I. T. Chang
Director

Attachment

cc: Office of Environmental Quality Control.
William Coops, The Research Corp. of the
University of Hawaii

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. Andrew I. T. Chang
Director, Department of Social
Services and Housing
State of Hawaii
P. O. Box 339
Honolulu, Hawaii 96809

Dear Mr. Chang:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 9/10/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/8

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

VALENTINE A. SIEFERMANN
MAJOR GENERAL
ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
FORT RUGER, HONOLULU, HAWAII 96816

5 OCT 1976

HIENG

Dr. Albert Tom
Environmental Quality Commission
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Tom

Natural Energy Laboratory of
Hawaii at Ke-Ahole Point, Hawaii

We have no comments to offer regarding the Environmental Impact Statement for the subject project.

We would like to retain the copy of the Environmental Impact Statement because our proposed Hawaii Air National Guard facility will be in the adjacent area.

Very truly yours,

WAYNE R. TOMOYASU
Captain, CE, HARNG
Contr & Engr Officer

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Captain Wayne R. Tomoyasu
State of Hawaii
Department of Defense
Office of the Adjutant General
Fort Ruger, Honolulu, Hawaii 96816

Dear Captain Tomoyasu:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/5/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/7

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O.Box 3378
HONOLULU, HAWAII 96801

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

Audrey W. Mertz, M.D., M.P.H.
Deputy Director of Health

James S. Kumagai, Ph.D., P.E.
Deputy Director of Health

Henry N. Thompson, M.A.
Deputy Director of Health

In reply, please refer to:
File: _____

MEMORANDUM

To: Dr. Richard E. Marland, Director
Office of Environmental Quality Control

From: Deputy Director for Environmental Health

Subject: Environmental Impact Statement (EIS) for Natural Energy Laboratory of Hawaii at Ke-Ahole Point, Hawaii

Thank you for allowing us to review and comment on the subject EIS. Please be informed that we have some concerns on this project.

Staff comments are as follows:

(1) The subject EIS states that the sewage of the proposed project will be discharged to the Keahole Airport Sewage Treatment Plant (STP) which is not municipally owned (developed and owned by the State of Hawaii-Department of Transportation). The Keahole Airport STP was approved only to handle the sewage generated by Keahole Airport.

(2) The subject EIS does not indicate whether any industrial waste shall be generated by the project. The quantity and method of disposal should be discussed.

(3) Air quality impacts cannot be determined from the information presented in the subject EIS. A commitment to a more detailed analysis and evaluation of air quality impacts in the future should be made, especially in light of the existing inversion characteristic of the Keahole-Kona area atmosphere, which increases the concentration of air pollutants.

This is Recycled Paper

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

JAMES S. KUMAGAI, Ph.D.

cc: OEQC, HI
William Coops, The Research Corp., UH, HI

This Is Recycled Paper

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Dr. James S. Kumagai
State of Hawaii
Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Kumagai:

SUBJECT: Response to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii, Phase I, Your Memo Undated

Your review of the subject EIS is acknowledged. The following responses are addressed to the comments in your memorandum.

1. A letter (dated 11/8/76) has been sent to the Airports Division, Department of Transportation, requesting that action be taken to request that the permit for the Ke-ahole Airport STP be modified to permit the small amount of domestic sewage from the NELH to be discharged into the Airport system.

2. There will be no industrial waste generated by the laboratory (Phase I). If any industrial wastes are generated by future major projects, this will be addressed in the required EIS for that project.

3. There will be no air quality impact from this phase of the laboratory as no pollutants are generated, and it is not envisioned that any will be generated by future projects. Here again if any pollution could be developed in some unknown future project, it will be discussed in the EIS for that project.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2-21

Enclosure

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 8, 1976

State of Hawaii
Department of Transportation
Airports Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Mr. Owen Miyamoto

Gentlemen:

The master plan for the State of Hawaii Natural Energy Laboratory at Ke-ahole Point, Hawaii proposed that the domestic sewage from the facility be discharged into the existing sewage disposal plant at the Ke-ahole Airport. It is anticipated that the domestic sewage developed will be very small and it is not anticipated that any industrial sewage will be generated at our research facility. It is understood that should the airport needs every develop to require increasing the capacity of the airport plant that the Laboratory would either assist in paying for the cost of the increase or install a separate disposal facility.

The State Department of Health, in reviewing the EIS for the Natural Energy Laboratory, noted the intent to discharge into the airport system. They pointed out that the approval for the sewage treatment plant was made on the basis it was to handle only sewage generated by the airport. They advise that any other use would have to be requested by the Airports Division.

While there is no plan at this time to start immediate action to start on the sewage disposal system for the laboratory, we would like to resolve this matter.

It would, therefore, be greatly appreciated if you would initiate a request to the Department of Health to have the Ke-ahole Airport permit modified to permit the Natural Energy Laboratory discharge its domestic sewage into the airport system.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

Should there be any questions, please contact our Staff Engineer, Bill Heaman, at 948-7654.

Sincerely,

William R. Coops
Administrator

WRC:tm

cc: Bill Heaman ✓
Robert Chun
Dr. James S. Kumagai

COUNTY OF
HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720

HERBERT T. MATAYOSHI
Mayor

RAYMOND H. SUEFUJI
Director

September 13, 1976

Dr. Richard E. Marland, Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, HI 96813

Re: Natural Energy Laboratory of Hawaii
Ke'ahole Point
Environmental Impact Statement

This will acknowledge receipt of a copy of the subject Statement with a request for any comments. Having had earlier opportunities to express our concerns, we have no further comments to offer at this time.

RAYMOND SUEFUJI
Director

RN:rfd
Enclosure

cc: Mayor
Public Works
Research & Development

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. Raymond Suefuji
Director, Planning Department
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Suefuji:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 9/13/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/11

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

DEPARTMENT OF PARKS & RECREATION
COUNTY OF HAWAII

Herbert Matayoshi, Mayor
Milton Hakoda, Director

September 23, 1976

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Subject: Natural Energey Laboratory of Hawaii
Environmental Impact Statement

We have no comments to offer on the subject document and thank you for affording us the opportunity to review the report.

Milton T. Hakoda
Director

enc. (EIS)

• 25 AUPUNI STREET • HILO, HAWAII 96720 • TELEPHONE 961-8311

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. Milton T. Hakoda
Director, Department of Parks
and Recreation
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Hakoda:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 9/23/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/13

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

HAWAII HOTEL ASSOCIATION
SUITE 907
2270 KALAKAUA AVENUE
HONOLULU, HAWAII 96815
TELEPHONE 923-0407

September 28, 1976

Mr. Donald Bremner
Deputy Chairman
State of Hawaii
Environmental Quality Commission
Office of the Governor
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Dear Mr. Bremner:

Thank you very much for your letter of September 21 regarding the Environmental Impact Statement for Natural Energy Laboratory of Hawaii at Ke-ahole Point.

I have no comments to make on the subject at this time but thank you for the opportunity.

Mahalo and aloha,

Adi W. Kohler
President
Hawaii Chapter

Please reply to:
P. O. Box 218
Kamuela, Hawaii 96743

American Hotel & Motel Association

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. Adi W. Kohler
President, Hawaii Hotel Association
Suite 907
2270 Kalakaua Avenue
Honolulu, Hawaii 96815

Dear Mr. Kohler:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 9/28/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/6

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

P. O. BOX 4247
HONOLULU, HAWAII 96813
TEL: 523-2400

SHORELINE PROTECTION ALLIANCE

September 28, 1976

Mr. William Coops
The Research Corporation of the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96822

Re: Draft EIS for the Natural Energy Laboratory of Hawaii

Dear Mr. Coops:

Thank you for the opportunity to comment on the draft EIS. There is only one point that I would like clarified in the final EIS. Is it proposed that the public be allowed access to all of the shoreline at Ke-Ahole Point or would public access be restricted from some of the shoreline?

Respectfully,

Douglas Meller
Secretary

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. Douglas Meller
Secretary
Shoreline Protection Alliance
P. O. Box 4247
Honolulu, Hawaii 96813

Dear Mr. Meller:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 9/28/76

Your review of the subject EIS is acknowledged. In response to your question, it is the intent of the NELH and the County of Hawaii that the public will have access to all of the shoreline at Ke-ahole Point. The only possible exception to this would be areas that required restriction for purposes of public safety, for example, those which might contain exposed machinery or pipelines. The Phase I development of the NELH, described by this EIS, will result in no such restrictions. Future projects are still in the conceptual stage; however, any which might lead to restriction of shoreline access would be the subject of an Environmental Impact Statement.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/4

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

F 211
FCU

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

RE:0211

Office of the Director

October 8, 1976

JMT2		SKY	
DR			
CM			
REC'D OCT 18 1976 RMTC			
JK		RDP	
MY		DKA	

MEMORANDUM

TO: William R. Coops
Research Corporation, University of Hawaii

FROM: Doak C. Cox, Director
Environmental Center

Natural Energy Laboratory of Hawaii
at Ke-ahole Point, Hawaii (Phase I)
Draft Environmental Imoact Statement

In accordance with our standard review procedures, we have solicited the assistance of the following members of the University in the preparation of this review:

Harold L. Baker, Ag. Res. Econ.
Brent Gallagher, Oceanography
Charles Lamoureux, Botany
Jacquelin N. Miller, Environmental Center
Steve Smith, Hawaii Institute of Marine Biology
Ray Tabata, Sea Grant
Pat Takahashi, Civil Engr.

Impacts of the potential actions whose utility and feasibility may be disclosed by the research are very great. A requirement that such secondary impacts be analyzed as secondary impacts of the research before the research is undertaken would, however, be futile, unless the nature of the potential actions is fairly certain in advance. In many cases research is necessary to determine what environmental impacts will stem from the potential actions, and it would be absurd to require a statement on such impacts before the research required to determine them can be undertaken. In general, then, the concerns of an EIS system in relation to research relate to its primary environmental impacts, those that will result from the research undertaking itself.

Significant primary environmental impacts are unlikely in the case of most research projects, particularly those undertaken in the office or laboratory. Field projects, however, may have significant impacts, and in some cases very

important impacts, and this is particularly true in the case of "pilot projects" or "demonstration projects" in which in nature and scale the research approaches those of final actions. For such projects even the secondary impacts of the research itself (as distinct from the impacts of subsequent action) may be significant. Hence it is appropriate that environmental impact statement system requirements apply to such projects.

It appears from the NELH Phase I EIS that the establishment of the NELH consists of the designation of a site and the construction of some facilities for the future conduct of field research that may involve a variety of scales but is expected to include some that will be of "pilot" or "demonstration" scale. Because the nature of the actual field research to be undertaken is somewhat problematical at the moment, it is appropriate that the environmental assessment needs be met in stages, and that the Phase I EIS relate to the combination of:

1) The environmental impacts of the support facilities to be provided in Phase I construction (as covered in the text of the current EIS);

2) The general nature of the probable impacts of the major kinds of research thatare likely to be undertaken at the site (as is covered in the appendix); and

3) A plan for subsequent environmental assessment and EIS preparation as necessary prior to the undertaking of any of the actual research or the construction of the special facilities for this research, as the actual research plans are developed (as described in the Summary).

Although the Environmental Center was provided with an opportunity to contribute to the development of the NELH EIS in the consultation phase, and although the Center received many comments on the Assessment that was made available for such consultation, the Center did not actually contribute in that phase. Hence its identification as an "Organization consulted in the preparation of the EIS" (p. XI-2) may be misleading.

We find that most of the criticisms of the Assessment submitted by our reviewers have been met in the EIS itself. Comments and questions that remain pertinent are keyed to page (p) number.

pp. II-8 to II-12. Utilities.

We suggest that reference be made to table II-3 for the rationale for the selected capacities of the electrical and communications facility, the water supply facility, and the sewerage facility.

p. III-4, P.1, l.5. Flora.

Does "caper" refer to Hawaiian endemic pua-pilo or maiapilo (Capparis sandwichiana var. Zoharyi)? To our knowledge "caper" is not used as its common name in any source with which we are familiar.

p. III-5, P.2., l.2. Wildlife.

Paragraph 2 states, "Other animal species present in the coast zone are insects, the gecko, and the skink." There are several species of both geckoes and skinks in Hawaii. This reference is imprecise.

p. III-5, P.2., ls. 7-8.

The sentence "No species found at the ponds are exotic or considered endangered," is confusing, although not incorrect. Exotics are species introduced by man, and would not be expected to be endangered. Endangered species in Hawaii, without exception, are native species, not exotics.

p. V-8, P.1. Agriculture.

". . . the project site is not zoned as agricultural and is lava with no agricultural potential." A site does not have to be physically productive to be suitable for agriculture, for example, floral nurseries or intensive livestock activities where climate and location are important.

p. V-8, P.2. et seq. Airport development and operations.

The significance of the noise levels from the existing and future airport runway to the use of the proposed NELH facilities should be discussed. Might electronic noise generated by the NELH interfere with aircraft communication noise or navigation?

p. V-5, P.3. Site access.

How much coastline will be made accessible by the completion and opening of the NELH access road? Fig. II-3 indicates the road coming in south of the lab site, providing access to coast toward the south, but the lab itself might bar access to the north. How much additional area is really opened up? There are already roads to the coast at Honokahau not far to the south. There are other jeep roads used by local residents now. More precise figures should be given.

p. A-1. Future Alternate Energy Systems.

Are natural energy alternatives not discussed, such as geothermal energy, wave-power and salinity gradient, possible with investigation of the NELH site?

p. A-5, P.2., ls. 1-2. Marine environment.

"The impact might result in a shift in the planktonic speciation in the immediate vicinity of the discharge." What is probably meant is that the impact might be a shift in the species composition in that vicinity.

p. A-14. Potential impacts.

Might any visual pollution be expected from the circulation of the deep, nutrient rich water used in OTEC systems? Would there be any cloud-over-coral-reef effect? Outgoing and incoming aircraft will fly over this area. It would not be a favorable impact on tourism if cloudy water pollution was evident.

We appreciate the opportunity to review this EIS.

cc: OEQC
R. M. Towill Co. (attn: F. Doyle)
Contributors

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Dr. Doak C. Cox, Director
Environmental Center
University of Hawaii at Manoa
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Dr. Cox:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/8/76

Your review of the subject EIS is acknowledged. In Chapter XI of the EIS, we have listed all organizations that reviewed the Environmental Assessment and the first draft of the EIS as those consulted. The responses below refer to the keyed comments of your October 8 letter.

1. Utilities - On Page II-7, which describes the Phase I development, the sizing of the utility systems is referred to Table II-3, which gives the projected personnel and utility requirements in the year 1990.

2. Flora - "Caper" in the EIS refers to the pua-pilo, as it is known locally. The common name "caper" is taken from the scientific name, and is listed in the book "Gardens of Hawaii," by Marie C. Neal.

3. Wildlife - The reference to the gecko and the skink in the EIS has been clarified. The species actually observed are listed on Page III-5 of the EIS; the gecko (Lepidodactylus lugubris) and the skink (Ablepharus boutoni poecilopleuris).

4. Exotic and Endangered Species - The word "exotic" was dropped from the description of the organisms in the pond.

5. Agriculture - The objective of the paragraph on agriculture (Page V-8) was to indicate that the NELH facility was not going to be developed on prime agricultural land. The paragraph has been slightly modified for greater clarity. The activities listed in your letter (nurseries and intensive livestock) have no reason to be attracted specifically to Ke-ahole Point instead of to the other open areas along the coast.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

6. Airport Development and Operations - The noise levels at the NELH site from the present airport runway do not present a problem, due to the 2,300-foot distance from the runway to the utility terminus at the eastern boundary of the project. However, if the second runway is constructed the sound source will move to within 960 feet of the utility terminus.

The FAA has developed noise contour curves for the takeoff and landing patterns of various aircraft. These contours are based upon actual measurements and are official FAA noise descriptor methods. The noise contour curves plot the 85 dB(A) contour. The actual determination of noise effects is complex, and depends upon not only the noise levels, but also the number of exposures, the length of explosures, and the time of day at which the noise occurs. However, as a simplification, the 85 dB(A) level can be taken as the boundary between tolerable and intolerable noise.

Hawaiian and Aloha Airlines fly DC-9 and 737 jets, respectively. The noise contours for these aircrafts, with modified engines, were used to determine the limits of the 85 dB(A) noise. Contours for modified engines were used because the nation's jets are being retrofitted with quieter engines to meet new FAA noise regulations. By 1980, or long before the new runway is completed, the retrofit should be complete.

With the modified engines, the 85 dB(A) contour extends a maximum of 900 feet from the runway centerline, or almost to the utility terminus. Future major projects at the NELH, whose life span may coincide with the operation of the second runway, may have to take into account the noise problem. The NELH site is beyond the 85 dB(A) contour, however, noise levels even approaching 85 dB(A) may be unacceptable for certain projects.

There are several measures that could be taken to alleviate such a problem:

a. Locate all buildings away from the eastern boundary of the NELH site,

b. Plant trees or hedges as noise breaks,

c. Design the buildings for noise reduction.

The Phase I NELH facilities will not generate electronic "noise" that could interfere with airport operations. Future NELH projects will have to be approved by the Federal Aviation Administration and the State Department of Transportation to ensure that the safety of airport operations is not compromised.

7. Site Access

It is the intent of the NELH that the public will have access to all of the shoreline at Ke-ahole Point. The only exception to this would be if future projects required restriction of certain areas for reasons of public safety. Such a restriction would be thoroughly discussed in the EIS for the particular project.

The access road parallels the coastline for approximately 3,000 feet. The recreational area opened up by the access road will extend beyond this 3,000-foot length. The jeep trails used by residents are rough and suitable only for four-wheel drive vehicles.

8. Future Alternate Energy Systems

Geothermal energy is not within the scope of the NELH research. In addition, Ke-ahole Point has no known potential for the development of geothermal energy.

The salinity gradient off Ke-ahole Point will be measured as part of a program to develop data necessary for the design of future projects. If the gradient is such that it is a resource for energy extraction, this could be a possible project for the NELH.

There may be some preliminary testing of a wave pump off Ke-ahole Point, however, the actual operation will probably be in an area with a more favorable (i.e., rougher) wave climate.

9. Marine Environment - The sentence in question (Page A-5) has been reworded as follows, "The impact might be a shift in the planktonic speciation in the immediate vicinity of the discharge."

10. Potential Impacts - Preliminary indications are that there will be no turbidity pollution generated by the OTEC operation. Several basic research projects are planned for the NELH site in order to define environmental impacts and design criteria, and are discussed in greater detail in the revised EIS. One of these basic projects will develop information on the effect of mixing high nutrient cold water with warmer surface waters.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/14-16

cc: State of Hawaii
Office of Environmental Quality Control

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER (mep)
Fourteenth Coast Guard District
677 Ala Moana
Honolulu, Hawaii 96813

16475
6 OCT 1976

Mr. William Coops
The Research Corp. of the
University of Hawaii
402 Varsity Bldg., 1110 University Ave.
Honolulu, Hawaii 96822

Dear Mr. Coops:

Staff review of the "Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-Ahole Point, Hawaii (Phase I)" has been completed. The Coast Guard has no comments to offer on this phase of the project though we look forward to reviewing future phases of development of the NELH for possible comment at that time. There is no objection to the project being implemented as stated therein.

The opportunity to review and comment on this environmental impact statement is appreciated.

Sincerely,

J. V. CAFFREY
Captain, U. S. Coast Guard
Chief of Staff
Fourteenth Coast Guard District

Copy to:
COMDT(G-WEP-7)
CEQ Washington DC
EQC Hawaii

RESEARCH CORP. OF THE
UNIVERSITY OF HAWAII

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Commander
Fourteenth Coast Guard District
677 Ala Moana Blvd.
Honolulu, Hawaii 96813

Dear Sir:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/6/76

Your review of the subject EIS is acknowledged. The Fourteenth Coast Guard District will be kept informed as to future phases of the development.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/10

cc: State of Hawaii
Office of Environmental Quality Control

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

GEORGE R. ARIYOSHI
GOVERNOR

JOHN FARIAS, JR.
CHAIRMAN, BOARD OF AGRICULTURE

YUKIO KITAGAWA
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
1428 SO. KING STREET
HONOLULU, HAWAII 96814

October 28, 1976

MEMORANDUM

To: Environmental Quality Commission

Subject: Natural Energy Laboratory of Hawaii at Ke-Ahole Point, Hawaii - TMK: 7-3-10: Por. 33)

The proposed project will have no adverse impact upon agricultural activities in the foreseeable future.

Thank you for the opportunity to comment.

John Farias, Jr.

JOHN FARIAS, JR.
Chairman, Board of Agriculture

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. John Farias, Jr.
State of Hawaii
Department of Agriculture
1428 South King Street
Honolulu, Hawaii 96814

Dear Mr. Farias:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Ltr. of 10/28/76

Your review of the subject EIS is acknowledged. Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/20

cc: State of Hawaii
Office of Environmental Quality Control

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, CORPS OF ENGINEERS
BLDG. 230, FT. SHAFTER
APO SAN FRANCISCO 96558

PODED-P

6 October 1976

Mr. William Coops
The Research Corporation of the University of Hawaii
402 Varsity Building
1110 University Avenue
Honolulu, Hawaii 96822

Dear Mr. Coops:

We have reviewed the environmental impact statement for The Natural Energy Laboratory of Hawaii at Ke-Ahole, Hawaii (Phase I). The following comments are offered for your consideration.

a. Although the Phase I development is not expected to affect the marine environment off Ke-Ahole Point, the statement should recognize that flourishing coral communities exist nearby. The results of marine biological surveys should be included in future studies to assure that potential impacts of anchoring and mooring systems and discharge of heated or nutrient enriched waters are adequately assessed.

b. Pink coral is usually found at depths of 1,200 feet and no shallower than 600 feet. The methods and source of observation of pink coral at depths less than 500 feet (p. III-7) should be documented.

c. The discussion of construction period impacts, particularly of the marine construction effort, p. V-11, should be described in more detail.

d. Should geothermal energy projects be included among future research projects, potential air emission impacts should be given careful consideration.

RECEIVED
OCT 12 1976
RESEARCH CORP.
OF THE U OF H

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

e. The reference to a 1971 amendment by Congress of Corps of Engineers permit authority, p. XIV-1, is unclear. Paragraphs d (1)-(3) of our 2 April 1976 comments cite the appropriate authorities for Department of Army permit requirements which would be applicable to this project.

Sincerely yours,

WM. J. MATTHEWS
Acting Chief, Engineering Division

CF:
Office of Environmental
Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Telephone: (808) 955-6344

The Research Corporation of the University of Hawaii

November 9, 1976

Mr. William J. Matthews
Acting Chief, Engineering Division
Department of the Army
Honolulu District, Corps of Engineers
Building 230, Fort Shafter
APO San Francisco 96558

Dear Mr. Matthews:

SUBJECT: Responses to Comments Received on the Environmental Impact Statement for the Natural Energy Laboratory of Hawaii at Ke-ahole Point, Hawaii (Phase I) - Your Letter of 10/6/76

Receipt of your letter concerning the subject EIS is acknowledged. The following responses are addressed to the comments in your letter.

1. The EIS does mention (page III-7) the high percentage of coral coverage on the bottom off Ke-ahole Point. An ongoing biological survey is presently being conducted off Ke-ahole Point. This study represents the first attempt to obtain baseline data on fish and benthic organisms in the area. Specific biological transects are being run, and can be repeated in order to determine seasonal or long range variations. Results of the baseline study will be used in future Environmental Impact Statements.

2. The EIS was in error on the depths of the pink coral zone, and has been corrected. The research submarine Sea Cliffe conducted a dive off Ke-ahole Point on July 26, 1974 (described in Reference 2 of the EIS). The bottom was inspected between the depths of 3,500 feet and 350 feet. Various depth zones of the transect were described and pink coral was noted as a common organism in the zone between the 900 and 400-foot depths. No further breakdown of the zone was given.

3. The "construction period" referred to is not a Phase I development, but possibly part of a future energy program. At this time the exact nature of the future research projects is unknown, and impacts cannot be discussed in detail. The impacts, assuming that there is a marine construction effort, are briefly described in Appendix A of the EIS.

4. Geothermal energy projects are not within the scope of the Natural Energy Laboratory of Hawaii, and there are no indications of geothermal potential at the Ke-ahole site.

402 Varsity Building, 1110 University Avenue, Honolulu, Hawaii 96814

5. The reference in the EIS pertaining to the Congressional amendment (page XIV-1) has been dropped, in keeping with the level of detail elsewhere in the Chapter.

Thank you for your interest in this project.

Very truly yours,

William R. Coops
Project Administrator

RYR:W2/17-18

cc: State of Hawaii
Office of Environmental Quality Control

XIII. SUMMARY OF UNRESOLVED ISSUES

Thirty-seven response letters were received during the preparation and review of the Environmental Assessment and the Environmental Impact Statement. The letters were received, answered, and changes were made where appropriate in the EIS. Two unresolved issues remain:

1. Parking - The issue of parking for beachgoers was raised by the County of Hawaii, Planning Department (March 15, 1976). At present, the NELH has no provisions for public parking at the site, and vehicles will have to park along the roadway shoulder. The degree of public usage of the access road can be observed and future plans made accordingly.

2. Scope of the EIS - There have been a few questions, primarily from the Office of Environmental Quality Control, concerning the Scope of the EIS. The main question is the extent to which the EIS for the NELH Phase I facilities should describe the impact of future projects. At this time, the future projects are conceptual and subject to change over the next few years. The nature of the changes depends to a great extent on Federal funding levels and the results of ongoing basic research and baseline data collection at the site. The approach of the NELH, which has been described earlier in this EIS (Chapters I and II), is to undertake an EIS for each significant project at the site, at the time when enough information is available to allow the EIS to deal with specific issues. This phased approach was supported in a letter of comment from the Environmental Center of the University of Hawaii (October 8, 1976). Such an approach, with accurate and up to date information, permits the desired evaluation of Phase I and the proposed projects by governmental agencies and the general public. An additional advantage of this approach is that each future energy project will be reviewed on its own merits and not as part of a general plan.

XIV. LIST OF NECESSARY APPROVALS

The development of the Ke-ahole site will require extensive government approval. The many government agencies having jurisdiction over the proposed projects at Ke-ahole are listed below.

A. Federal Agencies

1. Federal Aviation Administration (FAA)

The FAA has jurisdiction over the safety and operation of the Ke-ahole Airport system. As such, any development or proposed construction which will affect the Airport operation must be cleared through this agency. In particular, any construction underneath the "clear zone" flight paths of the Airport runways will have to meet FAA requirements.

2. United States Coast Guard (USCG)

The USCG will have jurisdiction over construction which will interfere with the operation or performance of the Ke-ahole Lighthouse. Also, any traversing of the USCG property with utility lines, power cables, etc., will require an easement from the USCG.

3. U. S. Army Corps of Engineers (COE)

The COE has responsibility for all construction work within the "navigable waters" of the United States and also has responsibility for insuring environmental protection in this area. Any work which involves construction or installation of facilities seaward of the shoreline boundary will require the filing of a permit application and an environmental assessment with the COE.

B. State of Hawaii

1. Department of Land and Natural Resources (DLNR)

DLNR has the responsibility for administering permits for construction within conservation districts. In the absence of rezoning to an "Urban" designation, a Conservation District Use Application (CDUA) must be filed with the DLNR prior to any construction on this site. All leases, subleases and conveyance of property rights to individual energy researchers will require action by DLNR through the State Attorney General and the State Surveyor. A CDUA will also be required for any construction work on the ocean bottom off Ke-ahole Point.

2. Department of Transportation (DOT)

All access and utility connections to the main highway will require the review and approval of the Highways Division, DOT, and the connections will have to meet standard DOT requirements. All construction seaward of the shoreline will require review and approval of the Harbors Division. Also, since the present NELH site is under the jurisdiction of the Airports Division, all proposed development and planning for this project must be reviewed and approved by the Airports Division. In addition, the connection of utility systems to the existing Ke-ahole Airport systems will require the consent and approval of the Airports Division prior to construction.

3. Department of Health (DOH)

The responsibilities for controlling air and water pollution are handled by the State DOH. In particular, sewage disposal methods for this site will be required to meet the DOH Public Health Regulations.

C. County of Hawaii

1. Planning Department

All major developments will require review and approval of the County Planning Department prior to construction. It will also be required (prior to any major development for the individual research projects), that this site be rezoned to an "Industrial" classification by the Planning Department. Construction must then meet the requirements of the County Zoning Ordinance.

Since the site is located in a "Special Management Area," (under the provisions of the Shoreline Protection Act of 1975), this EIS detailing effects of proposed development at the NELH site must be submitted and approved by the County Planning Department prior to filing permits with any other government agency.

2. Bureau of Building Construction and Inspection, Department of Public Works

All construction must be approved by the Building Department and a building permit issued prior to construction. In general, the obtaining of the building permit will be the final step necessary in obtaining government approval for any proposed development at this project site.

3. Department of Public Works (DPW)

As required in Ordinance 168, recently passed by the County of Hawaii, all clearing and grubbing, excavations, mass grading or other earthwork will require review and approval by DPW and the issuance of a grading permit.

APPENDIX A

FUTURE ALTERNATE ENERGY SYSTEMS

APPENDIX A - FUTURE ALTERNATE ENERGY SYSTEMS

A. Overview

The NELH Phase I Master Plan includes specific area allocations for OTEC (land based and floating), solar, and biomass experimental programs. Others may be accommodated in the reserved open area. Because of the significance to Hawaii of these programs, a brief description of each is included in this Appendix together with preliminary comments on their environmental impacts. A specific Environmental Assessment/Impact Statement will be required prior to the implementation of any of these future energy programs.

An artist's conception of the developed NELH site at Ke-ahole Point layout is presented in Figure A-1.

B. Land Based OTEC

1. Description

The Preliminary OTEC Proposal (Ref 18) of the Research Corporation of the University of Hawaii proposes a progressive research and development program beginning with small scale experiments in existing facilities, followed by construction of a land based facility to test components and subsystems, and finally a full scale prototype operation (land based or floating OTEC plant).

The proposed land based facility will consist of a 1 to 5 MW pilot plant, to be used for testing and evaluating various OTEC components. The pilot plant and components will be kept as small as possible for economy and flexibility, yet large enough to permit extrapolation of the data for prototype design. The heart of the system will be the heat exchangers where liquid ammonia will be vaporized to drive the turbines which will turn the

electric generators. Cold water is used to condense the ammonia before its return to the vaporizer where the cycle is repeated.

Site requirements for the pilot plant are:

a. A 1-5 MW power substation;

b. 250-1000 cubic feet per second of cold water, and an equal amount of warm water, with at least a 30°F temperature differential,

c. Approximately 7 acres of land near the ocean,

d. A means of disposing of up to 5 MW of power while the pilot plant is operating,

e. Facilities for housing the test equipment, laboratories, shops and offices.

The 4-12' diameter supply and discharge pipes are the dominant features of the pilot plant. The cold water intake pipe will be 6,000 feet long and reach a 2,000-foot depth in the nearby ocean. It is uncertain whether one or two discharge pipes will be used; there is a possibility of mixing the warm and cold discharge water and using only one discharge pipe. Pipes may be trenched in the nearshore area for protection against wave attack. As an approximation, the cold water temperature will be raised 4-5°F by the process and the warm water will be cooled an equal amount.

The operation of the land based pilot plant will probably continue even after completion of a floating OTEC prototype, in order to test second generation components.

2. Potential Impacts

a. Pipeline Construction

The large diameter intake and discharge pipelines will have an adverse effect on the physical environment of the shoreline and offshore reef areas, particularly during the construction phase. However,

once the lines are in place, the backfill (probably large armor stone) covering should quickly become new habitat areas. Preliminary surveys indicate a high percentage (15-90 percent) of coral coverage in the areas out to 100 feet deep (Ref. 2). The pipeline design must consider means to minimize trenching, with its inevitable adverse impacts. The pipeline routing must consider the archaeological sites, either avoiding them or providing for salvage or relocation of significant sites which prove unavoidable.

b. Marine Environment

An obvious potential impact of the pilot plant is the discharge of up to 1000 cubic feet/second of cold, nutrient-rich water into the shallow surface waters.

The nearshore waters off Ke-ahole Point are classified as Class "AA" waters and polluting discharges into these waters are prohibited. Nearshore waters are defined in the Public Health Regulations, Department of Health, State of Hawaii, (Ref. 19), Chapter 37A as "all coastal waters lying within a defined reef area, all waters of a depth less than ten fathoms or waters up to a distance of 1,000 feet offshore if there is no defined reef area and if the depth is greater than ten fathoms." The offshore waters beyond these boundaries are classified as Class "A" water into which polluting discharges are permitted, providing such discharges are in conformance with the National Pollutant Discharge Elimination System.

Discharges from NELH operations would, therefore, be required to be conveyed beyond 1,000 feet from shore to Class "A" waters or a change in classification of the nearshore waters from Class "AA" to Class "A" would be required. If conformance with these regulations is impractical, a variance would have to be requested from the Department of Health.

A preliminary oceanographic investigation was conducted off Ke-ahole Point during the summer of 1974 (Ref. 2). The data collected were used to make a theoretical first estimate of the scale of the physical impact that would result from operating a 20 MW experimental OTEC plant at Ke-ahole Point. Certain assumptions were made concerning the discharge, among them that the cooling and heating waters were mixed prior to discharge, and that the discharge was at a depth of 70 feet.

The analyses indicated that the 20 MW plant operation would have little effect on the marine environment except in the immediate area of the discharge. The thermal impact would be recognizeable against the background of diurnal fluctuations only in the immediate area of the discharge plume (approximately 1.5 sq. miles). The benthic organisms in this area would be adversely affected to some extent. The impact from the nutrient addition and resulting biostimulation would be confined to the immediate discharge site (0.4 sq. miles) with diurnal fluctuations masking any changes beyond this point.

The above figures are only a first estimate, but at least indicate the order of magnitude of the expected impact. The 2.5 MW plant would have significantly less impact than those described above for the 20 MW plant, since flow volumes of cold water are 500 cubic ft./sec. and 1,800 cubic ft./sec., respectively. Impact on the benthic organisms, particularly corals, can be minimized by selective positioning of the outfall diffuser.

Plankton, particularly larval stages of some marine organisms, are susceptible to rapid temperature changes. In the generating process, the cold water will be heated approximately 5°F, and the warm

water will be cooled by an equal amount. If the waters are mixed, the temperature of the warm water will be lowered another 14°F. This large temperature drop may be lethal to plankton in the warm water and may be a determining factor in the choice between a mixed discharge or two separate ones discharging at ambient temperatures. A high percentage of plankton mortality could result in an adverse impact, considering the volume of warm surface waters to be pumped through the pilot plant. Kona coast surface waters have higher nutrient concentrations than waters elsewhere in the State, because of freshwater percolation from the land mass and the onshore movement of upwelled water. This natural increase in nutrient levels and the resulting plankton biostimulation is a possible cause of the successful sport fishing in the Kona area. If this biotic chain does exist, any large scale interference would be significant.

The impact might be a shift in the planktonic speciation in the immediate vicinity of the discharge. The ultimate result of an increase in natural nutrients to the area is expected to be an increase in plankton biomass in the surrounding area with beneficial results to sportfishing.

c. Availability of Electric Power

The pilot plant may become an exporter of electrical energy and this output could be fed into the existing HELCO grid and be available to the Kona area. However, electrical generation at the pilot plant will probably be sporadic, particularly during the early years when equipment is being tested and new components are being shifted into the operating system.

An increase in available electrical power of 2.5 MW, particularly a sporadic increase, will not have a significant impact on the Kona economy. A recent economic analysis (Ref. 2) indicated that the Kona area could easily absorb a 5 to 10 MW increase in output. The 2.5 MW increase will have little effect on the existing island-wide 124 MW grid, and should be absorbed by the expected increased demand in Kona.

d. Future Energy Programs

The construction and operation of the proposed test facility would have an additional significant impact beyond those discussed previously. The OTEC facility would be the major project at the NELH, and should act as a "seed" program in attracting other energy related projects. It will also place Hawaii in a position of leadership in the development of alternate energy sources. This leadership should result in national recognition and publicity, and would in turn attract other research-oriented industry to the area. The State and County governments have encouraged this type of development for the island of Hawaii.

In addition, the successful operation of the 2.5 MW power plant would be a large first step toward lessening Hawaii's dependence upon imported petroleum.

C. Floating Prototype OTEC Plant

1. Description

A major objective of the OTEC program is to develop a full-scale floating demonstration or prototype plant for initial operation in the early 1980's. The estimated power range of the plant is 100 to 1,000 MW. The final size will be determined by technical, environmental and economic tradeoffs based upon the pilot plant operation and component testing. Figure A-2 shows a representative conceptual design of the

floating plant. The hull will be approximately 350 feet in diameter and 172 feet high. An underwater electrical cable will transmit the generated power to shore. The location of the full-scale prototype will not necessarily be directly off Ke-ahole Point. The location to a great degree would be determined by the requirement for electric power. Ke-ahole Point is ideal for power generation but other candidate locations exist in the Hawaiian Islands, such as the Kawaihae area approximately 30 miles to the north of the NELH site and Barbers Point on the Island of Oahu. Barbers Point is adjacent to a very active industrial area (Campbell Industrial Park) which might utilize a large part of the electric power generated by the OTEC plant.

2. Potential Impacts

a. A large floating OTEC plant would have impacts on the marine environment similar to those previously discussed for the 2.5 MW pilot plant, but of larger magnitudes, because of the greater volume of cold water. The specific offshore location selected will be a significant input to the environmental assessment. The large plant will have no direct effect on benthic organisms because the plant will be in at least 2,000 feet of water and the bottom will not be affected. The extent of some expected impacts on the marine environment of full scale 100 and 240 MW OTEC floating plants were evaluated in Ref. 3. The results are summarized below:

(1) The cold water discharge would cause a cooling of the surface water, with a maximum temperature decrease of 0.6/1.2°F within the immediate discharge area for the 100/240 MW plant. The surface cooling would result in an increase in heat flow from the atmosphere to the water, lowering the air temperature at the surface approximately 1°F. Effects of this atmospheric heat loss on the local micro-climate were not analyzed.

The thermal impact could be minimized by returning mixed discharge waters to a depth of water at which the temperatures are identical.

(2) Significant temperature changes were defined as those recognizeable within the normal daily fluctuations with the resulting affected areas being 11/16 sq. miles for the 100/240 MW plant. The maximum temperature change in the mixed layer was estimated to be less than or equal to 1°F.

(3) Zooplankton fluctuations are on the order of 100 percent in Hawaiian waters, with phytoplankton fluctuations unknown, but assumed to be similar. A normal background fluctuation of 25 percent was assumed and it was concluded that biostimulation due to the cold water discharge would be significant in an area of .6/1.7 sq. miles for the 100/240 MW plant.

Another possible impact is the potential damage to the plankton and larval stages of organisms, caused by the temperature decrease and/or shock as the warm surface waters pass through the heat exchangers. Results will be similar to those discussed in the preceding section for a land based OTEC plant. Heat exchanger design data for both plants and further research will be necessary to define the biological impacts. The average surface water temperature in Hawaii is approximately 75°F. The expected temperature drop through the heat exchangers is not yet determined, but a 4-5°F drop has been estimated.

b. A large floating offshore platform would be visually intrusive and a physical obstacle to boats. However, the visual impact could be acceptable, particularly if the platform does not have the stigma of environmental degradation.

The platform may be an obstacle to boaters but the surface area taken up will be negligible compared to the extent of the offshore waters. The site could become a point of interest, particularly to tour boat visitors.

c. The large volume of nutrient-rich water brought to the surface could become a valuable by-product if open ocean mariculture is developed in conjunction with the plant development. Lack of an abundant water supply and low priced lands are critical obstacles to successful aquaculture in Hawaii. Open sea mariculture bypasses the land problem and the OTEC plant will supply the nutrient-rich water as a by-product with no associated pumping costs.

d. The present electrical production is approximately 124 MW for the island of Hawaii and 1,250 MW for the State. The greatly increased power available from an OTEC plant generating 100 to 1,000 MW of power would have a significant impact on the social and economic environment if all of this power were used in the Kona area.

The projection of the impacts of the availability of large amounts of electrical energy depends upon the price at which it is available and the price of the energy from conventional sources. These figures are unknown at this time. At least a range of costs is needed for a statistical analysis and even this is not available so the discussion of the significance of possible impacts is conjectural.

An economic analysis (Ref. 2) estimated that the maximum useable output on the island of Hawaii of a new plant within the remainder of the century would be 35 MW, assuming the price of the energy was cost-competitive.

A plant larger than 35 MW leads to several possibilities:

(1) Replacement of the existing oil burning generator units on the island. Immediate beneficial effects would be a reduction in air pollution and an increase in energy self sufficiency;

(2) Assuming an abundant supply of relatively low cost energy, energy intensive industries could be attracted to the area of the OTEC plant. An example of this would be the manganese ore (nodules) processing industry.

(3) If the required energy storage technology (hydrogen storage systems or equivalent) is developed, the island of Hawaii could become an energy exporter. Hydrogen storage would involve the construction of a plant to produce liquid hydrogen and liquid oxygen by the electrical dissociation of sea water.

e. The Environmental Task Force of the Committee on Alternate Energy Sources for Hawaii (Ref. 1) established criteria by which to judge the significance of the impacts of potential alternate energy systems. The Task Force placed the OTEC concept in the group rated as one of the least damaging to the environment. Table A-1 shows the impact ratings of the alternatives.

f. OTEC is particularly attractive because it is on a scale large enough to hold the promise of energy independence for Hawaii. In addition, it is not site-specific, and if it is successful on the island of Hawaii, it can be applied elsewhere in the State or where other suitable ocean conditions exist. The project is in the exploratory stage and the various environmental, social and economic impacts can be better defined as the project advances. The economic and environmental tradeoffs

will have to be compared with those of a land based fossil fuel plant with an equivalent capacity.

D. Solar Energy Programs

1. Description

The development of a solar energy research facility is one of the goals of the Natural Energy Laboratory at Ke-ahole Point. Hawaii receives more solar energy annually than most places in the U.S. (Ref.1), and is a natural test site for new solar energy systems.

There are presently 3 basic techniques of solar energy conversion:

a. Photovoltaic conversion makes use of solar cells with special films for the direct production of electrical energy. The system is technically feasible, but cost is prohibitive at present. A break-through in the cost of the solar cells is needed to make this technique commercially feasible.

b. Low temperature solar heat collection uses flat plate collectors with circulating water being heated in internal piping in good thermal contact with the plates. These collectors are being commercially produced, and are suitable for installation in homes and offices for water heating and air conditioning.

c. High temperature collectors concentrate solar energy through focusing or filtering of the sun's radiation to make steam or heat water to a sufficiently high temperature to set up an efficient thermal power cycle to generate electric power. This technique is complex, and still in the developmental stage.

It appears that the use of the NELH, with regard to solar energy, will be as a test center for the various systems being developed. The feasibility of high temperature collectors and the photovoltaic method for the generation of electricity is dependent on present research.

2. Potential Impacts

a. The environmental advantages of solar energy systems exceed most other energy sources. They are non-polluting and use a renewable resource. Referring to Table A-1, solar energy was rated as one of the least severe in terms of impact, making it a desirable energy source, if economically feasible. The only significant physical impacts of a solar energy test system would be the land area needed for the collectors and/or focusing arrays and the visual impact if the system were sufficiently large.

A significant beneficial impact would be the establishment of a "clean" industry, however small, in the Kona area. In addition, it would be a step toward energy independence for Hawaii.

A solar energy test facility at the NELH will provide the data that will allow a determination of the economic and technical feasibility of various energy sources. Hawaii stands to benefit from such an evaluation because of the potential applicability of the full-scale systems in Hawaii.

E. Biomass Conversion and Aquaculture

1. Description

Operation of a 2.5 MW OTEC pilot plant would be a stimulus to biomass conversion or aquaculture development because of the availability

of large amounts of nutrient-rich waters; however, the OTEC plant is not a prerequisite. The techniques of the conceptual biomass conversion and aquaculture operations are not clearly defined at this time. The first step in either process would be the cultivation of algae. The algae could then be converted into fuel (biomass conversion) or used as the first level of a food chain for aquaculture.

The floating OTEC plant will pump large quantities of nutrient-rich waters to the surface. This water may be considered a waste product to be disposed of with as little environmental impacts as possible or it could become a valuable resource for open ocean mariculture.

2. Potential Impacts

The number of jobs created by the biomass conversion/aquaculture facility will depend upon the size and automation of such a facility, both of which are unknown at this point. The same holds true for the significance of the facility as a food source.

The discharge from the biomass conversion/aquaculture will be into waters classified AA, the highest category in Hawaii. The biomass conversion/aquaculture operations could filter the nutrients from the deep cold waters, making them more acceptable for discharge into the surface waters, or they could add their own waste products to the discharge. The actual effect of biomass conversion/aquaculture upon the water flowing through the OTEC system cannot be definitely determined at this time.

Successful production of fuel from biomass conversion or food from an aquaculture facility would have significant beneficial impacts. The fuel production would assist Hawaii's efforts toward energy independence, and both the food and fuels should have beneficial effects on the economics of the island of Hawaii and the State of Hawaii.

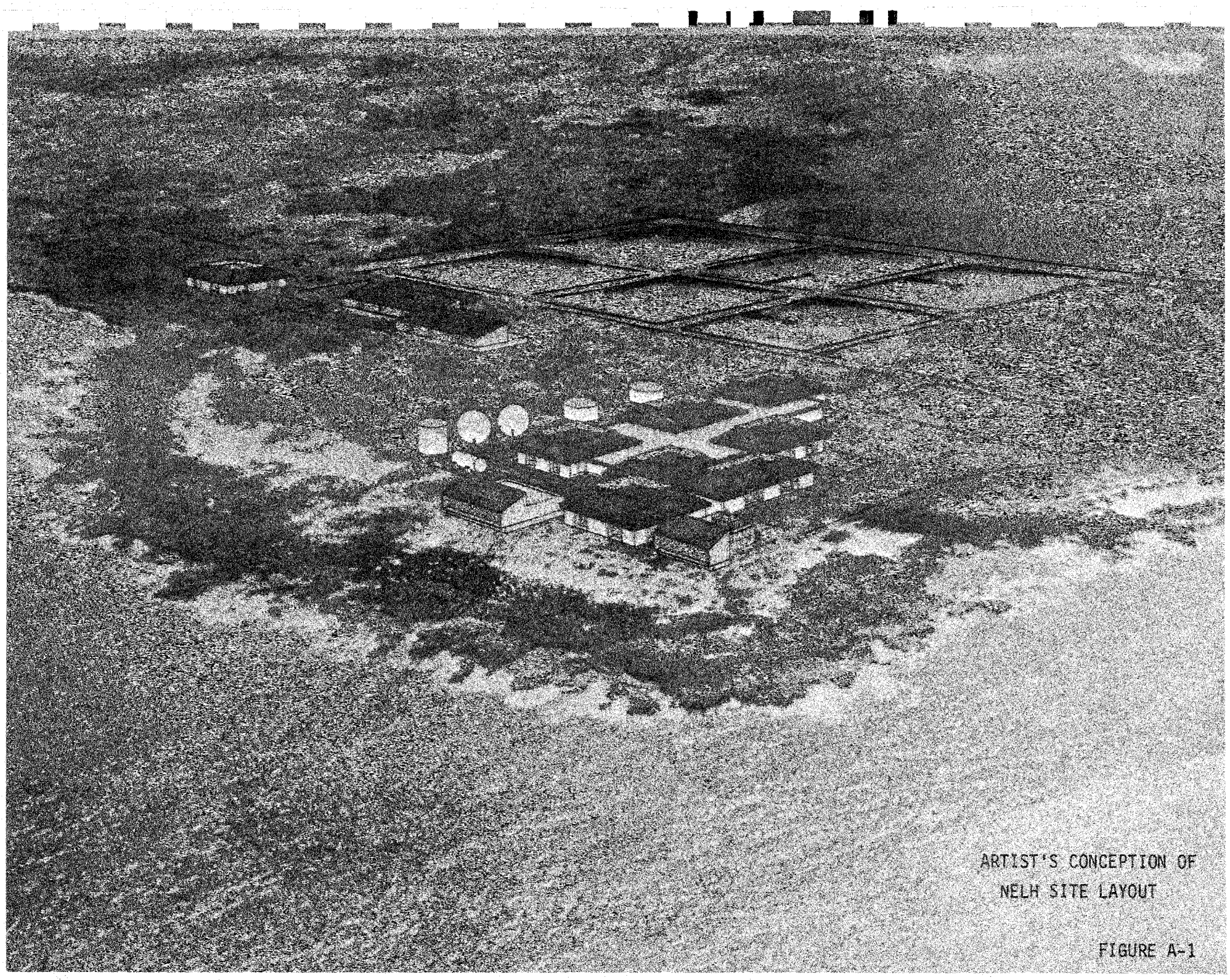
TABLE A-1

SURVEY OF ENVIRONMENTAL IMPACTS OF ALTERNATE ENERGY SOURCES
(Ref. 1)

Impact	Alternate Sources																	
	Solid Waste		Bioconversion						Hydroelectric	Wind	Geothermal	Solar	OTEC	Waves	Coal			Nuclear
	PUROX	Garrett	Fuel	Gas	Forest	Cane	Pine	Other							Land-based	Ocean-based	Liquid	
Total	28	27	40	25	38	28	28	34	19	26	38	26	28	28	39	35	33	37
Energy Resources Depletion	1	1	2	3	4	1	1	2	1	1	3	1	2	1	4	4	4	2
Area Committed for Conversion	3	3	3	2	4	1	1	4	-	3	3	4	3	4	3	2	2	3
Area Committed for Transmission	1	1	2	1	2	1	1	1	3	3	3	3	3	3	2	2	2	2
Water Consumption	2	3	4	2	2	3	3	3	1	1	3	1	3	1	2	3	2	4
Use of Air Space	1	1	2	1	1	1	1	1	1	3	2	3	1	2	1	1	1	1
Air Pollution	1	2	4	2	3	3	3	3	1	1	2	1	1	1	3	3	3	1
Water Pollution	2	1	3	1	2	2	2	2	1	1	3	1	2	1	4	4	3	2
Construction Activity	3	2	2	3	3	3	3	3	3	3	4	3	3	4	3	1	3	4
Heavy Metals or Toxic Substances	3	1	3	1	1	1	1	1	1	1	2	1	1	1	2	2	1	2
Thermal Discharge	2	2	4	3	4	4	4	4	1	1	3	1	2	2	2	3	4	4
Solid Waste	2	2	2	1	2	2	2	2	1	1	2	1	1	1	3	3	2	2
Visual Intrusion	2	2	3	1	4	2	2	4	2	3	3	3	1	4	3	1	2	2
Noise Generation	3	3	3	2	4	2	2	2	1	2	2	1	1	1	3	2	1	1
Public Health	1	2	2	1	1	1	1	1	1	1	2	1	2	1	2	1	1	3
Transportation Hazard	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	3	2	4

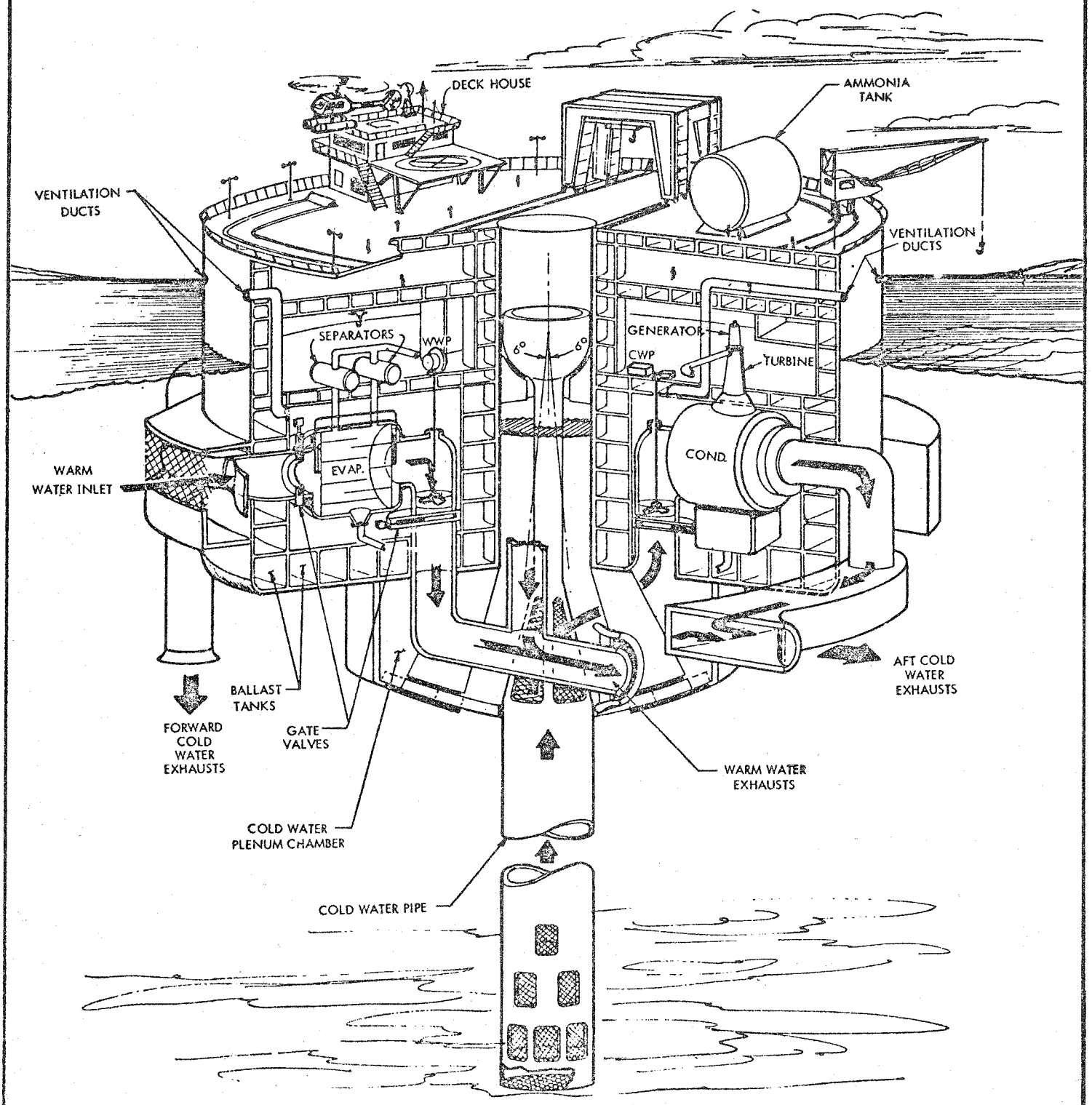
Impact Severity Rating: 1-negligible, 2-light, 3-moderate, and 4-severe

This chart represents the work of the Environmental Task Force in its assessment of the alternate energy reports.



ARTIST'S CONCEPTION OF
NELH SITE LAYOUT

FIGURE A-1



The Research Corporation
of the
University of Hawaii

PROPOSED OTEC FULL SCALE PLANT
(AFTER TRW CORP & Ref. 20)

R. M. TOWILL CORPORATION
PLANNERS-ENGINEERS-SURVEYORS-PHOTOGRAMMETRISTS

FIGURE A-2

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