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October 5, 1990

Norman A. Oss
President

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

Attention: Mr. William W. Paty

Gentlemen:

Subject: Conservation District Use Permit HA-2258 for the Pohoiki
Geothermal Transmission Line at Puna, Hawaii

Thank you for your recent letter requesting verification of Condition 1.
As you requested, I am enclosing a copy of Decision and Order No. 10620.

If you have any questions on the matter, please contact Clyde Nagata at
969-0321.

Sincerely,

Norman A. Oss
Norman A. Oss
President

NAO:CHN:ts

Enclosure

DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE OF HAWAII

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BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

In the Matter of the Application of)
HAWAII ELECTRIC LIGHT COMPANY, INC.)
For Approval to Commit Funds in
Excess of \$500,000 for Two 69 kv
Transmission Lines Through a
Residential Area.)

DOCKET NO. 6523

DECISION AND ORDER NO. 10620

Filed May 8, 1990
At 8:40 o'clock A.M.

Bertha F. Kurosawa
Chief Clerk of the Commission

ATTEST: A True Copy
BERTHA F. KUROSAWA
Chief Clerk, Public Utilities
Commission, State of Hawaii.

Bertha F. Kurosawa

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

In the Matter of the Application of)
HAWAII ELECTRIC LIGHT COMPANY, INC.)
For Approval to Commit Funds in)
Excess of \$500,000 for Two 69 kv)
Transmission Lines Through a)
Residential Area.)

Docket No. 6523

Decision and Order No. 10620

DECISION AND ORDER

I.

INTRODUCTION

By an application filed on September 6, 1989, the Hawaii Electric Light Company, Inc. (HELCO) requests the Commission's approval to construct two overhead 69 kv electric transmission lines at an estimated cost of \$10 million. The transmission lines are to be strung from Puna Geothermal Ventures (PGV) planned geothermal facility at Pohoiki to HELCO's Puna substation. Portions of the lines will run through or border along residential areas. Included in the estimated \$10 million is the cost of constructing a switching station at Pohoiki. While the transmission lines are to be constructed by HELCO, the switching station is to be constructed by PGV and turned over to HELCO upon completion.

HELCO seeks the Commission's approval pursuant to General Order No. 7, which requires such approval for any expenditure by a utility exceeding \$500,000. HELCO also seeks approval pursuant

to Hawaii Revised Statutes (HRS) section 269-27.5, which requires the Commission's approval for the construction of new overhead transmission lines in excess of 46 kv through residential areas.

Copies of HELCO's application were served upon the Division of Consumer Advocacy, Department of Commerce and Consumer Affairs (Consumer Advocate).

On September 25, 1989, the Puna Community Council (PCC) filed a motion to intervene and become a party to this proceeding. On October 3, 1989, by Order No. 10358, the Commission denied the motion for its failure to conform to the requirements of rule 4-1 of the Commission's Rules of Practice and Procedure. The Commission allowed PCC a seven day extension from the service date of Order No. 10358 to file an amended application to intervene.

On October 10, 1989, PCC, through its attorney Cynthia Melen, Esq., filed an amended motion to intervene and become a party. By Order No. 10380, the Commission on November 2, 1989, granted PCC's amended motion and directed HELCO and PCC to meet and develop a prehearing order.

On November 7, 1989, the Commission held a public hearing pursuant to HRS section 269-27.5 at the Pahoehoe High and Elementary School Cafetorium, Pahoehoe, Hawaii. On December 13, 1989, the Commission issued a prehearing order (Order No. 10420), the filing of which was stipulated to by the parties.

On January 12, 1990, the Consumer Advocate filed a statement of position in which it advised the Commission that it would not submit testimony or exhibits in this proceeding and that it believed that the proposed lines are required and should not be

placed underground. On January 29, 1990, the Consumer Advocate amended its position and stated that it would participate in the hearing to ask questions concerning the relative safety of the proposed project.

On January 24, 1990, PGV filed a motion to intervene or in the alternative to participate in this matter, but on January 29, 1990, it withdrew its motion. By means of Order No. 10504, the Commission granted PGV's motion to withdraw its motion to intervene or participate. At the time of the hearing, on the request of PGV, the Commission allowed PGV to participate in the proceeding, limited, however, to the issue of the cost of the transmission lines and for the purpose of protecting the rights of PGV's officers, employees, and consultants who might be called as witnesses.

On February 6, 1990, Cynthia Thielen withdrew as counsel for PCC, and PCC entered an appearance pro se through its past president Ronald Phillips and its current president Donald Jacobs.

A hearing on the application was held on February 7th and 8th, 1990, at the Hilo State Office Building, conference rooms A & B, 75 Aupuni Street, Hilo, Hawaii. Thomas W. Williams, Jr., Esq., appeared on behalf of HELCO. Brenda M. Hoernig, Esq., appeared on behalf of the Consumer Advocate. PCC appeared pro se through Ronald Phillips and Donald Jacobs.

The parties filed their respective opening briefs on February 21, 1990. HELCO and PCC filed their respective reply briefs on February 28, 1990.

II.

ISSUES

The prehearing order set forth the following as issues in this docket:

A.

1. Whether construction of the overhead 69 kv transmission lines through residential areas at PGV's cost is reasonable and consistent with the public interest. In making this determination, it may be appropriate for the Commission to consider, among other factors:
 - a. The cost of constructing, maintaining and operating the proposed transmission lines overhead versus the costs of constructing, maintaining and operating all or part of the proposed transmission lines underground.
 - b. Provisions of State and Federal law and of the State Energy Plan encouraging the development of alternate energy resources.
 - c. The impact, if any, of the proposed transmission lines on the environment, including the health, electronic communications and property values of Puna area residents.
 - d. HELCO's rights to place the transmission lines within the proposed routes pursuant to its franchise and to permits issued HELCO by other governmental agencies.
2. Whether HELCO's application for approval to commit funds for the construction of two overhead 69 kv transmission lines, that are to be paid for by PGV, should be approved by the Commission pursuant to Rule 2.3(g)(2) of General Order No. 7.

B.

1. Whether construction of the two proposed 69 kv high voltage electric transmission lines overhead along Highway 130, also known as the Keaau-Pahoa Highway, constitutes a potential hazard to health and safety which warrants constructing these lines underground.
2. Whether placement and construction of two 69 kv high voltage electric transmission lines, either overhead or underground, will insure safety or security of

the public if the system is not also designed to prevent the load to the geothermal generating facility from being disconnected where such disconnection could cause major venting of the geothermal power plant releasing, inter alia, toxic hydrogen sulfide gas.

3. Whether approving the construction of two overhead 69 kv high voltage electric transmission lines from PGV's geothermal plant to the HELCO substations is in the public interest before modifications are instituted to the load distribution system of the substations to ensure the systems are adequate to distribute the 25 mw of power to the Big Island grid.

In the prehearing order, the Commission declared that HELCO has the burden of proof as to the issues under Section A. With respect to the issues under Section B, the Commission ordered that HELCO has the ultimate burden of persuading the Commission that the construction of the proposed transmission lines is generally safe, prudent and in the public interest; but that the intervenor PCC has the burden of proof as to any specific assertion it may make that (1) the construction of the proposed 69 kv transmission lines, whether overhead or underground, constitutes a potential hazard to health and safety; (2) the system must be designed to prevent the load to the geothermal generating facility from being disconnected to insure safety or security of the public; and (3) public interest requires that modifications to the load distribution system of the substations be made before the Commission approves the construction of the overhead 69 kv transmission lines.

III.

HELCO'S PROPOSED TRANSMISSION LINES

A.

HELCO's proposed transmission lines will connect PGV's planned geothermal facility at Pohoiki to HELCO's Puna substation. The need for the transmission lines arises out of HELCO's purchased power arrangements with PGV. PGV is the successor in interest to Thermal Power, with whom HELCO had an as-available purchased energy contract, dated March 24, 1986. On March 25, 1986, by Decision and Order No. 8692, the Commission approved HELCO's request to include in its fuel adjustment clause the energy payments to be made under that contract. In July 1989, HELCO and PGV entered into a firm capacity amendment which commits PGV to deliver 25 MW of firm capacity to HELCO by December 31, 1990 (with a grace period of two months) and to pay for two 69 kv transmission lines to interconnect PGV's facility with HELCO's electric system and for a switching station at Pohoiki. The Commission, in Decision and Order No. 10519, filed on February 14, 1990 in Docket No. 6498, found the capacity payments to be made to PGV under the firm capacity amendment to be in the best interest of the general public and authorized HELCO to recover that payment from the ratepayers. The Commission concluded that the 25 MW of firm capacity to be received by HELCO to be essential for HELCO to meet its projected peak load.

The construction of the proposed two transmission lines and switching station, for which approval is sought in this docket, is in pursuance of the firm capacity amendment. As provided in the agreement, PGV will pay for the construction of both the lines and

the switching station, although the transmission lines will be built by HELCO and the switching station by PGV.

B.

The proposed alignments of the transmission lines were selected after a route selection process that included participation by community groups and governmental agencies. The selected alignments--Alignments A and B--are not the most direct or the most inexpensive routes. Initially, HELCO's consultant recommended routes that would have substantially shortened the routes and reduced construction costs by \$4 million, but the routes would have cut across existing subdivisions, which was not acceptable to the community. PGV has agreed to the additional costs that would be incurred with the selected alignment to minimize the impact on the Puna area residents.

The first of the two transmission lines (Alignment A) will be 17 miles long. It will originate from the western edge of the geothermal site, cross Pohoiki Road and enter Nanawale Forest Reserve, a State conservation district. It will run through the forest reserve along the northeasterly boundary of Leilani Estates subdivision and then through Puna Sugar Company land, following a dirt road along the northwest edge of Leilani Estates subdivision toward Kalapana Road. Alignment A will then cross Kalapana Road and continue across former sugar cane fields and along an existing road to Highway 130, just north of Pahoia town. From this point, the alignment will be located within the Highway 130 right of way, on the mauka side of the highway, for 9.7 miles. About one-half

a south of Keaau, Alignment A will cross Highway 130 and follow paved road northeast to connect to the main power grid near the a 69 kv substation. For the entire length of the line along highway 130, new poles will be installed which will support (in addition to the 69 kv line) the 12.47 kv distribution line and telephone lines that are now on existing poles which will be removed. The cost of Alignment A is approximately \$4.3 million.

The second transmission line (Alignment B) will be 8.2 miles long. It will originate on the northern edge of the geothermal site, cross Kapoho Road, and head northwest across open vacant land to the edge of Nanawale Farm ranch lands. It will then continue along the outside edge of the ranch lands and Nanawale Estates subdivision to the northeast corner of Nanawale Estates subdivision. The alignment will then cross a triangular tip of Nanawale Forest Reserve, then run along the northwesterly boundary of Nanawale Estates subdivision, and then proceed northeast through State agricultural district land and across Kahakai Boulevard to the edge of Hawaiian Home Lands' Maku'u property. From there, the alignment will travel southwesterly on State land, adjacent to Maku'u, to Highway 130 and then head northwest within Highway 130 right of way on the makai side of the highway for 5.5 miles until it is north of Hawaiian Paradise Park subdivision. Once it clears the subdivision, the alignment will be routed toward the former railroad right-of-way, now an existing jeep trail. It will continue to follow the jeep trail to the 8.5 Mile Camp, at which point it will take the most direct route to the Puna substation. The line will interconnect with one of the two existing 69 kv

transmission lines running out of HELCO's Puna substation towards the Kaumana substation. Along Highway 130, the new poles for Alignment B will support a 34.5 kv subdistribution or radial line, serving the Puna area, and the existing 34.5 kv line and the poles on which they are currently situated will be removed. The cost of Alignment B is approximately \$4.4 million.

The two transmission lines will be constructed in two phases. Alignment A will require 11 months and Alignment B will require nine months to complete. The first transmission line will utilize part of Alignment B during the first phase of construction to avoid extended disconnection of the existing 34.5 kv line serving the Puna area while the two 69 kv transmission lines are being constructed.

The difference between the estimated \$8.7 million cost of the two transmission lines and the total cost estimate of \$10 million represents the estimated cost of constructing the switching station at Pohoiki. As stated above, the switching station will be constructed by PGV and, upon its completion, will be turned over to HELCO.

The State Department of Land and Natural Resources has approved the routing of the transmission lines through the Nanawale Forest Reserve, and the Department of Transportation has indicated that it will approve the installation of the transmission lines along Highway 130.

IV.

POSITIONS OF THE PARTIES

HELCO asserts that the construction of the proposed transmission lines is in the public interest because it: (1) will enable HELCO to satisfy its need for firm capacity from PGV; (2) will help HELCO improve its service reliability in the Puna area; and (3) is essential to the development of PGV's geothermal facility, which will promote the State's goal of energy self-sufficiency and greater utilization of renewable energy resources. HELCO maintains that the construction of the overhead lines will be safe and prudent and that construction of the lines underground is not justified because of the substantial difference in the costs of overhead construction and underground construction. It notes that PGV will not be able to afford the costs of underground construction.

PCC opposes the proposed interconnection of PGV's facility to HELCO's system, on the ground that the construction of these lines will not be safe, prudent or in the public interest. Specifically, it alleges that HELCO's load distribution system is inadequate to assure the uninterrupted distribution of the 25 MW of power and asserts that, if there is an interruption of service and HELCO is unable to accept PGV's power, PGV's geothermal plant would have to vent steam containing hydrogen sulfide. PCC claims that such venting poses a substantial threat to the health of those living in the community.

PCC, further, opposes the overhead construction of the transmission lines along Highway 130 and urges that, if they are

to be constructed at all, they should be constructed underground. It bases its position on the following: (1) a downed transmission line pole across Highway 130 could block the only highway access to Puna and prevent emergency vehicles from reaching their destinations; (2) overhead lines would adversely affect the natural beauty and views of the area, resulting in a reduction of property values; and (3) the potential health effects from the electric and magnetic fields emanating from the transmission lines warrant the placement of the lines underground as a matter of prudent risk avoidance.

The CA does not oppose the installation of the two 69 kv transmission lines overhead and along the routes proposed by HELCO.

V.

DISCUSSION

The Commission finds that the construction of the proposed transmissions lines is necessary, if HELCO is to be assured of firm capacity from PGV. The capacity to be furnished by PGV is required to improve HELCO's service reliability in the Puna area. The Commission further finds that the construction of the overhead lines is reasonable, will be safe and prudent, and is in the public interest.

PCC has earnestly and sincerely advanced arguments against, and expressed deep reservations about, the prudence and safety of the proposed transmission lines. The Commission, however, is unable to agree with the PCC's position.

A.

PCC's chief reason for opposing the construction of the proposed lines is its belief that the system interconnecting the PGV facility to HELCO's system is inadequate to assure uninterrupted distribution of the 25 MW of power from PGV's geothermal facility. PCC argues that if there is an interruption of service such that HELCO is unable to accept this power, under the present design technology as proposed by PGV, PGV's plant would have to vent steam, containing hydrogen sulfide, from the geothermal wells. PCC asserts that the toxic and lethal nature of hydrogen sulfide is such that a venting of this gas would jeopardize the health and welfare of the surrounding communities.

The evidence in the case indicates that while it is possible for a total interruption of service to HELCO to occur, it is not very likely. HELCO's proposal includes two separate 69 kv lines. They will be constructed in such a manner that if one line trips out, the other line will be able to carry the whole 25 MW of power. It would be an unusual situation for both of the 69 kv lines to experience interruption at the same time.

Even if both lines should trip, resulting in a total interruption of service or disconnection to the HELCO system, there would be no vertical venting of steam out of the wells. The disconnection will activate the emergency generator and trigger the steam turbines which will divert the flow of steam around the turbines and release the steam through the plant's emergency steam release facility. The steam release facility consists principally of two state of the art rock mufflers which are designed to

dissipate the steam's acoustic energy. Each of the mufflers is designed to handle 100 per cent of the maximum total plant steam. Sodium hydroxide would be introduced into the rock mufflers to abate the hydrogen sulfide. As a result of this procedure 96 per cent of the hydrogen sulfide would be abated over the first four hours and thereafter there would be an abatement of 98 per cent of the hydrogen sulfide. Under this procedure, the emissions of hydrogen sulfide would amount to 0.01 parts per million. Thus, the plant's steam release facility should be able to handle any serious or life-threatening problems with hydrogen sulfide.

Testimony in the case notes that two events must simultaneously occur before there could be any unabated vertical release of hydrogen sulfide: (1) the two transmission lines would have to fail; and (2) the PGV's emergency generator that would otherwise activate the steam release facility would have to fail. The simultaneous occurrence of these events is unlikely. However, even if they should occur, the amount of the hydrogen sulfide emitted would not pose a life-threatening or serious threat to the communities' health and welfare.

Heavy concentrations of gaseous hydrogen sulfide is a dangerous poison. Concentrations of 1,000 to 3,000 parts per million have been reported to produce deaths when breathed for any considerable period. It is reported that the maximum concentration which the average individual can tolerate for one hour is 200 to 300 parts per million. The side-effects of this gas, in a less than lethal dosage, can be fainting, headaches, and nausea.

B.

PCC argues that if the transmission lines are allowed to be constructed, they should be laid underground, and not strung overhead, for safety and aesthetic reasons.¹ It asserts that poles bearing overhead transmission lines can fall as a result of accidents or storms, blocking access by emergency vehicles to the Puna community; that overhead transmission lines disturb the view plane and results in diminution of property values; and that overhead transmission lines emit electric and magnetic fields that are hazardous to health. These arguments are not supported by the evidence.

(1)

It is indeed possible, as the PCC points out, for the poles bearing the transmission lines to fall across Highway 130 as a result of an accident or storm; and the PCC presented evidence on the frequency of accidents on Highway 130.² However, considering the precautions that HELCO is required to take by the State, we view such risks to be minimal. One of the conditions imposed by the State Department of Transportation for its approval of this project is that HELCO must install metal barriers around the poles to protect them from errant vehicles. In addition, HELCO

¹PCC does not object to the proposed routing of Alignments A and B. It objects only to the stringing of the transmission lines overhead along Highway 130.

²The evidence presented by PCC showed that Highway 130 traffic count for April 1986 was 11,604 vehicles per day and for April 1989 it was 13,223 vehicles per day. The evidence further showed that for the years 1987 to 1989, there were 376 accidents, from all causes, on Highway 130.

intends to use sturdier poles for the lines along Highway 130. Further, near Highway 11, where the two transmission lines converge on one pole, the single pole would be located off of the edge of the pavement and built in an area on a high bank that is not readily accessible to vehicles. Moreover, as one of PCC's own witnesses pointed out, even if Highway 130 is blocked by a fallen pole, there are private roads which may be used to bypass any such blockage.

(2)

The Commission agrees that laying transmission lines underground promotes aesthetics and preserves scenic views. However, the utility has the responsibility to minimize the cost to ratepayers in providing reliable electric service. As noted below, the cost of placing transmission lines underground is very high and the burden of that cost ultimately falls upon the ratepayers. Thus, unless (1) there is a compelling reason (which outweighs the costs) to place the lines underground or (2) there is a stated public policy requiring the lines to be laid underground or (3) the ratepayers as a whole consent to bear the high cost of putting the lines underground, we do not believe that we should require HELCO to place the transmission lines underground. That placing the transmission lines overhead may obstruct one's view plane, in and of itself, is not sufficient cause to require the ratepayers to bear the cost of laying the lines underground. PCC has not demonstrated the presence of any

factor that provides an adequate basis for requiring HELCO to place the transmission lines underground.³

(3)

The PCC has failed to prove that overhead transmission lines emit electric and magnetic fields so as to pose an undue hazard to the health and welfare of the people in the vicinity of the lines. While concerns about such fields have been expressed in the literature, none of the literature reaches any definitive conclusion about the potential hazards of such electric and magnetic fields.

The Commission is satisfied that HELCO will construct the transmission lines in conformity with the overhead construction standards of the Commission's general order No. 6; that the transmission line design is based on sound engineering principles; and that the lines as constructed will be safe. HELCO has demonstrated that the transmission line design will meet the design standards set by the California Public Utility Commission's general order No. 95 and will even exceed the requirements of the National Electrical Safety Code; that by mainland standards, 69 kv transmission lines are not extremely high voltage lines; that the electric and magnetic fields of the Pohoiki-Puna substation transmission lines would probably be less than most 69 kv lines on

³The State Department of Transportation has rules concerning the preservation of scenic views along state highways under certain circumstances. (Department of Transportation Administrative Rules section 19-105-6.) Those rules apparently do not apply in this case. The Department of Transportation has already given its preliminary approval for the overhead construction of the first transmission line.

the mainland because of the extra ground clearance required by this Commission's general order No. 6; and that any electric and magnetic fields generated by the lines would be comparable to those already produced by distribution lines, wall wiring, appliances, and lighting fixtures in residential homes.

To support its contention that the electric and magnetic fields emitted by the proposed transmission lines would pose a serious threat to health, PCC introduced a number of documents and articles detailing concerns regarding the health effects of electric and magnetic fields. PCC presented none of the authors of these documents and articles as witness nor offered the testimony of any other expert on the matter. PCC, however, emphasizes in particular two documents as evidencing the potential dangers of electric and magnetic fields to health.

The first of these, identified as PCC Exhibit No. 3, is a report to the legislature of the State of California by the California Public Utilities Commission, in cooperation with the California Department of Health Services. The report is entitled, "Potential Health Effects of Electric and Magnetic Fields from Electric Power Facilities," and is dated September 15, 1989. PCC asserts that by this report the California legislature recognized the growing concern of electric and magnetic fields. PCC notes that Exhibit No. 3 specifically declares that electric and magnetic fields: (1) may present a significant cancer risk; (2) may be related to an increase of incidents of leukemia; and (3) may be related to an increased risk of cancer for electrical utility

workers. However, as HELCO points out, the report makes the following regulatory recommendation (at page B-4 of Exhibit No. 3):

It is recommended that California take no action at the present to regulate electric and magnetic fields around electric power facilities. Any such actions are premature given the current scientific understanding of this public health issue. Too little is known presently to be able to determine where or what rules would provide useful protection. Existing research data are not sufficient for adequate accurate risk assessment. We do not know which components, if any, of electric power utility operations pose significant health hazards. Although biological effects are clearly established, the relationship of these effects to possible public health risks is not yet established.

The second document which PCC emphasizes is a publication of the U.S. Congress, Office of Technology Assessment, entitled, Biological Effects of Power Frequency Electric & Magnetic Fields--Background Paper, publication No. OTA-BP-E-53 (Washington, DC: U.S. Government Printing Office, May 1989). This document is identified as PCC Exhibit No. 4. Portions of the document were read into the record. Among the portions read into the record is the statement that electric and magnetic fields, such as those produced by electric power systems, have been identified as an environmental agent which poses a potential threat to public health. However, also included in the portions read into the record is the following excerpt found on page 3 of Exhibit No. 4:

As recently as a few years ago, scientists were making categorical statements that on the basis of all available evidence

there are no health risks from human exposure to power-frequency fields. In our view, the emerging evidence no longer allows one to categorically assert that there are no risks. But it does not provide a basis for asserting that there is a significant risk." (Emphasis added)

(4)

An important consideration in deciding whether the transmission lines should be placed underground is the cost of doing so, particularly if that cost must ultimately be borne by the ratepayers. Placing the lines underground requires that trenches be dug along the length of their route along Highway 130 and that manholes, measuring 7 feet by 14 feet and 6-1/2 feet deep, be built for maintenance purposes.

HELCO's estimate of constructing the lines underground is \$44 million, substantially more than the estimated \$10 million to string the lines overhead. The burden of paying the additional cost of \$34 million, if the transmission line is placed underground, will rest on the ratepayers. Although PGV has agreed to pay for the transmission lines, its agreement is with respect to transmission lines that are strung overhead. PGV is will not pay for the cost of laying the lines underground. We find that the cost of placing the transmission lines underground is prohibitive and not in the best interests of the ratepayers on the island of Hawaii.

VI.

ULTIMATE FINDINGS

The Commission finds:

1. Construction of the proposed two overhead 69 kv transmission lines is necessary to interconnect PGV's geothermal facility at Pohoiki with HELCO's system.
2. The proposed transmission lines will allow PGV to deliver 25 MW of firm energy capacity to HELCO.
3. Construction of the proposed transmission lines will improve HELCO's service reliability.
4. The interconnection of PGV's geothermal facility with HELCO's system is consistent with the State's goals of energy self-sufficiency and the utilization of renewable energy resources.
5. The construction of the overhead transmission lines will be safe and prudent, is reasonable, and is in the public interest; and HELCO's application for approval to commit funds to construct the overhead transmission lines should be granted.
6. Neither the possibility of accidents or storms causing poles to fall across Highway 130 nor the potential impact of the proposed overhead transmission lines on views along Highway 130 and on property values warrants requiring HELCO to place the transmission lines underground.
7. PGV will not pay for the cost of laying the transmission lines underground, and, as a consequence, if the transmissions lines are placed underground, the cost of doing so must be borne by the ratepayers.

8. The cost of constructing the transmission lines underground is prohibitive and is not a reasonable burden for ratepayers to bear.

9. There is currently insufficient evidence that 69 kv overhead transmission lines emit electric and magnetic fields so as to pose an undue hazard to the health of those in the vicinity of the lines.

10. PCC has failed to sustain its burden of proving that (a) the construction of the proposed overhead 69 kv transmission lines constitutes a potential hazard to health and safety; (b) the system as designed poses danger to the safety and security of the public; and (c) public interest requires modifications in the load distribution system.

VII.

ORDER

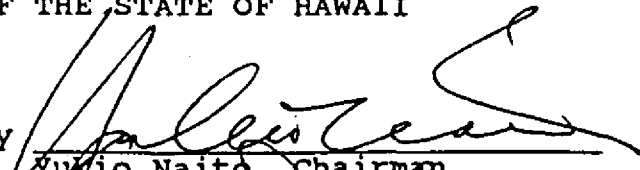
IT IS ORDERED:

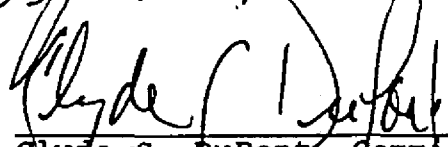
1. HELCO's request to construct two overhead transmission lines along the proposed routes, and the related interconnection facilities, the costs of which are ultimately to be paid by PGV, is approved.

2. This decision and order shall take effect upon service.

DONE at Honolulu, Hawaii this 8th day of May, 1990.

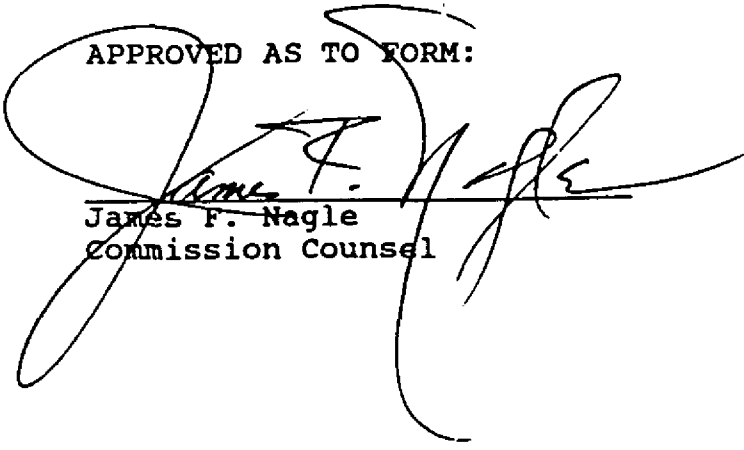
PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAII

By 
Yukio Naito, Chairman

By 
Clyde S. DuPont, Commissioner

By 
Patsy K. Young, Commissioner

APPROVED AS TO FORM:


James F. Nagle
Commission Counsel

CERTIFICATE OF SERVICE

I hereby certify that I have this date served a copy of the foregoing Decision and Order No. 10620 upon the following parties, by causing a copy hereof to be mailed, postage prepaid, and properly addressed to each such party.

DEPARTMENT OF COMMERCE AND CONSUMER AFFAIRS
DIVISION OF CONSUMER ADVOCACY
1010 Richards Street, 2nd Floor
Honolulu, HI 96813

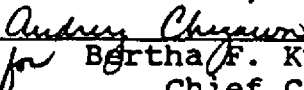
HAWAII ELECTRIC LIGHT COMPANY, INC.
NORMAN A. OSS, PRESIDENT
P. O. Box 1027
Hilo, HI 96720

HAWAIIAN ELECTRIC COMPANY, INC.
GEORGE T. IWAHIRO, VICE PRESIDENT
P. O. Box 2750
Honolulu, HI 96840

THOMAS W. WILLIAMS, JR., ESQ.
GOODSILL ANDERSON QUINN & STIFEL
1600 Bancorp Tower
130 Merchant Street
Honolulu, HI 96813

DONALD JACOBS, PRESIDENT
PUNA COMMUNITY COUNCIL, INC.
P. O. Box 595
Pahoa, HI 96778

STEPHEN K. YAMASHIRO, ESQ.
101 Aupuni Street, PH 1014A
Hilo, HI 96720


for Bertha F. Kurosawa
Chief Clerk

DATED: May 8, 1990

SEP 29 1987

Dr. Marvin T. Miura, Director
Office of Environmental
Quality Control
465 South King Street- Rm. 115
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Environmental Assessment Notice of Preparation
of an Environmental Impact Statement for the
Pohoiki Geothermal Transmission Line Project
Puna, Hawaii

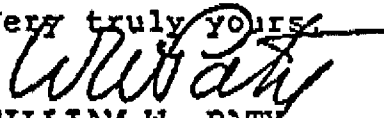
We have received the attached Environmental Assessment
prepared by DHM Planners Inc. for the applicant, Hawaii Electric
Light Company, and concur with the decision that an Environmental
Impact Statement is required for the project.

Any comments or requests should be addressed to:

Wendie McAlaster
DHM Planners Inc.
1188 Bishop Street,
Suite 2405
Honolulu, Hawaii, 96813

Please find enclosed for your information four (4) copies of
the EA/Prep Notice for the Pohoiki Geothermal Transmission Line.

For any questions to the foregoing, please contact our Land
Management Division at 548-6460.

Very truly yours,

WILLIAM W. PATY
Chairperson of the Board

Enclosures

cc: Hawaii Board Member
Hawaii District Land Office
All Divisions, DLNR



DEPUTIES

LIBERT K. LANDGRAF
MANABU TAGOMORI
RUSSELL N. FUKUMOTO

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
HONOLULU, HAWAII 96809

JUN 8 1989

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

FILE NO.: HA-5/25/89-2258
180-Day Exp. Date: 11/21/89
DOCUMENT NO.: 5804E

Mr. Norman Oss, President
Hawaii Electric Light Company, Inc.
54 Halekauila Street
Hilo, Hawaii 96720

Dear Mr. Oss:

NOTICE OF ACCEPTANCE AND ENVIRONMENTAL DETERMINATION
Conservation District Use Application for
Two 69 KV Transmission Lines (Alignment A and B)
Within a 50-foot Wide Easement of Nanawale
Forest Reserve (Parts 2 and 3), at
Puna District, County of Hawaii

This acknowledges the acceptance for processing your application
HA-5/25/89-2258 for the Pohoiki Geothermal Transmission Line.

According to your information, you propose to construct two 69 KV
transmission lines (Alignment A and B) between the Pohoiki
geothermal site and Puna Substation within a 50-foot wide easement
of Nanawale Forest Reserve (Parts 2 and 3), TMKs: 1-4-3: 8 and
1-4-1: 4 at Puna District, County of Hawaii.

Also, additional easements 5 feet wide, extending 10 to 15
feet perpendicular from the requested easement boundary, will be
required where guy wires and pole anchors are necessary.

After reviewing the application, we find that:

1. The proposed use is a conditional use within the Resource subzone of the Conservation District according to Administrative Rules, Title 13, Chapter 2, as amended;
2. A public information meeting will be required in that the proposed use is of sufficient public interest; and

- 3. In conformance with Title 11, Chapter 200, of the Administrative Rules, a negative declaration was determined for the proposed action. This determination applies to the specific land use proposal for a small portion of the project that is in the Conservation District but does not apply to the project outside of the Nanawale Forest Reserve (Parts 2 and 3). The environmental determination on the rest of the Pohoiki Geothermal Transmission Line will occur independent of this present application.

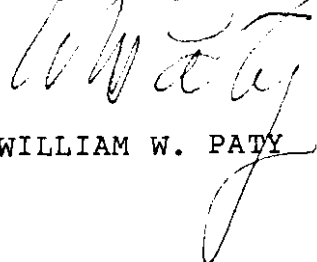
As the applicant, please be advised that it will be your responsibility to comply with the provisions of Section 205A-29(b), Hawaii Revised Statutes, relating to Interim Coastal Zone Management (Special Management Area) requirements.

Negative action as required by law, on your application by the Board of Land and Natural Resources can be expected should you fail to obtain from the County thirty (30) days prior to the 180-day expiration date, as noted on the first page of this notice, one of the following:

- 1. A determination that the proposed development is outside the Special Management Area (SMA);
- 2. A determination that the proposed development is exempt from the provisions of the county ordinance and/or regulation specific to Section 205A-29(b), HRS; or
- 3. A Special Management Area (SMA) permit for the proposed development.

Pending action on your application by the Land Board in the near future, your cooperation and early response to the matters presented herein will be appreciated. Should you have any questions, feel free to contact Roy Schaefer of our Office of Conservation and Environmental Affairs at 548-7837.

Very truly yours,



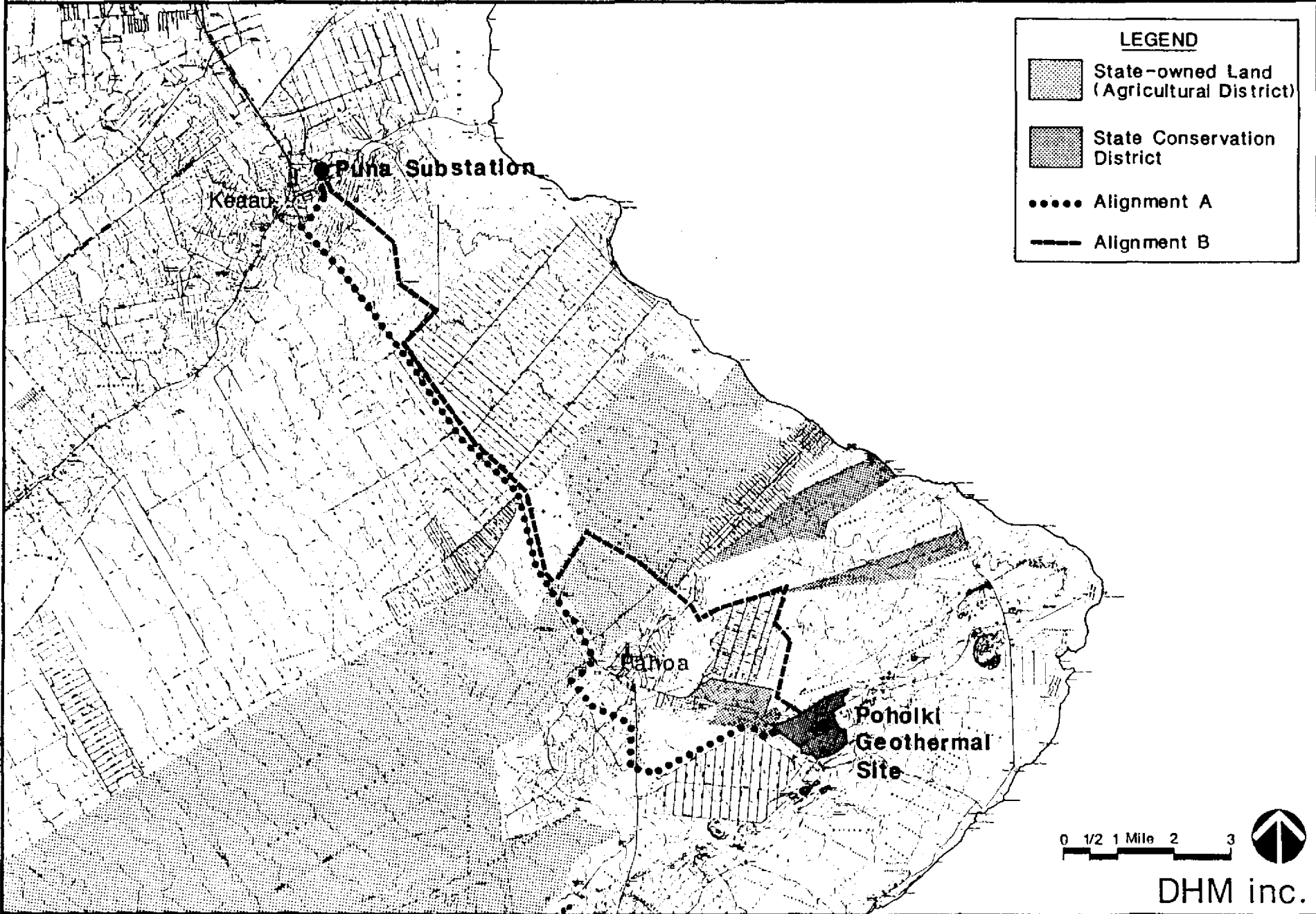
WILLIAM W. PATY

Attachment (receipt)

- cc: Hawaii Board Member
- Hawaii Land Agent
- Hawaii Planning Department
- Hawaii Dept. of Public Works
- Hawaii Dept. of Parks and Recreation
- Hawaii Dept. of Water Supply
- DOH/OEQC/EC/OHA/DOT

EXHIBIT I-4

STATE-OWNED LAND & STATE CONSERVATION DISTRICT



**CONSERVATION DISTRICT
USE APPLICATION
and
ENVIRONMENTAL ASSESSMENT
POHOIKI GEOTHERMAL TRANSMISSION LINE**

DHM inc.

March 1989

FOR DLNR USE ONLY

Reviewed by _____
 Date _____
 Accepted by _____
 Date _____
 Docket/File No. _____
 180-Day Exp. _____
 EIS Required _____
 PH Required _____
 Board Approved _____
 Disapproved _____
 Well No. _____

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

DEPARTMENT MASTER APPLICATION FORM

(Print or Type)

I. LANDOWNER/WATER SOURCE OWNER
 (If State land, to be filled
 in by Government Agency in
 control of property)

Name _____

Address _____

Telephone No. _____

SIGNATURE _____

Date _____

II. APPLICANT (Water Use, omit if applicant
 is landowner)

Name Hawaii Electric Light Company, Inc.

Address 54 Halekauila Street

Hilo, Hawaii 96720

Telephone No. 969-0321

Interest in Property Perpetual Easement

(Indicate interest in property; submit
written evidence of this interest)

*SIGNATURE *Norman A. Orr*
President

Date _____

III. TYPE OF PERMIT(S) APPLYING FOR

(X) A. State Lands

(X) B. Conservation District Use

() C. Withdraw Water From A Ground
Water Control Area

() D. Supply Water From A Ground
Water Control Area

() E. Well Drilling/Modification

*If for a Corporation, Partnership,
Agency or Organization, must be signed
by an authorized officer.

IV. WELL OR LAND PARCEL LOCATION REQUESTED

District Puna

Island Hawaii

County Hawaii

Tax Map Key Portion of 1-4-3:8
Portion of 1-4-1:4

Area of Parcel 696.54 ac/596.67 ac
(Indicate in acres or
sq. ft.)

Term (if lease) _____

ENVIRONMENTAL ASSESSMENT
POHOIKI GEOTHERMAL TRANSMISSION LINE

DHM inc.

March 1989

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SUMMARY

APPLICANT: Hawaii Electric Light Company, Inc.
54 Halekauila Street
Hilo, Hawaii 96720

PERSON SUBMITTING CDUA: DHM inc.
1188 Bishop Street, Suite 2405
Honolulu, Hawaii 96813

PROPERTY LOCATION: Nanawale Forest Reserve, Parts 2 and 3,
Puna District, Hawaii County

| TAX MAP KEY: | <u>Parcel Area</u> | <u>Transmission Line Easement</u> |
|---------------------|--------------------|-----------------------------------|
| 1-4-3:8 | 696.54 acres | 0.3 acres |
| 1-4-1:4 | 596.67 acres | 4.6 acres |

ACTION: Applicant action. Application for Conditional Use of the Conservation District to allow construction and operation of a 69 kV transmission line through two parts of Nanawale Forest Reserve.

ACCEPTING AGENCY: State of Hawaii, Department of Land and Natural Resources

| | | |
|---------------------------------------|--------------------------|--------------|
| EXISTING LAND USE REGULATIONS: | State Land Use District: | Conservation |
| | Conservation Subzone: | Resource |
| | County General Plan: | Conservation |
| | Special Management Area: | None |

EXISTING LAND USE: Forest Reserve open to the public for hunting of pigs and goats

PROPOSED LAND USE: 69 kV transmission line within a 50-foot wide easement

I. INTRODUCTION

Hawaii Electric Light Company (HELCO) is proposing to construct two 69 kV transmission lines between the proposed geothermal power plant south of Pahoia, Hawaii and the Puna Substation near Keaau. Subsequent to a routing study and public and agency informational meetings, two alignments were identified. These alignments crossed sections of State-owned land in the State Agricultural District. Therefore, in accordance with Chapter 343, Hawaii Revised Statutes (HRS), an environmental assessment was prepared and submitted to the Department of Land and Natural Resources. It was determined that an environmental impact statement (EIS) would be required and the EIS Preparation Notice was published in the October 8, 1987 OEQC Bulletin.

Since then, additional meetings were held to further discuss community concerns about the alignments crossing private subdivision parcels and to investigate alternatives. As a result, small segments of the proposed alignments have been relocated within the State Conservation District to avoid three subdivisions (Leilani Estates, Pohoiki Bay Estates, and Nanawale Estates). Therefore, a Conservation District Use Application is being submitted to DLNR.

An environmental impact statement is being prepared for the two 69 kV transmission line alignments to fully disclose all potential impacts of the project. The draft EIS is expected to be filed with OEQC in April 1989. Botanical,

archaeological, ornithological, entomological, and geological field studies were conducted in the project area, including the affected Conservation District lands. Copies of these reports are appended to the Routing Study which will be bound with the EIS.

This document has been prepared to summarize the project conditions and potential impacts and mitigation measures for the affected Conservation District land only.

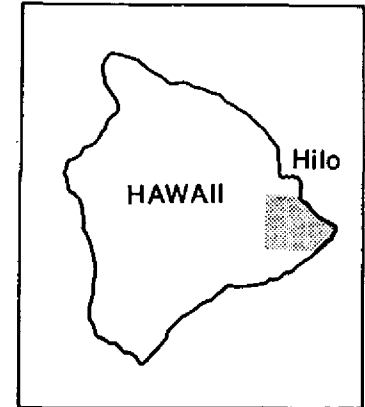
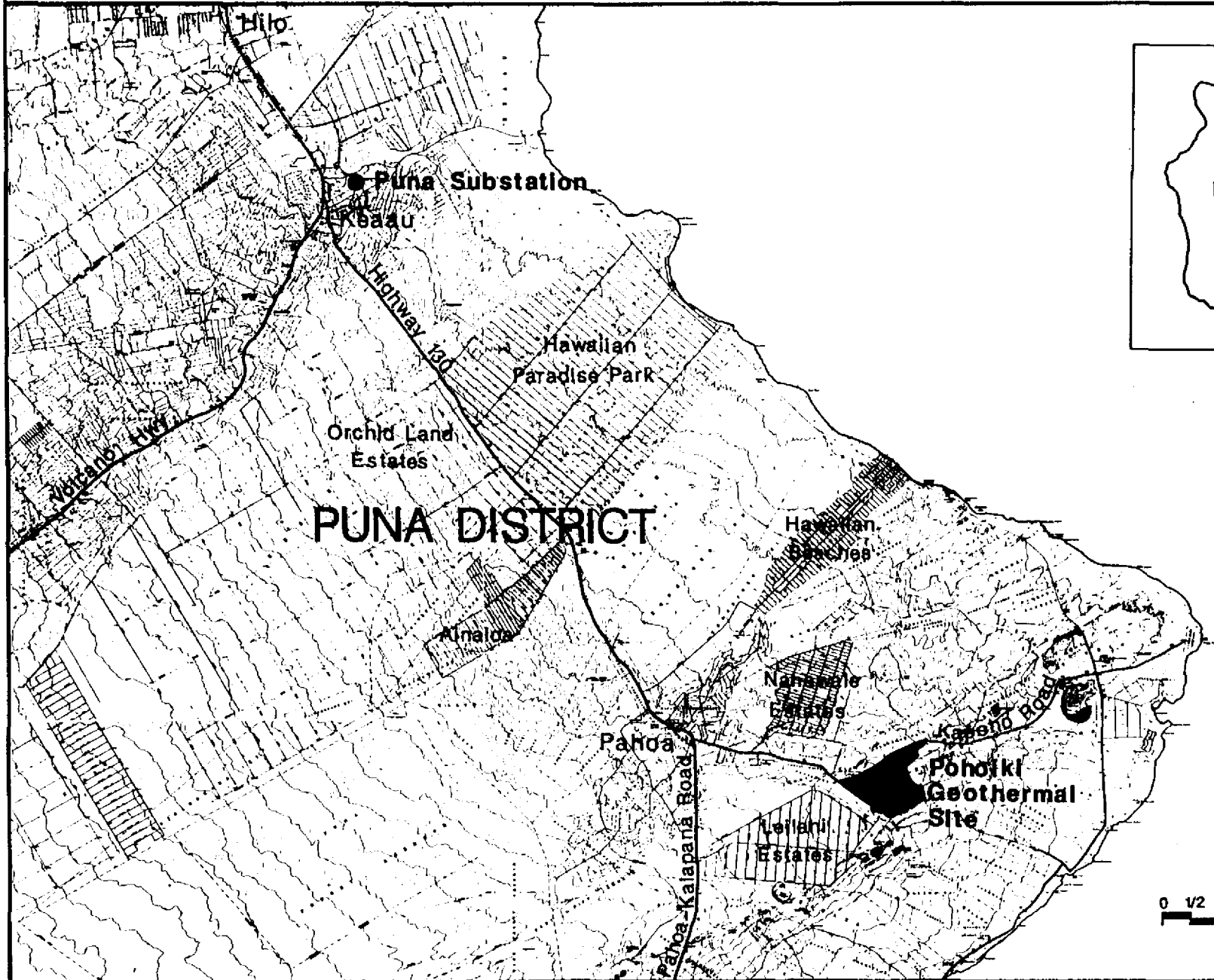
II. DESCRIPTION OF PROPOSED ACTION

A. BACKGROUND

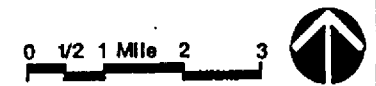
Puna Geothermal Venture (PGV) is proposing to develop a 25 megawatt (MW) geothermal-electric power plant at the Pohoiki geothermal site (also referred to as "Pohoiki") in the Puna District of Hawaii. (Exhibit 1.) In compliance with the federal Public Utilities Regulatory Act (PURPA), Hawaii Electric Light Company (HELCO) will purchase the electric power generated by the geothermal power plant and will distribute it to customers on the Island of Hawaii. To do this, HELCO must construct transmission lines which connect the proposed generators at Pohoiki to the main power grid near HELCO's Puna Substation at Keaau. Two 69 kilovolt (kV) transmission lines capable of carrying 25 MW of power are required to provide and maintain reliable service.

The proposed transmission lines are needed exclusively to transmit the power produced by the 25 MW Pohoiki geothermal plant. The first new 69 kV line is needed by July 1990 when PGV intends to have at least 20 MW of power on line. The second 69 kV transmission line will be installed by December 1990 to provide backup to the first 69 kV line.

EXHIBIT 1 LOCATION MAP

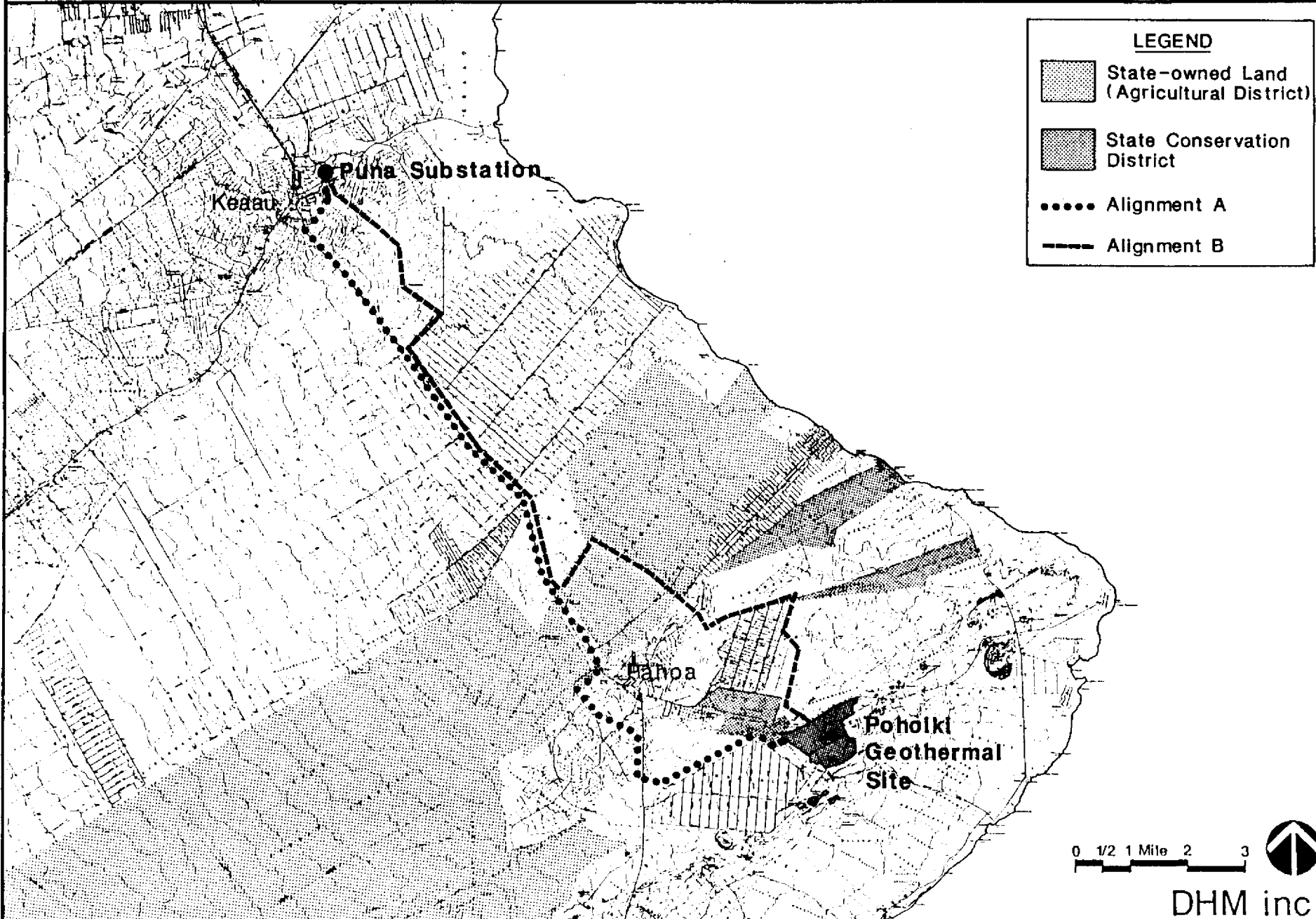


5







DHM inc.

STATE-OWNED LAND & STATE CONSERVATION DISTRICT



LEGEND

-  State-owned Land (Agricultural District)
-  State Conservation District
-  Alignment A
-  Alignment B



DHM inc.

The specific alignments selected for the two transmission lines were largely determined through a route selection process which was an objective evaluation of conditions in the study region to identify areas of constraint and opportunity for a transmission line. Refinements to the alignments were made as a result of subsequent meetings with concerned community and subdivision associations, government officials, and Hawaiian Telephone Company. The proposed alignments between Pohoiki and Puna Substation are shown in Exhibit 2.

As mentioned earlier, a portion of each alignment passes through the State Conservation District, thereby subjecting the project to the requirements of a Conservation District Use Application (CDUA) as set forth in the Department of Land and Natural Resources regulation No. 4. (Refer to Exhibit 2). This document has been prepared to fulfill the requirements of the CDUA.

B. PROJECT LOCATION

As shown on Exhibits 2 and 3, the proposed project consists of two 69 kV transmission lines between the Pohoiki geothermal site and Puna Substation. Alignment A, the mauka alignment, will be constructed first. It will originate on the western edge of the geothermal site, cross Pohoiki Road, and enter Nanawale Forest Reserve (NFR)-Part 3 which is designated as State Conservation District. At the property line between the forest reserve and Leilani Estates Subdivision, the alignment

will be located within the forest reserve to avoid crossing the numerous private one-acre residential parcels of the subdivision. The alignment within the Conservation District will be about 4,000 feet long. Once beyond the subdivision, the alignment will leave the forest reserve and be located on private agricultural land.






Alignment B, the makai alignment, is proposed to originate on the northern edge of the geothermal site, cross Kapoho Road, and head northwest across open vacant land to the edge of Nanawale Farm Ranch Lands. It then continues along the outside edge of the Ranch Lands and Nanawale Estates Subdivision to avoid the subdivided parcels. At the northeast corner of Nanawale Estates, the alignment will cross the triangular tip of Nanawale Forest Reserve (NFR)-Part 2, thereby crossing 250 feet of State Conservation District land. Once across the forest reserve, the alignment is located on State Agricultural District land.

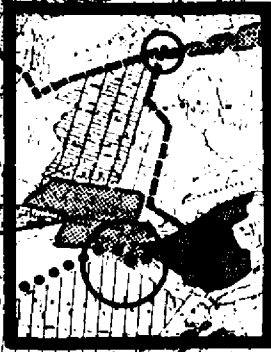
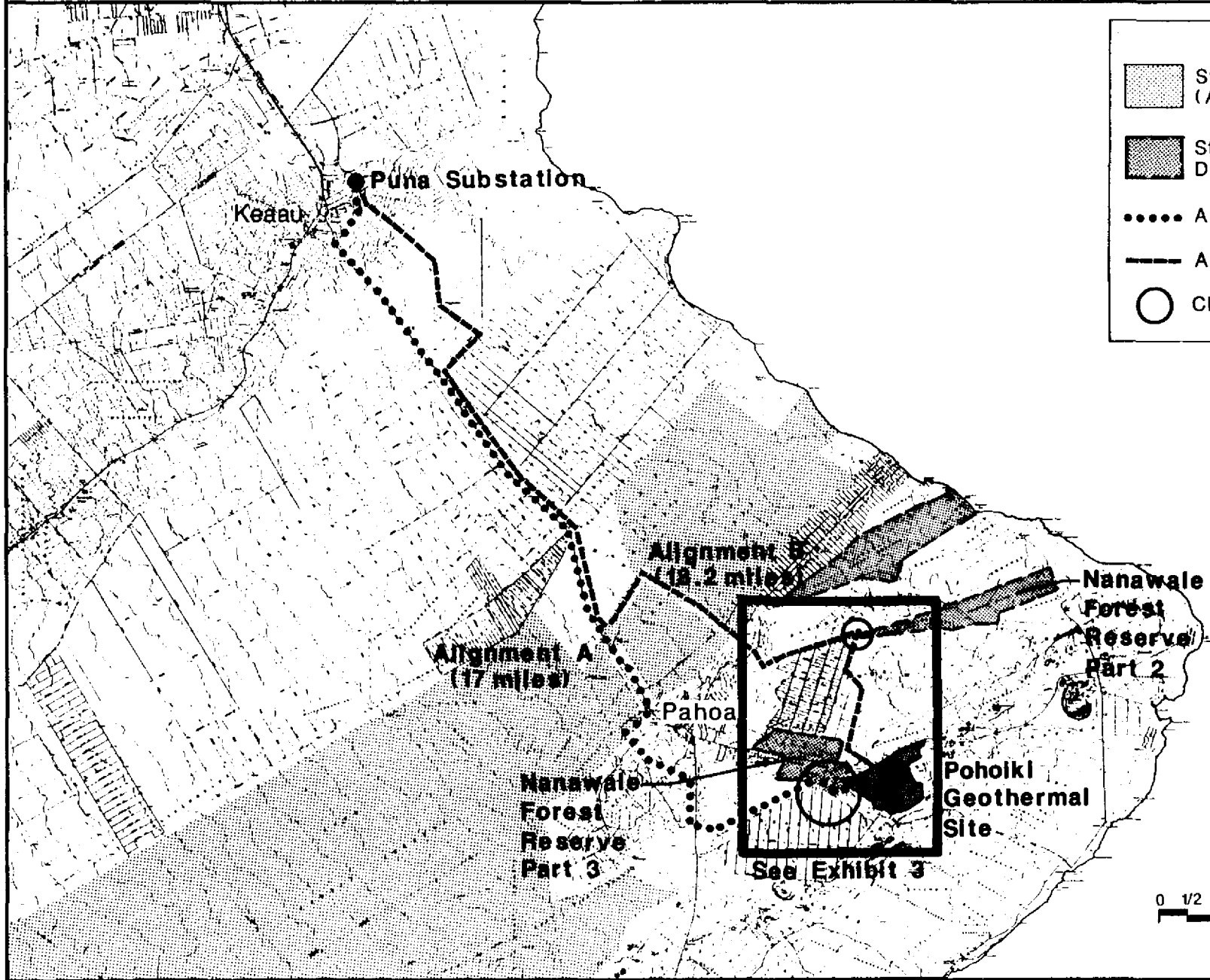
C. PROJECT FEATURES

Each proposed 69 kV transmission line will consist of three aluminum conductors (0.856 inches in diameter) which will be supported by horizontal post insulators or strings of suspension insulators attached to single wooden poles. (Exhibit 4). A shield wire (0.375 inch diameter) will be strung at the top of the poles for protection against lightning. The wooden poles will range between 57.5 and 67 feet above ground with 7.5 to 8 feet embedded in the ground.

EXHIBIT 2 PROPOSED ALIGNMENTS

LEGEND

-  State-owned Land (Agricultural District)
-  State Conservation District
-  Alignment A
-  Alignment B
-  CDUA Required



8

EXHIBIT 3 CDUA PROJECT AREA

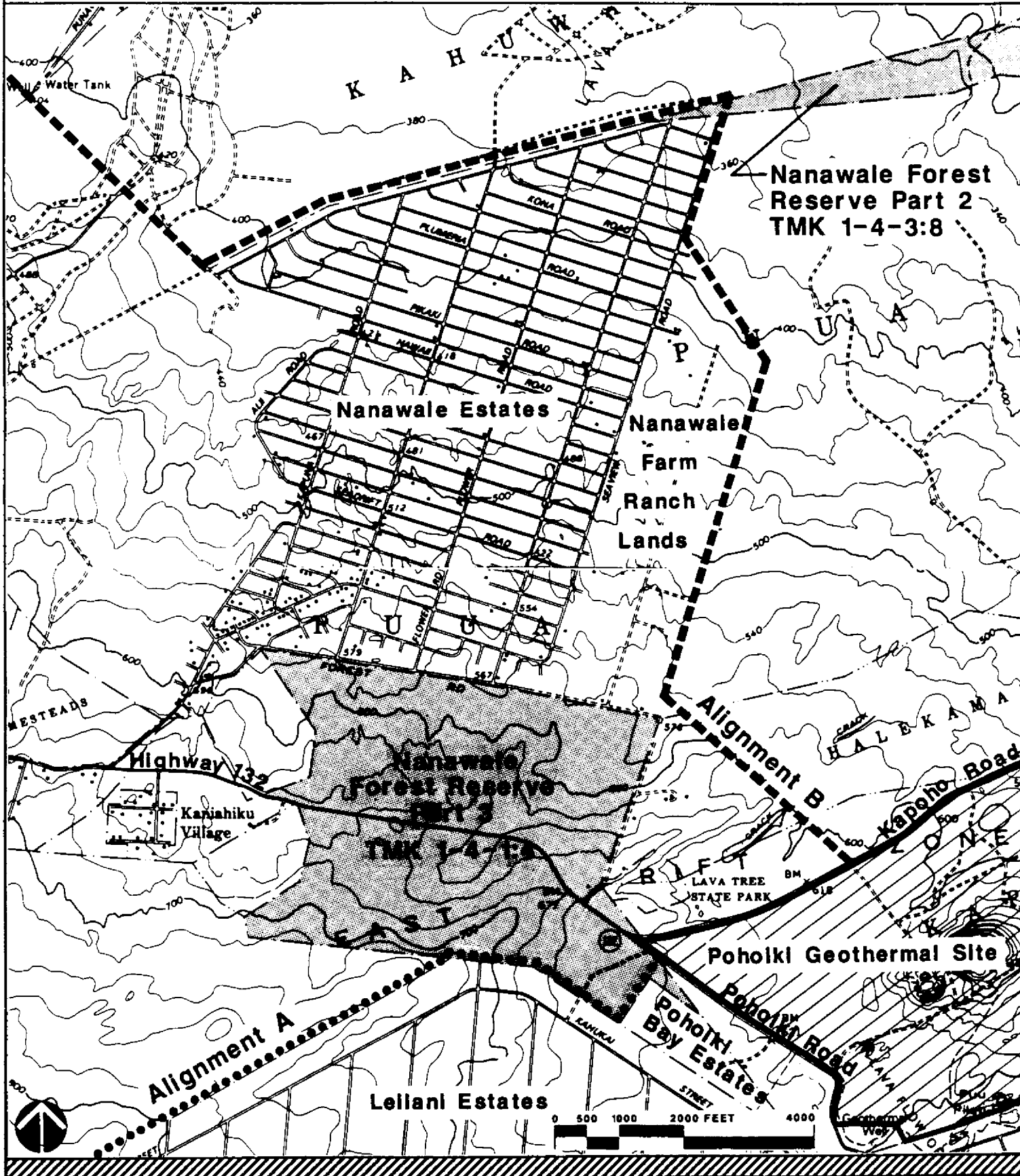
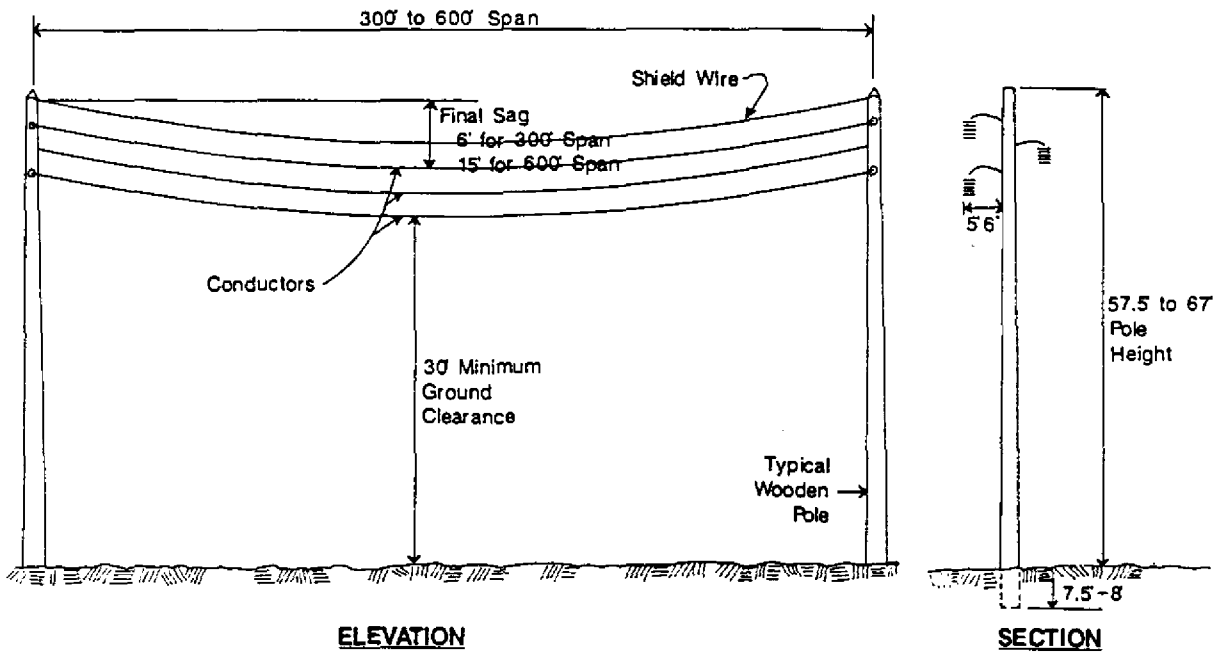
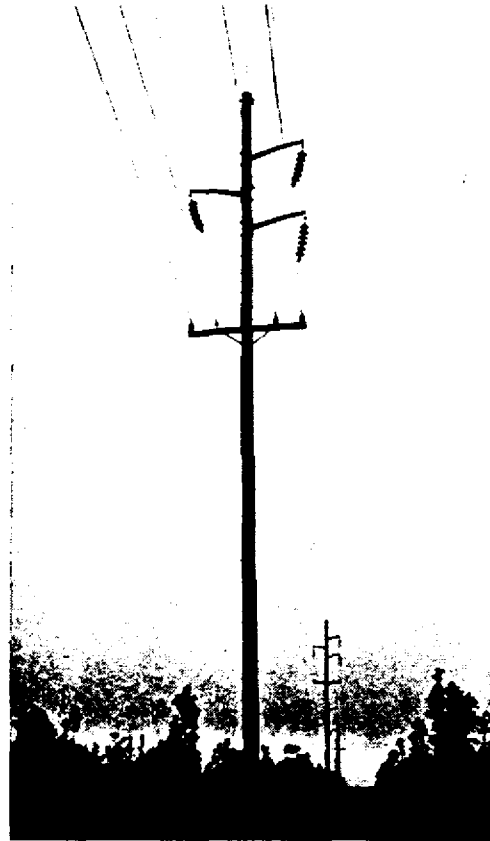
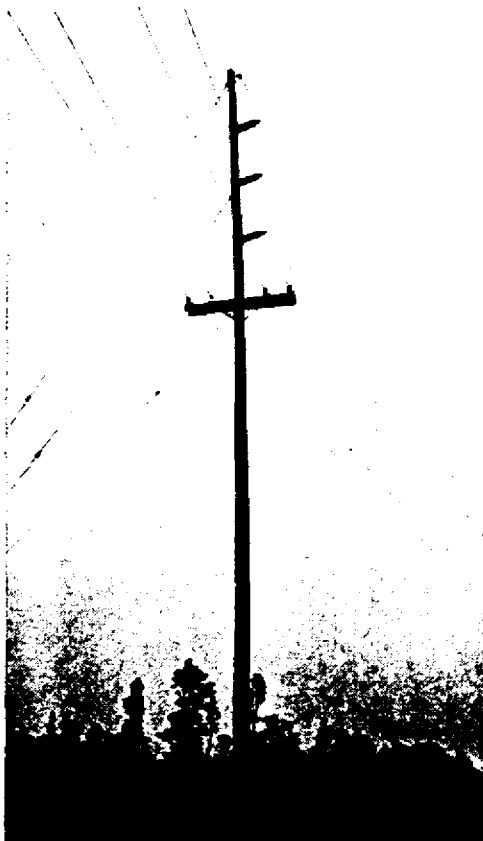


EXHIBIT 4

TYPICAL 69 KV LINES



TYPICAL WOODEN POLE CONFIGURATION



TYPICAL WOODEN POLES

DHM inc.

The poles will have a diameter of approximately 16 inches at the base, tapering to approximately 8.5 inches at the top. The wood will be fully treated against termite damage and rot. To provide stability against high winds and changes in direction of the alignment, guy wires and anchors may be installed on some poles.

Through forested areas such as the forest reserve, the poles will be spaced approximately 400 to 450 feet apart to optimize pole height and conductor sag. Alignment A will consist of approximately ten poles through the Conservation District. Since Alignment B will cross only 250 feet of Conservation land, no poles need be installed in the Conservation District. The conductors will span across the forest reserve from poles located in the adjacent Agricultural District.

HELCO will require a 50-foot wide easement for each transmission line that crosses the Conservation District. This easement will allow for conductor swing, use of multi-pole structures where necessary, and adjustments of pole sites in the field during construction should the pole hole diggers encounter adverse geological conditions, archaeological and historic sites, or areas of ecological sensitivity. The poles will generally be centered within the easement. The total easement area for Alignment A will be 4.6 acres; Alignment B, 0.3 acres. Additional guy wires and anchor easements may be required if the anchors fall outside the 50-foot wide easement area.

D. CONSTRUCTION

Construction of the proposed lines will entail the following steps:

- o Clearing and rough grading for construction/access road.
- o Preparing pole sites.
- o Hauling poles to their sites and framing the poles.
- o Setting the poles.
- o Stringing the conductors on the poles.

Construction of the two transmission lines in the Conservation District will be undertaken by ground crews and heavy ground equipment. A narrow clearing along the edge of NFR-Part 3 will be widened to 10 to 12 feet and roughly graded for use as an access road. In areas heavily vegetated with trees and shrubs, an additional 10 to 15 feet along one side of the access road must be cleared for framing and setting the poles. Alignment B will not require an access road through the NFR-Part 2 since no poles will be located there. A narrow clearing will be required during conductor-stringing operations.

At each pole site, a hole approximately 2-1/2 feet in diameter and 7-1/2 or 8 feet deep will be dug. Hand tools and a back hoe will be used where possible. However, soil conditions at many of the sites, particularly those covered by recent lava flows, may preclude the use of manual digging. In such cases, the use of air hammers and

explosives may be necessary. After the pole has been set, the hole will be backfilled with excavated or imported material. Installation of anchors will be performed in a similar manner.

Most of the pole foundations will be embedded into basaltic rock which has a high lateral load bearing capacity. The primary concern in these areas will be to seek out and repair any lava tubes or other cavities immediately adjacent to the embedded foundations. When a pole site is directly above a lava tube or cavity, HELCO's general procedure is to evaluate the size and depth of the opening to determine its feasibility for a pole foundation. If the opening is small, and not identified by the biologist or archaeologist to be preserved or repaired, HELCO will build a foundation in it by filling the opening with rock, soil, and/or concrete. If a cave or cavity is too large, it will be re-sealed, and another pole site selected.

Transmission poles and other materials will be hauled to each pole site by a pole trailer and equipment truck. The poles will be the largest and heaviest materials to be transported over ground. The poles will be laid alongside the construction/access road near the respective pole site and crews of at least four persons will install transmission and grounding fixtures, conductor devices, and insulators on the poles while on the ground.

Poles will be lifted into place using a crane, and held in place while the hole is backfilled with the excavation material. A utility line-truck and pick-up or 4-wheel-drive would be at the site also, plus a minimum 4-man crew.

The ground method will be used for stringing the conductors in the forest reserve areas due to the proximity to residential subdivisions. Conductor installation generally requires a 10 to 12-person crew and would take less than one week per alignment through the Conservation District.

E. SCHEDULE AND COST

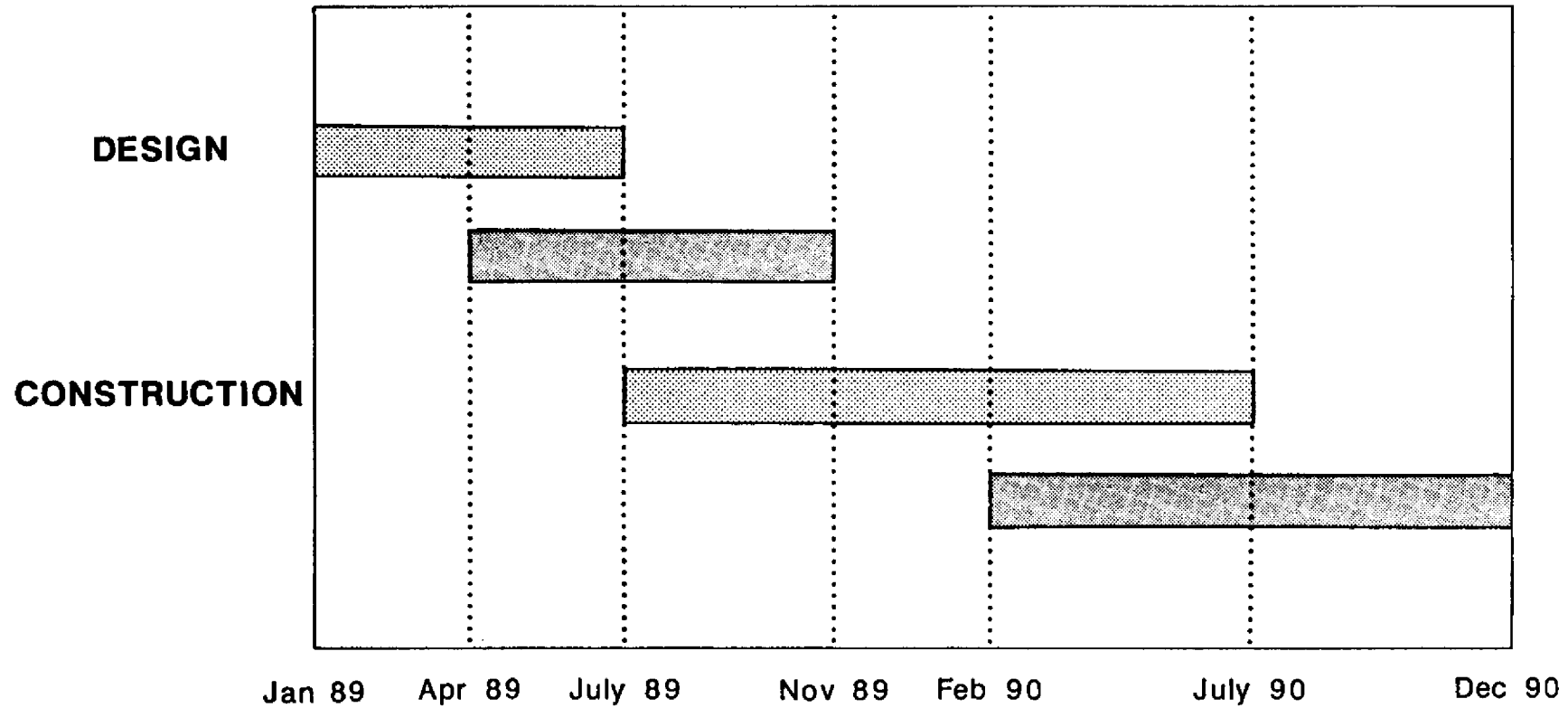
The entire project, from initial planning to operation, is scheduled to proceed as follows:

1. Preliminary planning - This has been completed for both lines and is documented in the Routing Study and EIS.
2. Design - This phase includes preparing construction documents and specifications for each line and ends when all necessary permits have been obtained.
3. Construction - This entails the actual building of the lines. Operation of each line marks the end of its construction phase.

The approximate schedule, by phase and line, for this project is shown in Exhibit 5.

PROJECT TIMETABLE

15



- Alignment A (mauka)
- Alignment B (makai)

The design and construction of the two transmission lines between Pohoiki and Puna Substation is expected to cost about \$10 million (1989 dollars).

F. MAINTENANCE

Once the transmission lines are built and in operation, the easements will be used for maintenance purposes only.

Periodic fly-overs and visual inspection will be done to identify problem trees that may be interfering with the conductors, and generally all vegetation beneath the lines that may grow over 30 feet will be removed. Other vegetation will be allowed to grow back within the easements, especially at the edges.

With the exception of large trees, an access way will be cleared as necessary when it is being used. No herbicides will be used to control vegetation within the easements.

III. DESCRIPTION OF THE AFFECTED ENVIRONMENT

A. SOILS

Both parts of the Nanawale Forest Reserve which would be crossed by the proposed alignments are relatively recent a'a lava flows. The lava flow of 1955 crossed NFR-Part 3 where Alignment A would be located, and the lava flow of 1840 crossed the tip of NFR-Part 2 which Alignment B will span across. (See Exhibit 6.)

B. CLIMATE

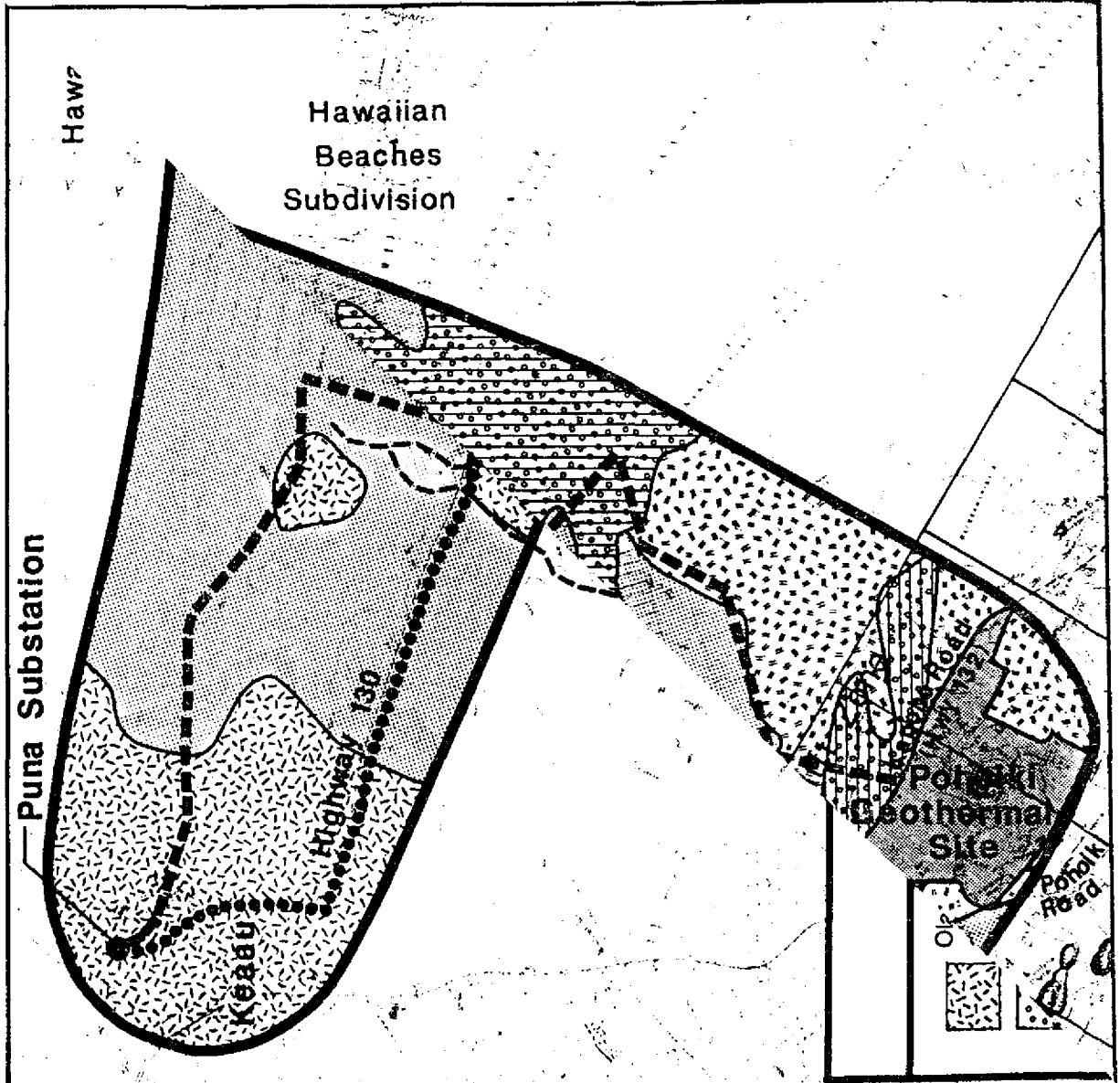
The Puna region has a relatively high annual rainfall. The project area near the Conservation District lands of the forest reserve receives about 125 inches of rain per year.

Temperatures in the area are quite uniform throughout the year, with the monthly means ranging from 71 to 76 degrees. The rainiest and coolest month in Puna is December, while the hottest and driest are June and July.

Winds in the Puna area are affected by Mauna Loa where the onshore flow provides an upslope wind by day and a counter downslope wind develops at night and in the early morning. The latter flow predominates. Average wind speeds range

EXHIBIT 6

SOILS/GEOLOGY



between 7 and 8 miles per hour, with slightly stronger winds in mid-afternoon and light winds in the evening hours.¹

C. BIOLOGICAL CHARACTERISTICS

During the route selection, field surveys were conducted by scientists and professional experts to inventory the existing biological characteristics of the area in terms of vegetation, insects, and birds, and to identify areas of potential environmental problems or concerns. The surveys included the portions of Conservation District affected by the proposed alignments.

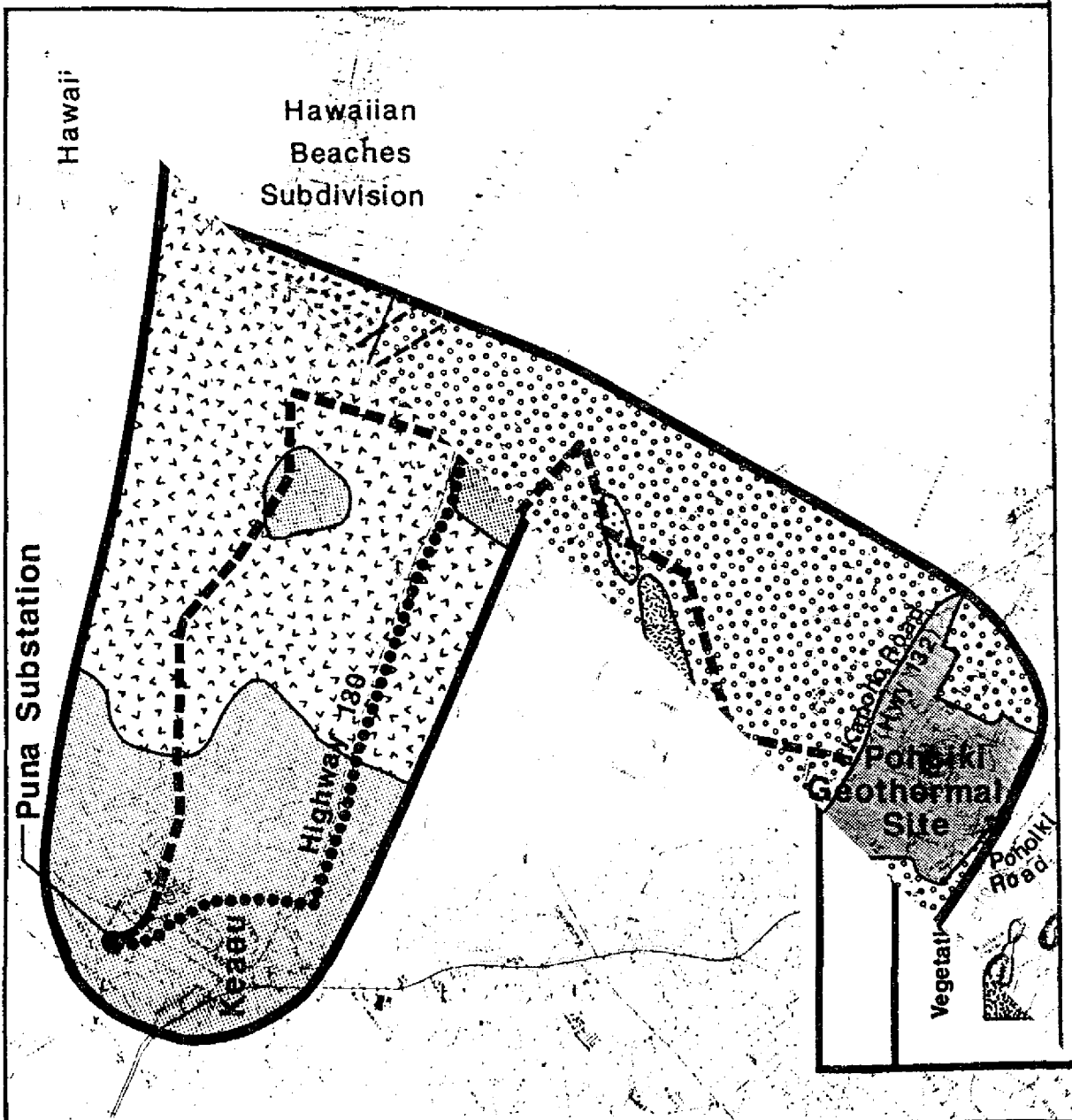
1. Vegetation (Exhibit 7)

The vegetation in the study region reflects the geologic and climatic conditions. Because of the volcanic activity in the Puna district, the natural maturation sequence of vegetation is constantly being truncated, resulting in youthful plant communities. This is particularly evident along the alignments in the Pahoia region, including the Nanawale Forest Reserve and surrounding areas. The dominant vegetation cover is the early successional association of ohia

1. Bechtel National, Inc., Puna Geothermal Venture Project Application, December 1986, pp. 6-5 to 6-11.

EXHIBIT 7

VEGETATION & INSECTS



(Metrosideros polymorpha) and false staghorn fern (Dicranopteris linearis). While the species mix in the poorly developed to young forest is primarily of native character, diversity is very low and consists essentially of common plants found in many other regions of Hawaii.²

2. Insects

The project area in the Conservation District was found to be populated by non-native or common native insects by the project entomologist.³ Some important habitats found in the Puna region (but not in the forest reserve) are lava tube caves where surface vegetation provides the main energy source to the caves via root penetration. Cave-adapted animals which subsist in these environments are highly sensitive to surface alteration or destruction. Due to the great number of lava tubes and caves in the Puna area, it is possible that additional important cave habitats exist beneath the alignments in the Conservation District.

2. W.N. Takeuchi, et.al., Bernice P. Bishop Museum, "Botanical Survey," April 22, 1987.

3. G.M. Nishida and W.C. Gagne, "Terrestrial Arthropods," February 1987.

3. Birds

There is a relative abundance of common, exotic bird species throughout the project area. Based on the ornithological survey,⁴ northern cardinals and house finches are more abundant in the wooded habitats such as the forest reserve while Japanese white-eyes and the spotted dove and zebra dove are more evenly distributed throughout the Puna area. Common mynas are most common in the agriculturalized areas of Puna, but were also abundant in the forest reserve. A less-common introduced exotic species, the house sparrow, was identified near NFR-Part 3. One 'io or Hawaiian hawk, an endangered species, was seen soaring high above Nanawale Farm Ranch Lands, outside of Nanawale Forest Reserve-Part 2.

D. ARCHAEOLOGICAL RESOURCES (Exhibit 8)

An intensive field survey and literature search were conducted to identify and evaluate archaeological resources in the study area.⁵ No archaeological sites were found in the Nanawale Forest Reserve or immediate vicinity and the potential for sites was assessed as very low.⁶

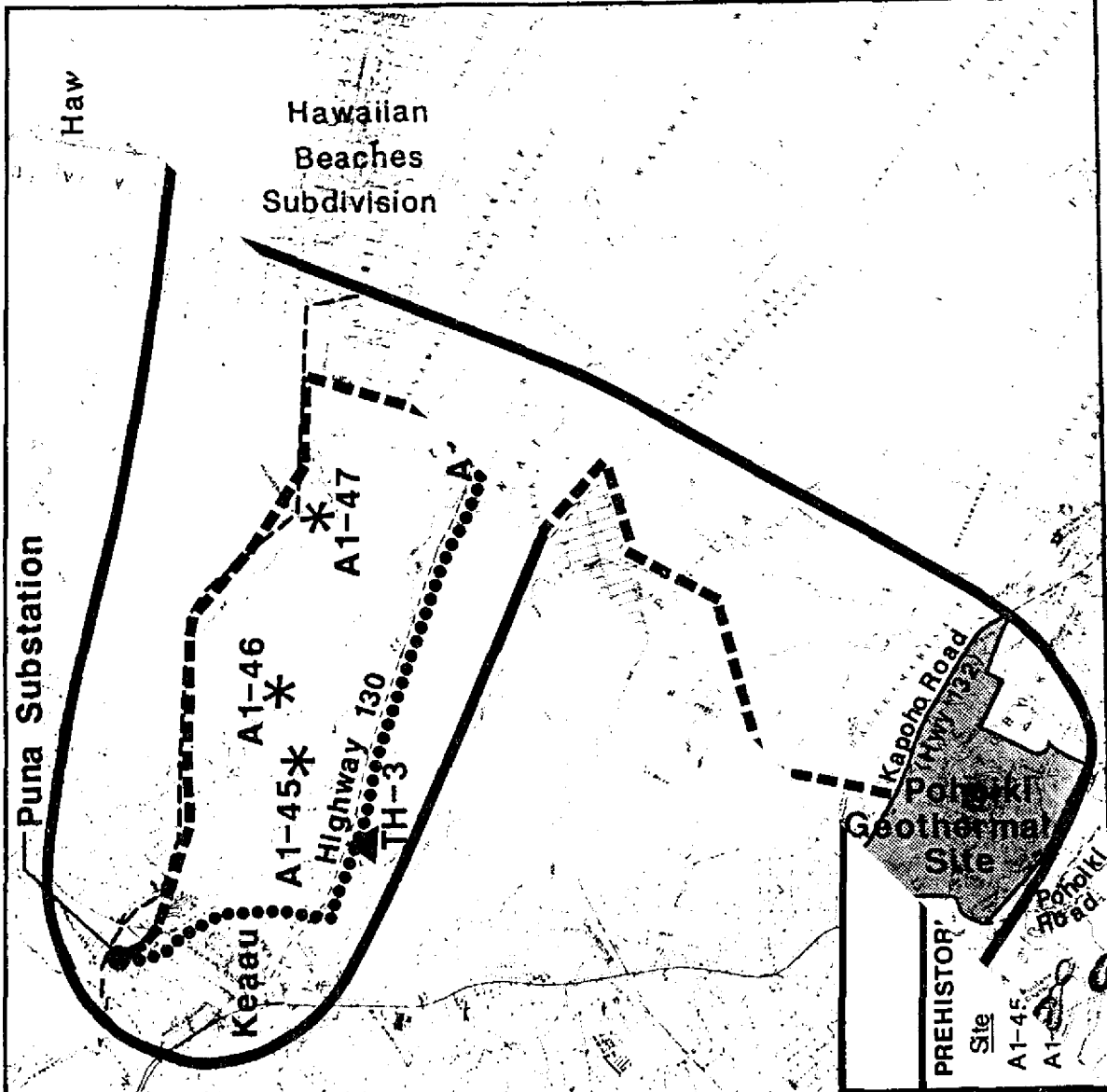
4. Robert C. Fleischer, "Ornithological Survey," April 15, 1987.

5. Eric K. Komori, "Archaeological Survey," April 30, 1987.

6. Eric K. Komori, Letter to DHM Planners Inc., March 8, 1988.

EXHIBIT 8

PREHISTORIC & ARCHAEOLOGICAL SITES



E. AIR QUALITY

The present air quality in the region is good most of the time since there are no large man-made stationary sources of pollution in the vicinity and the area is not highly urbanized. Air quality is primarily affected by the sulfur dioxide (SO₂) emissions from nearby volcanic activity. Recent studies indicate that the majority of the time, atmospheric concentrations of SO₂ in the project area are relatively low. However during periods of vigorous volcanic activity or periods of unusual meteorological conditions, such as winds from the south, episodes of high concentrations do occur.⁷ In addition, vog and acid rain are increasing concerns on the entire island as well as in Puna.

F. LAND USE/LAND OWNERSHIP

The two separate portions of Nanawale Forest Reserve (NFR Part 3 and Part 2) which would be crossed by the alignments are State-owned and are designated State Conservation District and Resource subzone. Nanawale Forest Reserve is open to the public for hunting wild pigs and goats. The public hunting period, regulated by DLNR, is weekends and holidays, year round. The only arms permitted on these lands are bows and arrows and knives.

7. DPED, Baseline Air Quality-Kilauea East Rift, Executive Summary, September 13, 1985, p. 7.

Both parcels of the forest reserve are adjacent to residential subdivisions and agricultural land. The tip of NFR-Part 2 is adjacent to Nanawale Estates Subdivision, while the sides of the forest reserve abut private-owned productive agricultural land and vacant land. (Refer to Exhibit 3.) The southern edge of NFR-Part 3, along which Alignment A is proposed, is adjacent to fee-simple one-acre lots within Leilani Estates Subdivision.

G. ROADS AND UTILITIES

State Highway 130 (Pahoa Highway) is the primary route in Puna between Keaau and Pahoa and Kalapana, travelled by commuting residents as well as tourists. The highway is a two-lane paved, all-weather road, in good to excellent condition. It has a pavement width of 20 to 24 feet with 4 to 10 feet wide gravel shoulders within a 40-foot wide right-of-way. The State Department of Transportation is in the process of expanding the right-of-way to 100 feet. Two other major roadways in the region are Kapoho Road (State Highway 132) and Pohoiki road (a County road), both of which are adjacent to the Pohoiki geothermal site. Kapoho Road bisects NFR-Part 3. These roads are two-lane, narrow roads with about 22-foot wide pavement and 5 to 6-foot dirt and grass shoulders in 50 to 80-foot wide rights-of-way. There are also numerous private subdivision roads and "cane haul" roads throughout the area.

From the intersection of Kapoho road and Pohoiki road, a dirt road crosses the forest reserve and project area and terminates at Kahukai Street in Leilani Estates. There is no existing road in NFR-Part 2 near the project area. Roads adjacent to the reserve include those in Nanawale Estates to the south and dirt roads in the agricultural lands to the north.

There are no existing utilities within the forest reserve. Although the County of Hawaii has a 20-foot wide non-exclusive easement for waterline purposes along the southern property line of NFR-Part 3, no waterline has been installed or planned for.⁸ There are, however, electric distribution and telephone lines located in the road right-of-ways of the nearby subdivisions.

H. VISUAL CHARACTER

The Puna region has a clearly rural visual character exemplified by the natural and agricultural vegetation and low-density development. The main highways through the region are the primary vantage points for frequent view exposure for large numbers of travellers, both residents and visitors. The proposed project areas within the forest reserve are not visible from the main highways. In fact, due to the existing vegetation within and adjacent to the

8. Mr. Bob Harada, Department of Water Supply, Hawaii County, personal communication, May 2, 1988.

forest reserve, the project will not be directly (openly, clearly) visible from any point except within or next to the easement.

The view from roads and lots within the subdivisions depends on the amount of development at specific locations, and, in undeveloped areas, the height of natural vegetation. Many residents in the subdivisions have built two-story homes with lanais and large windows at the second level to take advantage of expansive views to the ocean and mountains over the surrounding trees. At ground level, trees and undergrowth typically block long expansive views.

IV. POTENTIAL IMPACTS AND PROPOSED MITIGATION

A. SOIL EROSION

Due to extensive lava soils, minimal slope, high absorption of rainfall into the ground, and minimal surface runoff, the potential for long-term effects on soil erosion in the area is expected to be minimal.

There is, however, some potential for soil erosion during the construction phase in areas which are cleared for the pole sites, pole anchors, and unpaved access roads. The following steps will be taken to minimize potential soil erosion problems:

- o Existing roads and jeep trails will be used as much as possible for access by necessary ground crews and equipment during construction and maintenance of the line. No access road will be required in the 250-foot long easement through NFR-Part 2.

- o In many cases, the access roads will not need to be totally cleared of vegetation unless it is heavily vegetated, so this will help reduce erosion of bare soils by wind and/or rain. In these areas, disturbance to soils and their vegetative cover will be confined to the pole sites. Fortunately, where new access roads may be needed, the ground is primarily lava flows where there is little if any soil cover and the erosion potential is very low.

B. GEOLOGIC HAZARDS

Geologic hazards in the project area include lava tubes and cavities and lava flows. Due to the possibility of unidentified subsurface lava tubes and cavities along the alignments, extensive field surveys will be conducted to determine optimum sites for poles in these sensitive areas. Remedial work may then be required to provide lateral support to transmission pole foundations where such tubes or cavities are encountered. These formations are also a concern for pole placement due to their high potential for archaeological sites and artifacts and unique ecosystems for insects. When a pole site is directly above a lava tube or cavity, an archaeologist and biologist will be called in to evaluate the significance of the formation and recommend appropriate mitigative action.

The potential for lava flows overrunning the alignments is generally equal throughout the area, with a slightly higher risk near the Kilauea east rift zone. To reduce the likelihood of a natural catastrophe damaging or destroying both lines at once, they were located at least one-half mile apart wherever possible.

C. BIOLOGICAL RESOURCES

Vegetation

A detailed botanical survey of the project area indicated that the botanical resources are common, of low diversity, and the impact of the project would be very minimal.⁹ The plant formations in the Conservation District lands impacted by the project are also low-diversity and early-successional communities which occur throughout the Puna district.¹⁰

Nevertheless, disruption to forest areas was minimized by locating the alignments along the edges of forests and avoiding densely vegetated areas and maximizing the distances between poles where possible. Because the degree of impact on vegetation is reduced depending on the availability of existing access along the alignments, existing roads and jeep trails will be used to the extent possible for access to the pole sites by construction and maintenance crews. No herbicides will be used to clear pole sites or to maintain clearance within the transmission line easements.

Other than the effects of direct physical disturbance to areas along the proposed alignment during construction and maintenance activity, the transmission lines' probable impact on nearby ecosystems is expected to be negligible.

9. W.N. Takeuchi, et.al. Bernice P. Bishop Museum, "Botanical Survey," April 22, 1987.

10. Wayne Takeuchi, Letter to DHM Planners dated April 20, 1988.

The possibility of fire due to arcing or spark discharge from conductors is extremely remote. Periodic tree trimming clears all vegetation within ten feet of energized conductors. Any damage or disturbance to the line, such as the downing of a conductor, would cause the system to "trip out." The relay mechanism would sense a fault on the line and immediately (within one-fifth of a second) cause the breakers to open at Pohoiki Substation, stopping the flow of electricity.

Wildlife

Vegetation in the project area primarily supports non-native and common native insects and birds. Further, the mitigation measures described under "Vegetation" will avoid the removal or degradation of important habitat, and therefore adverse effects on wildlife populations are expected to be minimal, and at most, temporary.

One io (Hawaiian hawk), an endangered species, was sited during the ornithological field survey. This species feeds primarily on rodents, insects and birds, and it is unlikely that the power line will hinder its activities. While other native birds may occasionally be found in the alignment areas, it is not likely that they are dependent upon them. Bird populations may retreat from the area surrounding the pole sites during construction but will return after poles are set and conductors are placed.

It is possible that subsurface caves, which may be habitats to important native insects, exist along the alignments. Prior to construction, a consultant with knowledge of caves in the region and Hawaiian cave biotas will be hired by HELCO to provide input as to the best way to cross caves with the least possible disturbance. During the pole hole digging phase of construction, the consultant will be notified upon discovery or disturbance to subsurface caves. Upon inspecting the caves in terms of biologic significance, he will make recommendations for preservation and repair and assist HELCO in adjusting the pole site. If there is no need to preserve the cave (for animal habitat or archaeological reasons), HELCO will decide whether to pursue placing a pole foundation at that location.

D. ARCHAEOLOGICAL RESOURCES

Due to the nature of the proposed project, ground construction impacts are limited to disturbance at the pole sites and along newly created or graded access roads. This allows sufficient flexibility in the placement of pole foundations to avoid sensitive areas. As a result, the proposed transmission line is not expected to have any adverse effect on sites which have been identified as having historic or archaeological value.

The archaeological survey of the project area did not locate any sites within the forest reserve. However, it is possible that isolated or underground sites such as lava

tube caves are present. To avoid destruction of unknown sites, proposed pole sites and any other surface areas that will be disturbed by construction activities will be surveyed by an archaeologist, who will locate and describe any historic remains within the areas affected by construction. Suitable means to protect or remove significant remains will be determined in consultation with the archaeologist and the Hawaii State Historic Preservation Office.

E. AIR QUALITY

During construction of the transmission lines, air quality will be temporarily affected. The blasting and digging for poles and anchors and the movement of construction vehicles over unpaved trails will create dust and particulate emissions. At no time, however, will State or Federal ambient air quality standards be exceeded.

Since the forest reserve consists of lava flows with little or no soil cover and the disturbed areas will be small and localized, dust emissions will be minimal in these areas. To reduce air quality impacts during construction, travelling speeds along unpaved trails within one mile of residences and roadways will be restricted to 20 mph. This will reduce dust generation by 65 to 80 percent. Should dry periods occur, dust control could also be accomplished through frequent watering of construction areas where dust may be an annoyance or problem.

Long term operation and maintenance of the lines will have no effect on air quality.

F. NOISE LEVELS

There will be temporary and localized noise level impacts during construction of the project; however all pertinent State noise control regulations and ordinances will be complied with.

Noise generated by the construction equipment will contribute to the noise near the agricultural subdivisions. Although this noise generation will be of short duration, the levels will be substantially higher than ambient noise levels along the alignments. Noise emissions generated by various pieces of equipment such as trucks, backhoes, chainsaws, and jack hammers range from 70 to 95 dBA at 50 feet from the source. These outdoor noise levels will be loud enough to interfere with human speech (60 dBA or greater) within approximately a half-mile of the construction site.

To minimize noise level impacts on the residents in the nearby subdivisions, helicopters will not be used for construction operations in the Conservation District. All other construction noise will be controlled and mitigated as required to meet State standards.

After construction, there will be no long term or permanent noise impacts. The 69 kV lines are of low enough voltage that there will be no corona discharge.¹¹ It is possible that a barely-audible hissing sound could be produced from loose or worn hardware, or contaminants such as salt or dust on the lines. These problems can and will be corrected by HELCO crews.

G. PUBLIC HEALTH AND SAFETY

Electric and Magnetic Fields

To address the concerns of Puna residents regarding potential health effects from the proposed project, HELCO hired an electric and magnetic field expert, Michael Silva, president of Eneritech Consultants of California. Mr. Silva conducted an evaluation of the electric and magnetic fields for the proposed 69 kV lines in March 1987 which included computer calculations and field measurements near existing (and similar) 69 kV facilities.¹²

Silva's field measurements of existing 69 kV lines indicated electric fields up to .265 kV/m at the centerline below the lowest point of sag, and .188 at 25 feet from the centerline. Magnetic fields were measured as 4.75-5.0

11. The corona is a discharge of electrical energy from the transmission conductors into the atmosphere, where it is dissipated.

12. J. Michael Silva, Pohoiki Geothermal 69 kV Transmission Line. Report on Electrical Measurements and Calculations, March 1987, p.3-4.

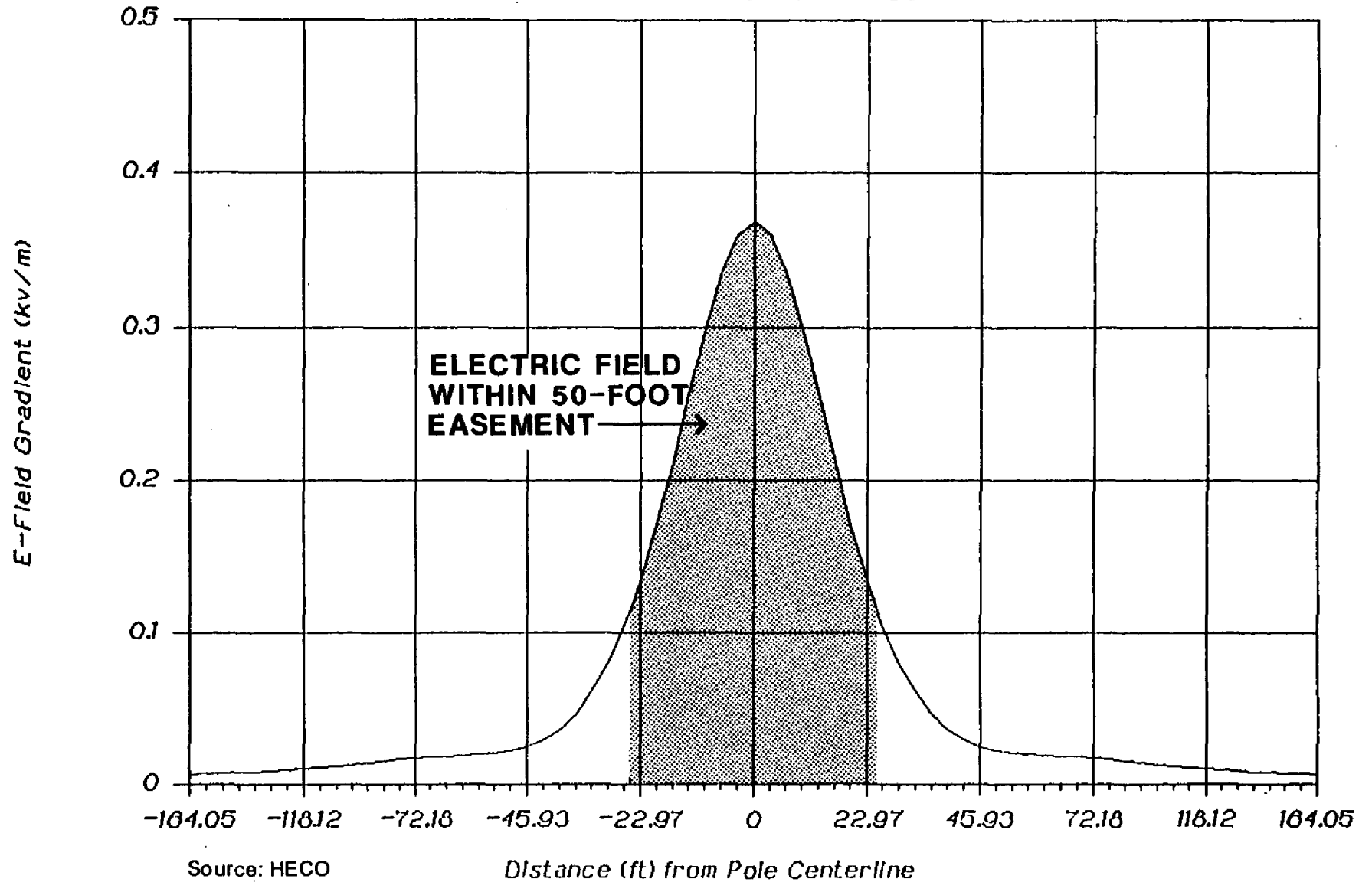
milliGauss (mG) at the centerline and 2.5-3.0 mG at 25 feet from the centerline. These field values are representative of typical situations.

Calculations were also made to account for conditions which may not have existed during routine field measurements such as high conductor temperatures and heavy electrical loads. Exhibit 9 is a lateral profile of the electric field for a Pohoiki 69 kV line with a 30-foot minimum ground clearance. It illustrates that the electric field gradients drop significantly as one moves a short distance from a transmission line. At the edge of a standard 50-foot right-of-way, the electric field exposure will be comparable to that which results from normal use of household appliances as shown on Exhibit 10.

The maximum magnetic field in the same location will be about 2-5 mG. These values are low due to the higher than normal conductor ground clearance. They are generally comparable to some household appliances and some of the existing lower voltage distribution lines already in operation along the route.

ELECTRIC FIELD GRADIENT PROFILE FOR 69 KV LINE

E-FIELD TRANSMISSION LINE STUDY



Source: HECO

Distance (ft) from Pole Centerline

EXHIBIT 10

ELECTRIC AND MAGNETIC FIELD VALUES FOR APPLIANCES

ELECTRIC FIELD VALUES (at 1 foot distance away)

| <u>Appliance</u> | <u>Electric Field, kV/m</u> |
|------------------|-----------------------------|
| Electric Blanket | .25 |
| Broiler | .13 |
| Stereo | .09 |
| Refrigerator | .06 |
| Iron | .06 |
| Coffee Pot | .03 |

MAGNETIC FIELD VALUES (at 1 foot distance away)

| <u>Appliance</u> | <u>Magnetic Field, milliGauss</u> |
|---------------------|-----------------------------------|
| Refrigerator | .3-3 |
| Iron | 1-3 |
| Coffee Pot | .8-1 |
| Electric Range | 3-30 |
| Garbage Disposal | 10-20 |
| Can Opener | 35-250 |
| Blender, Processor | 6-200 |
| Fluorescent Fixture | 2-40 |
| Color TV | 9-20 |

Silva concluded that the proposed Pohoiki 69 kV line design is in compliance with Hawaii and federal standards. The ground clearance (30 feet minimum and 50 feet typical) is greater than the 20 to 22-foot clearance used on the Mainland. As a result, the electric and magnetic field values below the line are low. The proposed design will produce a well-engineered and safe facility.

Other

Other forms of effects on public health and safety could result from the project's impacts on air quality, noise levels, and fire hazard potential. As pointed out in previous sections, however, these factors are not expected to be significant.

Beneficial effects on public health and safety will result from the proposed project. It will allow for transmission of additional capacity and improve the reliability of electric power service on the Island of Hawaii. This will help prevent potentially dangerous conditions, such as traffic light failures, which can lead to traffic accidents, and darkened residential and commercial areas, which can lead to higher levels of criminal activity and personal injuries.

H. LAND USES

The project will not significantly impact existing land uses within the forest reserve or in the immediate vicinity of the proposed alignments. Since HELCO will acquire an easement rather than a fee-simple right-of-way for the proposed transmission lines, owners of property within an easement will retain limited rights to the use of the property. The use will be restricted by safety requirements applying primarily to buildings and structures.¹³

Compensation will be paid to landowners who grant the transmission line easements based on a fair market appraisal. Owners of property adjacent to the easement will not be limited to the use of their land.

As much as possible, the proposed transmission lines were routed to avoid the State Conservation District completely. However, the alignments have been located through limited portions of the Nanawale Forest Reserve (Conservation District) to minimize potential conflicts with the private residential landowners of adjacent subdivisions. Within the forest reserve, potential impacts on land use have been minimized by locating the alignments along or near property lines. The easements may serve as a buffer between the hunting activity and the adjacent subdivisions.

13. Public Utilities Commission, State of Hawaii, General Order No. 6: Rules for Overhead Electric Line Construction in the State of Hawaii.

Although transmission lines are not expressly permitted in the Resource subzone, the Board of Land and Natural Resources may approve a non-permitted use if it can be shown that the public benefit outweighs any adverse impact on the Conservation District and complies with the general objectives of the subzone. The proposed project will provide public benefits in terms of safety, reliability, and socio-economic conditions, while not adversely impacting the Conservation District. The objective of the Resource subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas. The proposed transmission lines are consistent with the objectives of the subzone in that they will not impact or interrupt permitted uses within the subzone such as the area's current use for outdoor recreation or potential for use as parkland.

Several agricultural subdivisions are located adjacent to the alignments. Transmission lines through residential areas are often perceived as a nuisance which can detract from the use and enjoyment of adjoining properties. For this reason, both alignments have been routed to avoid crossing residential lands.

I. VISUAL QUALITY

The proposed transmission lines within the Conservation District will have very limited visual exposure to the public. They will not be visible from major highways or roads in the area, nor from other public vantage points such as parks or lookouts. The existing solid and partial vegetation on the large, one-acre lots between Alignment A and Kahakai Street in Leilani Estates will effectively screen the line from residents. Alignment B will span across the Conservation District in NFR-Part 2 and be screened from Nanawale Estates by the existing vegetation. Furthermore, the rustic appearance, texture and color of the wooden poles will blend well with the forest-type natural landscape in this area.

J. SOCIAL AND ECONOMIC IMPACTS

Employment and Economy

While most of the design and construction work for the proposed transmission lines will be done by personnel from HELCO and its parent company, HECO, certain tasks requiring specialized skills may be contracted to outside companies and individuals. The creation of these temporary jobs will generate income and excise tax revenues accruing to the State government. Both the creation of direct jobs and the purchase of supplies and materials for construction will support jobs locally through the multiplier effect.

After construction, the project will have little direct or indirect effect on employment levels, since the maintenance requirements for a transmission line are not substantial. Nevertheless, by transporting an additional 25 MW to the island's electrical grid and providing reliable electrical energy service, the project will indirectly help maintain the viability of the island's various economic sectors.

Housing

The proposed project will not significantly or adversely impact the existing housing stock and population level in the area. Most workers will be HELCO employees and/or local residents. However, if skilled workers for specialized tasks are not available on the island, they will be brought in from outside Hawaii and will make their own arrangements for housing. Because they will be residing on Hawaii for a relatively short time, it is likely that they would rent quarters rather than build or buy housing. In addition, there will be no displacement or relocation caused by the project.

V. ALTERNATIVES

A wide range of alternatives was considered during project and routing selection. For the overall alignments, marine and underground transmission cables were considered as generic alternatives to an overhead transmission line, however neither is cost-effective when compared to an overhead line and would probably result in greater environmental impact. Undergrounding the lines through the Conservation District would be considerably more disruptive to the environment than constructing the proposed overhead lines. Furthermore, the difficulties and delays involved in repairing underground or marine cable systems make them less reliable and more environmentally sensitive than overhead lines.

Specific routing alternatives were actively pursued by HELCO to avoid crossing the Conservation District land.

Alignments through Nanawale Estates, Leilani Estates, and Pohoiki Bay Estates, along the property lines shared with the forest reserve, were initially proposed. However, discussions with residents of the community and elected officials resulted in re-evaluation of the potential impacts of the proposed easements.

VI. AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

A. STATE

Department of Land and Natural Resources

Forestry and Wildlife Division

Land Management Division

Office of Conservation and Environmental Affairs

State Parks and Historic Sites Division

Water and Land Development Division

B. COUNTY

Department of Water Supply

C. OTHER

Puna Community Council