JOHN WAIHEE
GOVERNOR OF HAWAII

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

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

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JAN 27 1993

Ref.: LM-TW

'93 JAN 27 P3:06

Mr. Brian J. J. Choy, Director
Office of Environmental Quality Control
220 W. King Street, 4th Floor
Honolulu, Hawaii 96813

OFC. OF ENVIRONMENTAL QUALITY CONTROL

Dear Mr. Choy:

Subject: Negative Declaration for Hawaiian Electric Company's Proposed Waiau-Campbell Industrial Park 138kV Transmission Lines Project, Part 1-Campbell Industrial Park to Ewa Nui Substations, TMK: (9) 1-16:25 & 31, (9) 1-17:04, Ewa, Oahu, Hawaii

The State Department of Land and Natural Resources has reviewed the comments received during the 30-day public comment period which began on December 8, 1992 when the Notice of Availability of the draft Environmental Assessment and anticipated negative declaration was published in the OEQC Bulletin. The agency has determined that this project will not have significant environmental effects and has issued a negative declaration. Our findings and reasons are set forth in the final EA and in the attachment. Please publish this notice in the next OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the final EA.

Please contact Tom Wong at 587-0427 if you have any question.

Very Truly Yours,

William W. Paty

Enclosures

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1993-02-08-OA FEA Waiau-Campbell Industrial Part 138 KV Transmission Lines Project

FINAL ENVIRONMENTAL ASSESSMENT

Waiau-Campbell Industrial Park
138 kV Transmission Lines Project

Part 1-CIP to Ewa Nui Substations
Ewa, Oahu

Submitted Pursuant to Chapter 343, HRS

Approving Agency:
State of Hawaii
Department of Land and Natural Resources

Applicant:

Hawaiian Electric Company, Inc.
An HEI Company

Prepared by
CH2M HILL

February 1993

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Chapter 1
Introduction

Project Background

The proposed project is the Waiau-CIP Transmission Line, Part 1, Project. It consists of new transmission lines and a new substation that constitute the western portion of a new 138 kV transmission line system interconnecting the Campbell Industrial Park (CIP) Substation with the Waiau Power Plant. The eastern portion of the transmission line system through Waipahu and Pearl City is the Waiau-CIP Transmission Line, Part 2, Project. Both Parts 1 and 2 of the Waiau-CIP project are needed to meet transmission requirements for new power generation projects located in the CIP, to improve island-wide transmission system reliability, and to meet expected load growth in the Ewa District. Figure 1-1 shows the vicinity of the proposed project.

In October 1991, the Hawaiian Electric Company, Inc. (HECO), issued the *Waiau-Campbell Industrial Park 138 kV Transmission Line, Part 1, Project Routing Report* (CH2M HILL, 1991) and filed an application with the Public Utilities Commission (PUC) for approval to construct the project. In March 1992, the city council and the mayor approved HECO's petition to include the Ewa Nui Substation site on the City and County of Honolulu's Development Plan-Public Facilities Map (Ordinance 92-12). On December 22, 1992, the City and County of Honolulu Department of Land Utilization approved HECO's application for a Conditional Use Permit, Type 1, and a height waiver for the proposed transmission lines and Ewa Nui Substation.

Project Description

The Waiau-CIP Transmission Line, Part 1, Project will be a double-circuit, 138,000-volt (138 kilovolts [kV]), alternating current (AC) transmission line (Figure 1-2). From the CIP Substation, the 6.8-mile transmission line alignment will generally follow the Oahu Railway and Land Company (OR&L) right-of-way (ROW) to a canehaul road west of Varona Village. At that point it turns mauka near the canehaul road and follows the east side of Kaloi Gulch through a proposed state land acquisition to Farrington Highway, where it crosses to the mauka side of the highway. The alignment follows Farrington Highway east to the existing Ewa Substation where the new Ewa Nui Substation will be built. The new Ewa Nui Substation will be located next to the existing Ewa Substation, about 1½ miles west of Kunia Junction. An 8.7-acre site is needed for the substation to allow for landscaped setbacks and future improvements that will accommodate growth in electrical distribution demand.

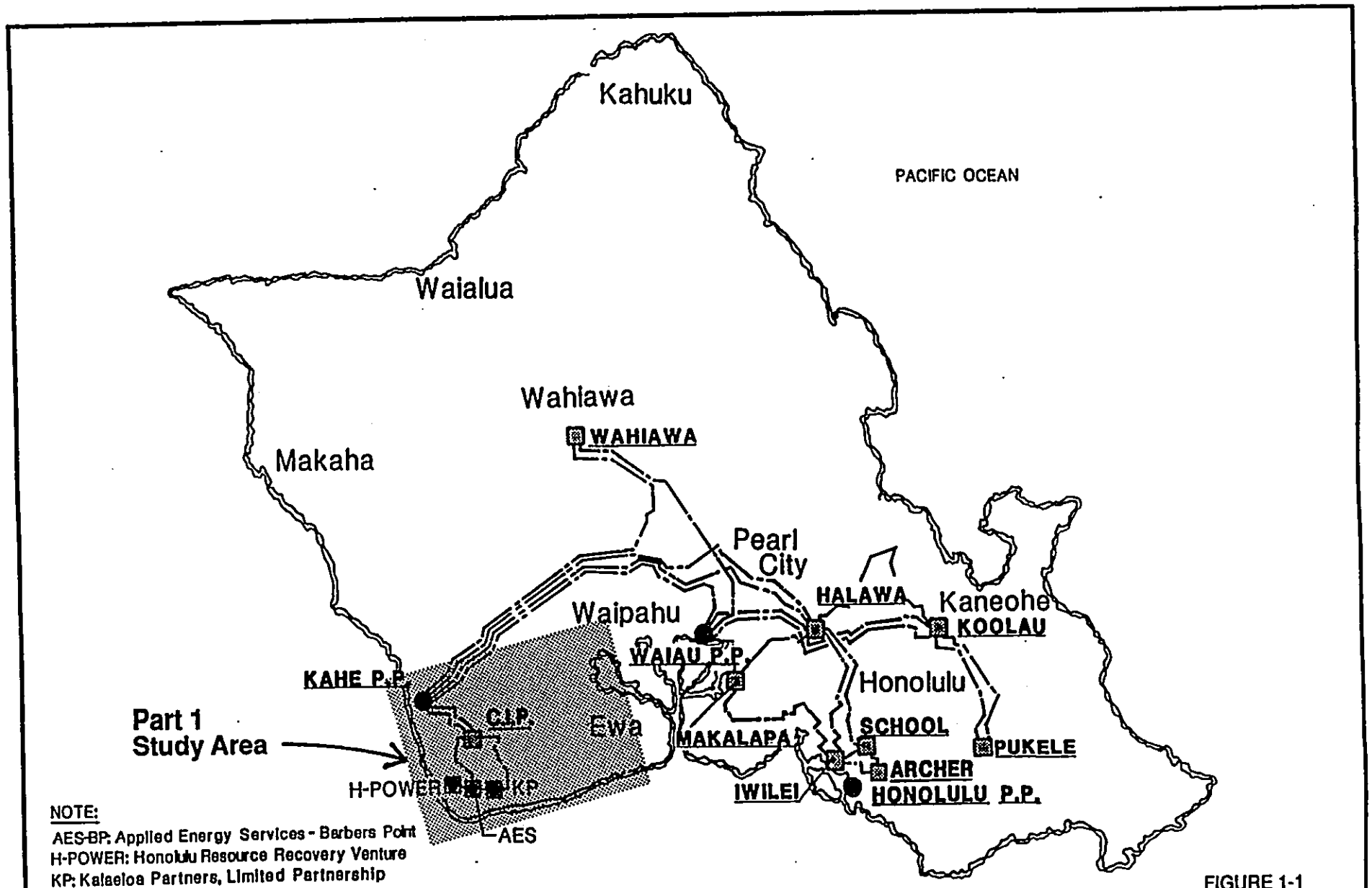

Kahuku
PACIFIC OCEAN
Waialua
Wahiawa
WAHIAWA
Makaha
Pearl City
HALAWA
Kaneohe
KOOLAU
Waipahu
WAIAU P.P.
KAHE P.P.
Honolulu
Part 1
Study Area
C.I.P.
Ewa
SCHOOL
MAKALAPA
PUKELE
ARCHER
H-POWER
KP
IWILEI
HONOLULU P.P.
AES
NOTE:
AES-BP: Applied Energy Services - Barbers Point
H-POWER: Honolulu Resource Recovery Venture
KP: Kalaeloa Partners, Limited Partnership
LEGEND
POWER PLANT
SUBSTATION
EXISTING 138kV LINE
NORTH
0 1 2 3 4 5 MILES
GENERATION AND 138KV TRANSMISSION SYSTEM
Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL

FIGURE 1-1

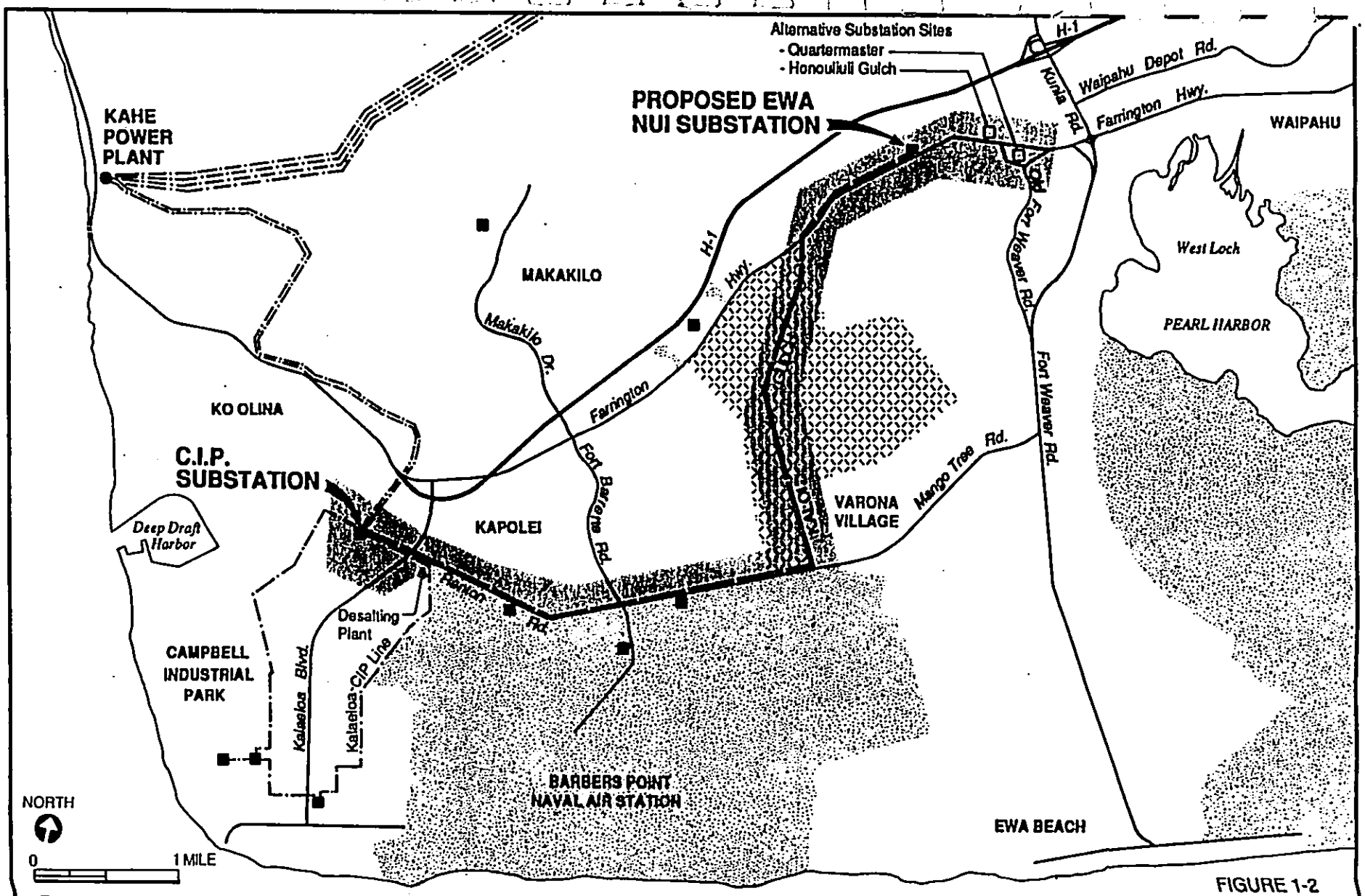


FIGURE 1-2

PROPOSED ALIGNMENT AND SUBSTATION SITE

- Project Alignment
- Corridor
- Existing Substation
- Existing 138 kV Transmission Line
- Federal Lands
- Proposed State Land Acquisition

Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL

Project Schedule and Cost

Construction of the transmission lines will take about 12 months, from June 1993 to June 1994. Construction of the civil and structural elements of the Ewa Nui Substation will take about 9 months, with an additional 5 months for electrical work. Work would be completed in June 1994. Operation of the transmission lines and Ewa Nui Substation is scheduled to begin at the end of June 1994. The estimated capital cost for the transmission lines is $24.9 million (1991 dollars). The estimated capital cost for the Ewa Nui Substation is $7.8 million (1991 dollars).

Applicant

Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, HI 96840-0001
Contact: Ken T. Morikami, Project Manager

Approving Agency

Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813
Contact: Sho Serikaku

Compliance with the State's Environmental Law

The Department of Land and Natural Resources (DLNR) has informed HECO that it should request easements from the state for that portion of the transmission line alignment that crosses the 1,100 acres that are to be owned by the state. HECO's request to the DLNR covers Tax Map Keys 9-1-16:31; 9-1-16:25; and 9-1-17:4. A request for approval of use of state lands requires compliance with the procedures set forth in Chapter 343, Hawaii Revised Statues (HRS), and preparation of an environmental assessment (EA). This EA is prepared pursuant to the state of Hawaii's environmental law; Chapter 343 of the HRS; and Chapter 200 of Title 11, Department of Health Administrative Rules.

Permits and Approvals

The permits and approvals for the project are as follows:

- Federal:

- Federal Aviation Administration—Notice of Proposed Construction or Alteration Determination of No Hazard to Air Navigation

- U.S. Navy approval for aerial easement over entrance to Barbers Point Naval Air Station

• State:

- Department of Health—Variance from community noise control rules, if necessary, during construction

- DLNR—Historic site review (see Appendix A, letter from DLNR)

- Department of Transportation—For work on state highways

- Office of Environmental Quality Control—Environmental assessment

• City and County:

- Department of Land Utilization—Conditional Use Permit Type 1 (approved December 22, 1992)

- Public Works Department—Construction within county road ROW

- Department of Transportation Services—Street usage permit

- Board of Water Supply—Review and approval of construction plans

- Department of General Planning and City Council: Development Plan—Public Facilities Amendment for Ewa Nui Substation (adopted March 10, 1992, by Ordinance 92-12)

Agencies Consulted in Making the Assessment

On August 3, 1992, requests for comments regarding preparation of this EA were sent to federal, state, and county agencies and to various individuals and organizations. The list of those entities is presented in Appendix A, along with the comments received and the responses to those comments. Appendix B is a summary of public and agency consultation, and a sensitivity analysis of corridor alternatives is presented in Appendix C.

Comments and Responses on Draft Environmental Assessment

A notice that the draft environmental assessment (DEA) was available for a 30-day public review period and that the approving agency, the Department of Land and Natural Resources, anticipated a negative declaration was published in the December 8, 1992, *OEQC Bulletin*. Four copies were filed with the Office of Environmental Quality Control. Copies of the DEA were mailed to reviewers on December 4, 1992. Table D-1 in Appendix D lists all of the reviewers who received a copy of the DEA for review and indicates those who responded. The DEA comment period ended on January 7, 1993.

Ten comment letters were received by the approving agency. Responses were mailed to all who commented on the DEA; both comment and response letters are reprinted in Appendix D. Table 1-1 is a summary of the comments and responses. The final EA includes revisions based on the comments received.

Determination by Approving Agency

As the approving agency, the Department of Land and Natural Resources has reviewed the final environmental assessment (FEA) and the significance criteria set forth in Section 11-200-12(b) of the Environmental Impact Statement Rules (Title 11, Chapter 200 of Hawaii Administrative Rules, Department of Health) and has determined that the proposed action of granting HECO a nonexclusive easement over state-owned lands for the proposed transmission lines does not require the preparation of an environmental impact statement. Accordingly, the department has made the decision to issue a Final Negative Declaration.

The department's findings and reasons for issuing a Final Negative Declaration is set forth below.

The state's Environmental Impact Statement Rules list 11 criteria to consider in determining the significance of potential environmental impacts of an action. The rules require the department to consider every phase of a proposed action, the expected consequences (both primary and secondary), and the cumulative as well as the short- and long-term effects of the action. A discussion of the proposed action and HECO's project relative to the significance criteria follows:

1. **Involves an irrevocable commitment to loss or destruction of any natural or cultural resource?**

   No. HECO's project does not adversely affect any natural or cultural resource. The FEA contains descriptions of natural and cultural resources based on field surveys. Consultation with agencies of expertise confirm that there are no impacts. See FEA Appendix A (letters from U.S. Fish & Wildlife Service and DLNR).

Table 1-1

Summary of Comments and Responses

	Comment	Response
Department of the Navy, Naval Base Pearl Harbor		
	No comment	None required.
Department of Education		
1	Concerned about potential health effects from electric and magnetic fields	"Prudent avoidance" being implemented to minimize EMF exposure levels
2	Barbers Point Elementary School and three proposed schools in Village of Kapolei are near lines.	Barbers Point Elementary is 400 feet from line and three proposed schools are more than 255 feet from line. EMF levels are not measurable at these distances.
Housing Finance and Development Corporation		
1	Correct acreage for Villages of Kapolei.	EA revised to state 890 acres.
2	Views of lines and EMF concerns have psychological impact that affect marketability of residential properties in Ewa.	Studies show that some buyers avoid homes by power lines and others purchase such homes without an effect on selling price. Lines are sited to have adequate setbacks from existing and future residences.
3	Property values decrease when adjacent to transmission lines.	Value depends on perception of buyer who considers a variety of factors. Studies do not show decrease in values for properties near transmission lines.
4	HECO should pay to relocate lines if necessary and indemnify state.	Standard clauses in State's easement document indemnify State and require HECO to relocate lines at its own expense.
5	Draft EA is missing Figure C-1.	Some copies lacked figure. Copies sent to HFDC.
6	Revise sensitivity analysis in Appendix C to reflect potential urban development around Kaloi Gulch.	Revision to analysis does not change ranking of alternatives.
7	Prefer to place transmission lines underground.	Cost of underground lines is 4 to 5 times that of overhead lines; property owner must pay cost of underground lines to avoid impact to all ratepayers.
Department of Health		
	No objections to construction of transmission lines	None required.
Department of Land and Natural Resources		
1	No known historic sites along route; subsurface sites unlikely to be found.	HECO will monitor for sites during construction according to the City's Conditional Use Permit condition.
2	State is acquiring 1,100 acres around Kaloi Gulch.	HECO and the state have agreed on alignment and are processing easement documentation.
3	Any damage to Oahu Sugar Company's cultivated areas caused by construction is responsibility of HECO.	HECO agrees to accept responsibility.

Department of Accounting and General Services		
	No comment.	None required.
Department of Public Works		
1	Address impact of stormwater discharge during construction.	Addressed in EA. HECO will comply with regulations.
2	Address measures to control discharge of pollutants.	Project will not discharge pollutants.
3	Investigate drainage improvements to Kaloi Gulch.	HECO has consulted with involved parties; no specific plans have been developed.
4	Provide 20-foot access road to substation.	A 20-foot access road is proposed.
5	Investigate future roadway improvements.	All parties have been consulted and all potential conflicts have been resolved.
6	Project may conflict with existing sewers.	Project has been designed to avoid sewers.
7	Investigate future sewers in area.	HECO has consulted will involved parties; no conflicts.
Department of General Planning		
1	Coordinate lines with future north-south road.	HECO met with Dept. of Transportation--no conflicts between both projects.
2	Clarify how "prudent avoidance" was applied to project.	Specific "prudent avoidance" measures proposed by HECO are described in the EA.
Department of Transportation		
1	Coordinate project with developers in the area.	HECO has contacted appropriate developers.
2	Place poles as far away as possible from edge of pavement.	The poles are placed as far away as possible.
3	Consult with city and state on proposed north-south road, Renton Road, and Farrington Highway.	HECO has consulted with city and state agencies on these roads.
4	Submit plans for work in highway ROW for review and approval.	HECO will submit plans.
BHP Petroleum, The Gas Company		
	Request study of potential EMF effects on nearby gas line.	HECO's engineering consultant is conducting study.

2. **Curtails the range of beneficial uses of the environment?**

No. The proposed easement is an encumbrance, but still allows other land uses appropriate to Kaloi Gulch. One circuit will overhang Kaloi Gulch, thereby minimizing encumbrances on lands adjacent to Kaloi Gulch. Master planning activities for the 1,100 acres around Kaloi Gulch include a variety of land uses for and adjacent to the Kaloi Gulch/transmission corridor (including storm water detention ponds, a golf course, open space and roads) that are compatible with the transmission lines.

Other sections of the proposed transmission lines follow existing roadways, utility corridors, or the energy corridor. The Ewa Nui Substation will consume 8.7 acres of privately owned land currently in sugar cane production. The substation equipment will be set back from the property line by at least 30 feet; the setback will be landscaped. Cultivation and future urbanization of the surrounding area are not curtailed.

3. **Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344?**

No. The proposed granting of easements to HECO and the project itself do not conflict with Chapter 344. The proposed alignment and substation site were selected after extensive consultations with federal, state, and county agencies (more than 100 meetings) since 1987. The transmission line route was selected based on a variety of environmental, social, and regulatory considerations including a recommendation by the Office of State Planning in its letter of November 15, 1991, to HECO.

4. **Substantially affects the economic or social welfare of the community or state?**

No. The transmission lines and substation do not consume large amounts of land and do not preclude the productive and economic use of surrounding lands. (See Criterion 2.) The overhead transmission lines effectively accomplish the project's objectives at a reasonable cost, and so would not adversely affect household income. (Underground lines, which would eliminate visual impacts but not magnetic field levels, would cost about five times as much as overhead lines.)

Potentially significant adverse economic impacts may occur to the community and Oahu if the project is not built.

The social welfare of the community or the state would not be substantially affected. (See Criteria 2, 3, 5, 6 and 7.)

5. **Substantially affects public health?**

No. The state Department of Health's comment letter on the environmental assessment's evaluation of EMF states that is has no objections to the construction of the

transmission lines. HECO is complying with the department's EMF policy (April 3, 1991) to exercise "prudent avoidance" in the siting, design, and operation of the transmission lines and substation. According to the department's policy, "the existing research data are inconclusive and not sufficient enough for adequate, accurate risk assessment" and "too little is presently known to be able to determine where or what rules would provide useful public-health protection." For these reasons, the policy states, "Where technically feasible and practical, public exposure should be minimized."

In siting the transmission lines, HECO has avoided existing populated areas; used existing power line corridors so that low-reactance phasing to reduce EMF levels is feasible; and followed an existing natural boundary (Kaloi Gulch) in the 1,100 acres (which the state is acquiring to protect agricultural use and where future development would occur after 1996) to minimize exposure to future populations. The location of uses in the 1,100 acres is unknown and there is an opportunity to plan for future land uses around Kaloi Gulch to minimize EMF exposure to the public. Consistent with DOH policy, HECO will measure EMF levels before and after construction. This program will be conducted in consultation with the landowners and the Department of Health. HECO has undertaken all feasible and practical measures to minimize public exposure so that the project does not have the potential to substantially affect public health.

Underground lines do not eliminate magnetic fields. In fact, the public would be potentially exposed to higher levels of magnetic fields when directly over the underground lines as compared to exposure levels directly under overhead lines. (However, underground lines cause the magnetic field levels to decrease more quickly over distance from the lines.) The additional cost of underground lines, about five times the construction cost of overhead lines, is a significant cost to pay without any certainty about the potential health benefits of undergrounding the lines or about the potential health risks of overhead lines. If HECO were required to place the transmission lines underground to address concerns about potential EMF effects, then this requirement could set a precedent to underground all existing lines on Oahu. This precedent would have a significant cumulative economic impact on HECO's customers and the City and County of Honolulu. The cost of undergrounding existing electric lines (excluding 138 kV lines) has been estimated at about $10 billion.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities?

No. The proposed project will not cause any changes to population growth or its distribution and it will not affect public facilities. The proposed project is needed to address an existing reliability problem and to accommodate planned urbanization in the Ewa District's "Second City."

7. **Involves a substantial degradation of environmental quality?**

No. The project's extensive environmental analysis and public and agency consultations since 1987 have resulted in a proposed project that minimizes environmental impacts to the greatest extent possible. Short-term (construction) and long-term (operation) impacts are described and mitigation measures prescribed in the FEA. In one topic area—the potential visual effects of the overhead transmission lines—there is disagreement over the significance of the effect. To some, undergrounding of the lines is the only solution. But this has significant adverse economic impacts to the community, unless the landowner or developer pays for the extra cost of underground lines. Recognizing that the overhead line configuration is the only practical solution at a reasonable cost, HECO has minimized the transmission lines' potential visual effects in several ways by: (1) following existing utility corridors where lines already exist; (2) placing existing 46 kV lines onto the new steel poles; (3) using fewer, tubular steel poles instead of numerous wood poles or bulky lattice towers; (4) painting the conductors a dark color so that they do not reflect light; and (5) landscaping where possible to soften the potential visual effects of the poles.

8. **Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions?**

No. This project does not create a commitment for other, future actions. This project is needed to accommodate planned urbanization of the Ewa District. Urbanization of the area is not a direct result of the project.

Construction of another project, the Waiau-CIP 138 kV Transmission Lines Part 2 Project, can occur along a variety of alternative routes in relation to the location of the Ewa Nui Substation and the Part 1 transmission lines. The Part 2 project is needed to improve system reliability. For environmental conditions specific to the Part 2 project area (i.e., the urbanized communities of Waipahu and Pearl City), an EIS was prepared and accepted by the State Department of Transportation on August 26, 1992. These environmental conditions do not exist in the Part 1 project area.

Another HECO project (under construction) that is needed for system reliability is the Waiau-Makalapa No. 2 138 kV Transmission Line Project, a new transmission alignment in the Aiea/Pearl City area from the Makalapa Substation to the Waiau Power Plant. A Negative Declaration for the project was issued by the state Department of Transportation on June 26, 1990.

9. **Substantially affects a rare, threatened or endangered species or its habitat?**

No. See discussion for Criterion 1.

10. Detrimentally affects air or water quality or ambient noise levels?

During construction there will be short-term noise impacts; however, the only existing noise-sensitive uses along the alignment are in the Barbers Point Naval Air Station. An elementary school is about 400 feet from the alignment. The nearest Navy residences are about 125 feet from the alignment. Measures to mitigate the noise impacts are described in the FEA. There are no long-term noise impacts from the project. There are no impacts to air and water quality.

11. Affects an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters?

No. A portion of the transmission line route between the OR&L right-of-way and Waimanalo (canehaul) Road is located in a 100-year flood prone area near Kaloi Gulch and the Ewa Villages. The design flood height is 3 feet above grade. The poles are designed to withstand flooding. The project will not affect the natural course of flooding. No other areas noted in this criterion are affected by the project.

Chapter 2
Project Purpose and Need

The purpose of the Waiau-CIP Transmission Line, Part 1, Project is threefold:

- To increase system reliability by establishing an alternate transmission line corridor, as recommended by Stone & Webster Management Consultants (1984)
- To provide additional transmission capacity and a new substation in leeward Oahu to meet expected load growth in the Ewa District
- To meet transmission requirements for existing and planned power generation projects in the CIP area

The need for the project is detailed in the following sections.

Existing Power Generation and Transmission System

HECO provides the majority of the electricity for a population of 817,000 on the island of Oahu. HECO provides service to approximately 250,000 metered accounts through its generation, transmission, and distribution systems. The system peak load as of November 1991 was 1,141 megawatts (MW).

Generation Resources

HECO serves most of Oahu's electricity requirements with oil-fired units at Kahe (649-MW capacity), Waiau (501-MW capacity), and Honolulu (116-MW capacity)—a total capacity of 1,266 MW. Three independent power producers located at Campbell Industrial Park provide HECO with about 420 MW of power (see "New Power Generation"). Power provided on an as-available basis is purchased from Oahu Sugar Company, Hawaiian Independent Refinery Inc., and the Waialua Sugar Company. Figure 1-1 illustrates the locations of the power plants and the interconnecting 138 kV transmission system.

Transmission and Distribution

As HECO's power is generated, transformers step up the voltage to 138 kV. Power then flows through the main (138 kV) transmission grid. The higher voltage allows efficient transmission of large amounts of power to all major load centers. Transmission substations at the major load centers have transformers that step down the 138 kV voltage to HECO's 46 kV subtransmission voltage. Local area substations further reduce the voltage from 46 kV to HECO's 12 kV local distribution voltage. Figure 1-1 illustrates the locations of the

nine existing 138 kV substations. Substations are also located at the Waiau Power Plant and the Kahe Power Plant.

System Reliability

HECO has historically provided a high level of reliable electric service and, until 1983, Oahu had not experienced a complete electrical blackout for 40 years. In 1982, Hurricane Iwa caused considerable damage to HECO's system, including damage to two of the four 138 kV circuits in the common transmission corridor between the Kahe and Waiau Power Plants, resulting in a partial outage. On July 13, 1983, one of these circuits and another major 138 kV line were out of service for repairs. On that date, a phase-to-phase fault occurred on the Kahe-CIP 138 kV transmission line, which eventually resulted in circuit breakers removing the line from the grid. With two 138 kV lines already out of service for repair, the short circuit on the Kahe-CIP line caused severe system instability, leading to automatic shutdown of the generation units and an island-wide blackout.

On September 10, 1988, approximately two-thirds of Oahu experienced an outage. The circumstances surrounding this outage were similar to those of the 1983 outage. While two 138 kV circuits (one from Kahe) were out of service so that two wooden structures could be safely replaced with stronger steel structures, a conductor failure on the CIP-Kahe-Waiau 138 kV circuit caused it to trip out. The Kahe-Halawa No. 1 138 kV circuit then became overloaded, and this left in service only one of the four circuits leading from the Kahe Power Plant. This overload led to an automatic shutdown of most of the island's generating units and caused an outage that lasted up to 7 hours in some locations.

On April 9, 1991, an island-wide power outage occurred. While one Kahe transmission line was down for maintenance, two other lines, Kahe-Halawa No. 1 and Kahe-Wahiawa, tripped out of service within 10 minutes of each other. A fourth line shut down, preventing damage to the remaining transmission line exporting power from the Kahe Power Plant. Findings on the causes of the power outage are inconclusive and still under investigation.

After the 1983 blackout, Stone & Webster Management Consultants made a comprehensive investigation of the system (1984). One of the recommendations of this investigation was that HECO develop a physically separate southern power transmission corridor from Kahe Power Plant to the Waiau Power Plant to reduce the possibility of multiple line outages that could result from a single catastrophe, such as a windstorm or a fire. Since 1983, there have been other outages involving the Kahe transmission lines, further underscoring the need for a new southern corridor. This second power corridor, which would be established with the addition of the new Waiau-CIP 138 kV lines, would provide an alternate path for power to flow in the event that the existing multiple lines out of Kahe were lost. This would improve the reliability of the entire transmission system and could have prevented or reduced the extent of the April 9, 1991, power outage.

HECO has adopted a minimum separation standard of ½ mile. The proposed Waiau-CIP Transmission Line, Part 1, Project reflects HECO's adoption of more stringent contingency planning criteria and incorporation of those criteria in its transmission studies and system additions.

Load Growth

HECO's Forecast Planning Committee semiannually updates a forecast of future loads. Factors considered in the load forecasts include historical data on loads and population growth, projected future development, increases in population, and associated commercial development. Between 1981 and 1985, peak system loads were relatively constant, averaging 935 MW. The HECO system has experienced an average annual increase of 3.2 percent in peak system loads from 1986 through 1991. In the future, loads are expected to continue to increase at an average of about 3.2 percent per year.

Over the next 20 years, HECO expects that a significant part of the island's load growth will occur in southwest and central Oahu. This growth is projected because numerous major residential, commercial, industrial, and recreational developments are planned for the central Oahu and Ewa Plain area.

According to a 1989 HECO study, projected load growth in the central and Ewa areas of Oahu will cause overloads on the Waiau and Wahiawa 46 kV systems beginning in 1992 unless load is shifted away from Waiau and Wahiawa. Currently, there is insufficient subtransmission capacity in these areas to which load may be shifted. A new 138-46 kV substation in the Ewa Plain area is needed to:

- Solve the immediate Waiau and Wahiawa overload conditions
- Provide a permanent solution to the Waiau 46 kV bus overload problem
- Provide for future load growth in the Ewa Plain area

New Power Generation

New generation resources are required because of the growth in demand for electricity. HECO is purchasing power from independent power producers in Campbell Industrial Park. Kalaeloa Limited Partnership (KP) has constructed a 180-MW, combined-cycle plant consisting of two oil-fired combustion turbines and one steam turbine.

A second plant, a 60-MW refuse/waste heat recovery unit, is operated by Honolulu Resource Recovery Venture (H-Power). This plant went into service in 1990.

A third power plant is operated by Applied Energy Services-Barbers Point (AES-BP) of Arlington, Virginia. AES-BP started operation of the 180-MW coal-burning plant in 1992.

HECO plans to add new power-generating capacity to meet future demand. A 200-MW power plant is proposed at the HECO tank farm in the CIP. The plant would come online in two phases: Phase 1 in 1995 and Phase 2 in 1996 to 1997.

The new generation sources at the CIP will improve HECO's system reliability by contributing to geographical dispersion of power sources and by diversifying generation types. However, Parts 1 and 2 of the Waiau-CIP line are needed to transmit the power to the load centers throughout the island.

Chapter 3
Alternatives

From 1987 to 1991, HECO and its consultant, CH2M HILL, conducted a route selection process to identify a preferred alignment and a transmission technology for the project. The process included extensive consultations with the public, community organizations, neighborhood boards, agencies, landowners, and elected officials to identify alternatives, environmental and social concerns, and community preferences (Appendix B). More than 100 meetings were held for the project and several newsletters were mailed out to the public. A series of meetings were held in 1991 with state and city agencies and Campbell Estate (the major landowner in the study area) to review alternative alignments in light of the state's action of filing a condemnation suit to acquire 1,100 acres of Campbell Estate lands where the transmission lines are proposed to be located. Subsequent meetings with state agencies were held in 1992 to refine the project's alignment.

Throughout the route selection process, a variety of environmental concerns were considered to arrive at a proposed transmission line alignment and site for the Ewa Nui Substation with a minimum of adverse impacts. In addition to community concerns, the factors evaluated included land jurisdiction (ownership); land regulations; existing land use; proposed land use; biological and water resources; geological, slope, and soil characteristics; visual resources; cultural and historic resources; utility and transportation systems; electric and magnetic field effects; and construction impacts. Engineering factors (such as reliability and constructability) and cost were also considered. A variety of corridor and alignment alternatives were analyzed, as were underground and overhead transmission technologies.

Under the No Action alternative, it is assumed that there will be no construction of new transmission lines between the Ewa Nui Substation and the CIP Substation. The purpose and need for the project would not be met and the risk of major electrical system outages would increase. For these reasons, the No Action alternative is rejected.

Transmission Technologies

There are two technically possible methods of constructing 138 kV transmission lines between the CIP and Ewa Nui Substations: conventional overhead construction and underground construction. It is also technically feasible to combine the technologies. For example, transmission lines can be in an overhead configuration in one portion of an alignment, and then be placed underground in another portion with the addition of a transition station.

The following analysis presents the basic elements of the two alternative transmission technologies and compares the environmental and economic considerations of construction and maintenance for each alternative.

Overhead Transmission Line

Conventional overhead 138 kV line construction consists of stranded aluminum conductors supported by monopole structures (wood or steel), multipole structures (wood, steel, or aluminum), or lattice structures (steel). The conductors are electrically insulated from the structure with porcelain or polymer/fiberglass insulators (Figure 3-1). HECO transmission lines are designed to exceed the standards of the PUC General Order No. 6 (GO-6), "Revised Rules for Overhead Electric Line Construction" (State of Hawaii, Department of Regulatory Agencies, 1969). GO-6 specifies standards for ground clearance, conductor clearances, and other construction standards to ensure safe and efficient service.

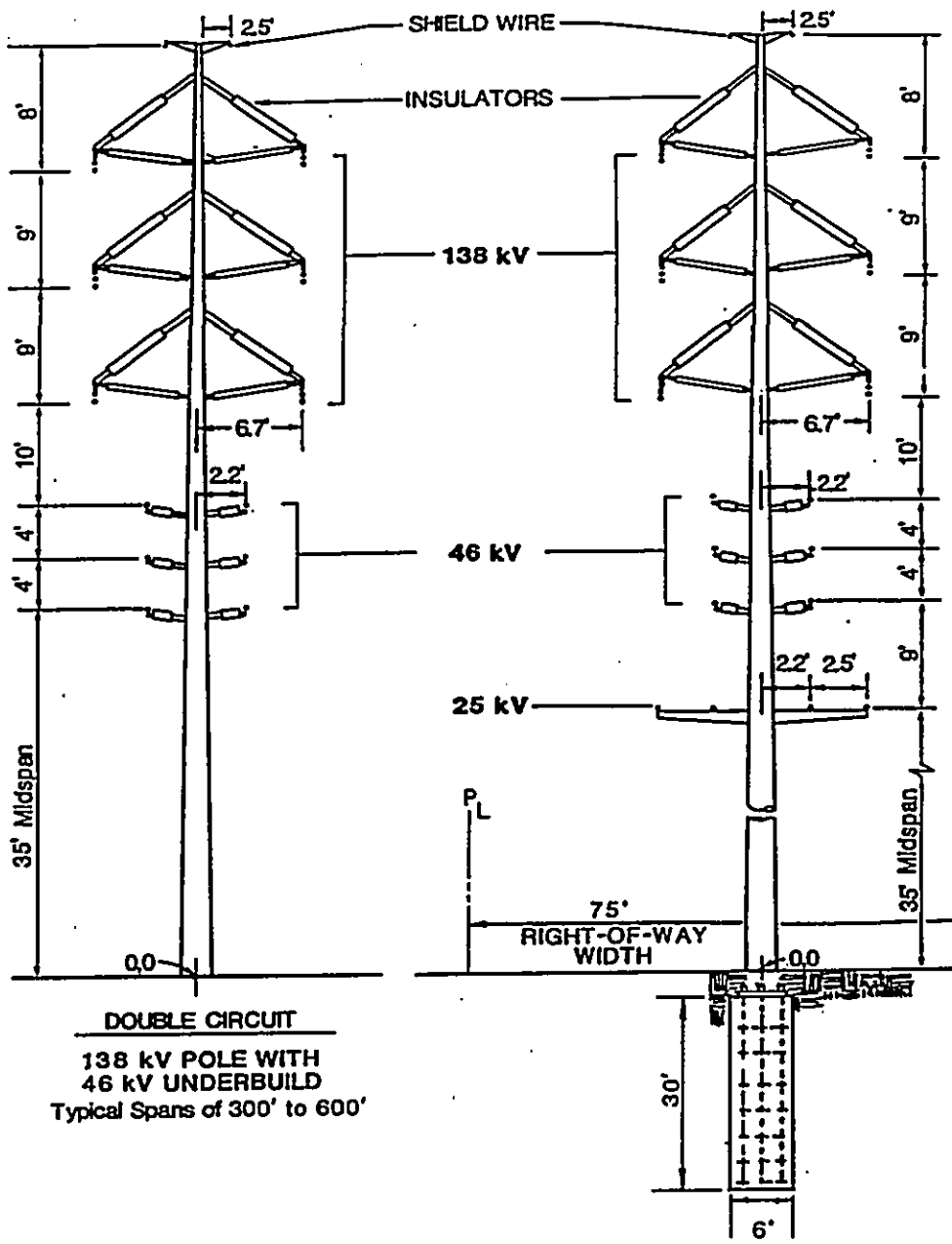
The type of support structure selected depends principally on the topography and land uses in and around the proposed ROW. Lattice steel and multipole wood structures are used in remote or mountainous terrain where span lengths are long (600 feet to 1,200 feet). The cost per mile is relatively low; however, the steel towers can be visually intrusive. Tubular steel poles (Figure 3-1) are generally used in developed areas where the route is expected to be highly visible and the span lengths are moderate (300 to 600 feet). Singular wood poles are used for lower-voltage subtransmission and distribution lines where the span lengths are shorter (up to 300 feet). Wood poles and steel poles require guy wires for support at angles; however, steel poles can be designed to be self-supporting. Both lattice steel structures and tubular steel poles can be painted to blend into or complement the surrounding environment. Tubular steel poles are proposed for this Waiau-CIP Transmission Line, Part 1, Project.

Underground Transmission Cable

Most underground transmission cable systems in the United States are high-pressure fluid-filled (HPFF) pipe systems (Electric Power Research Institute, 1975). Other systems are low-pressure fluid-filled (LPFF), or self-contained fluid-filled cables, and gas and solid dielectric cables. Gas dielectric systems are used in situations where short, high-capacity lines are needed and generally they are not used for long-distance transmission. LPFF self-contained cables require a duct for each cable and require larger excavations and higher overall costs. In solid dielectric systems, each circuit consists of a pipe that encloses conductors encased in polyethylene insulation. The reliability of solid dielectric systems has not yet been adequately demonstrated. Although solid dielectric cable systems are commonly used for lower-voltage lines (115 kV or lower), they are rarely used for higher-voltage lines such as the Waiau-CIP 138 kV Transmission Line. HECO's engineers believe, however, that over short distances solid dielectric cables can provide reliable service for 138 kV lines.

HPFF systems are the most reliable systems available today. Their good operating record and physical ruggedness make them particularly applicable for the Waiau-CIP line. HECO has used this type of system for its new 2-mile Iwilei-to-Archer and School-to-Archer 138 kV lines.

An HPFF 138 kV underground system consists of three paper-insulated cables installed in a fluid-filled pipe (Figure 3-2). The pipe contains a low-viscosity dielectric fluid under



DOUBLE CIRCUIT

138 kV POLE WITH
46 kV UNDERBUILD
Typical Spans of 300' to 600'

DOUBLE CIRCUIT

138 kV POLE WITH
46 kV AND 25 kV UNDERBUILD
Typical Spans of 300' to 600'

NOT TO SCALE

FIGURE 3-1

TYPICAL 138KV STRUCTURES

Waiau–Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company

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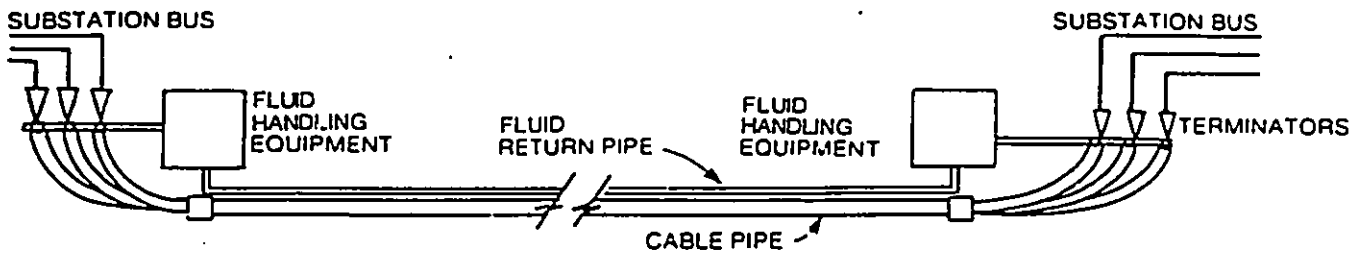
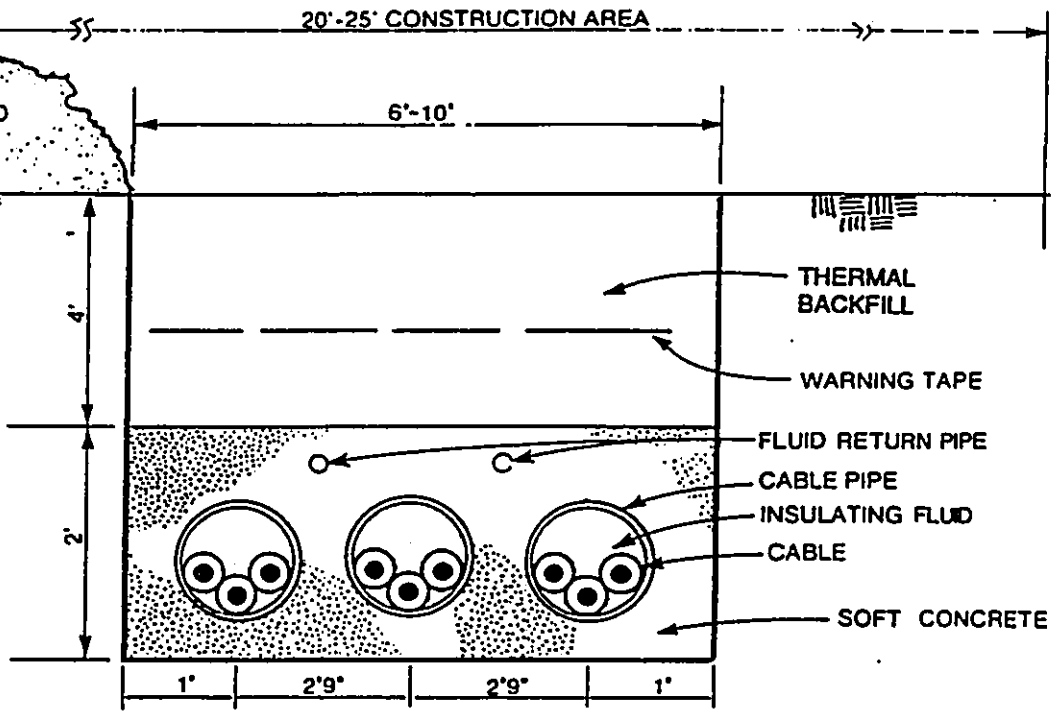
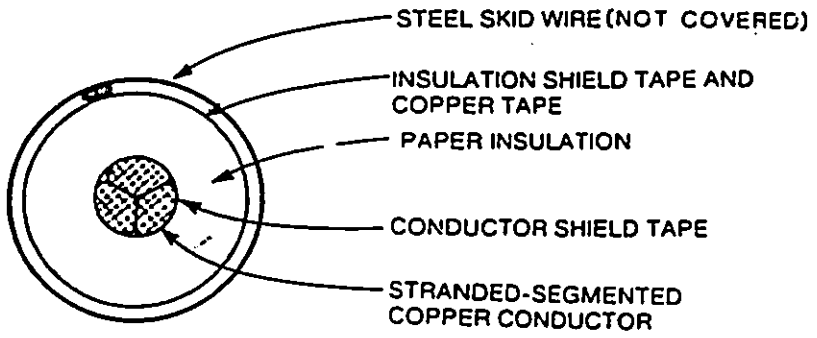


TYPICAL HIGH-PRESSURE FLUID-FILLED PIPE-TYPE CABLE SYSTEM



TYPICAL HPFF PIPE-TYPE CABLE TRENCH SECTION



TYPICAL HPFF CABLE CONSTRUCTION

NOT TO SCALE

FIGURE 3-2

TYPICAL 138KV UNDERGROUND SYSTEM

Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL

nominal 200-pound-per-square-inch pressure. Nontoxic, biodegradable fluids are available for cable systems. The fluid and insulation on each of the cables provide the necessary dielectric or electrical strength to the transmission cable. The pipe diameter is usually about 8 inches, but varies according to cable conductor size and ampacity. The pipe provides mechanical and moisture protection, which is particularly important because of the alluvial condition of the soil on Oahu. The number of pipes installed depends on the power and reliability requirements of the system. For the Waiau-CIP 138 kV Transmission Line, three circuits would need to be installed for the 6.8-mile underground route for reliability.

If the native soil has poor thermal properties, a trench must be excavated and the pipe system buried in a special backfill with specified thermal characteristics. A fluid return pipe is often installed next to the cable pipe. Special terminations are used at the line terminals for the transition from the cable insulation system of the underground system to the typical porcelain and air insulation of the 138 kV outdoor substations.

Two types of cooling can be used for an HPFF system: natural and forced. If forced cooling is required, fluid handling equipment includes pumping, cooling, filtering, and recirculating components at the line terminals. The space occupied by cooling stations varies according to their capacities. For example, a 525,000-British thermal units (Btu)-per-hour capacity station is 10 feet by 30 feet by 9 feet high. If forced cooling is not required, only fluid pressurization stations need to be installed at the terminals. Splice vaults (utility holes) are required at varying intervals along the line with a maximum interval of 2,000 to 4,000 feet.

Comparison of Transmission Alternatives and Environmental Considerations

The two transmission alternatives described earlier differ significantly in their cost, maintenance requirements, and environmental impacts. The following subsections and Table 3-1 offer comparisons of relevant characteristics of each transmission alternative.

Geophysical Considerations

The construction, operation, and maintenance of each of the transmission alternatives could affect topography and soil differently.

Overhead Transmission Lines. The construction of an overhead line generally has minimal impact on topography and soil because only the soil in and around the pole locations is disturbed. At each pole, soil is temporarily disturbed for augured excavations or pile-driving and backfilling. The soil not required for backfill would be trucked to a fill site. The land between the poles remains undisturbed except where equipment used for conductor pulling and splicing might require access. Surface soil may be compacted from movement of equipment, and the possibility of soil loss through erosion exists until vegetation is reestablished.

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Table 3-1
Transmission System Alternatives:
Summary of Characteristics and Potential Environmental Effects

Alternative Characteristics			Construction and Operation Effects			Maintenance Effects
Transmission Alternative	Basic System Components	Construction Cost ($M/Mile)	Geophysical, Biological, and Cultural Resources	Electromagnetic Fields and Visual Resources	Traffic Considerations	Maintenance Considerations
Conventional overhead	Augured concrete pier foundations or pile foundations in wet soils (6 to 10 piles for each pole) Tubular steel poles 80 to 120 feet high Three aluminum conductors and one shield wire Some sections underbuilt with 46 kV lines	$3.4 to 8.2 million	Clearing of surface vegetation at pole sites Excavation for pile foundations 13 ft x 18 ft x 4 ft Trees near ROW trimmed within 10 ft of conductor position in high wind	Electromagnetic Fields (Assumes double circuit lines with 46 kV underbuild) Electric field at center of ROW approx. 0.25 kV/m or less Magnetic field at center of ROW approx. 20-30 milliGauss Visual Poles and conductors visible throughout; sensitive siting of structures—nonreflective conductors	Construction ROW near roadway: one lane of traffic obstructed for 4-6 weeks each mile during peak traffic periods (two lanes off-peak) Maintenance Potential traffic disruption or delays depending on type of repair or maintenance practices	Location and access to line repair relatively easy "Live-line" maintenance is possible Repair time: hours

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Underground (HPFF)	HPFF pipe containing cable plus smaller fluid return pipe (three pipes in a trench) Fluid handling stations at each terminus Splice vaults (utility holes) every 2,000 to 4,000 feet Cooling stations, filtering, and recirculation equipment may be required	$15.6 to 20.8 million	**Construction** Trench excavation 7 to 10 ft wide and 8 ft deep 30 splice vault excavations 10 ft x 14 ft x 7 ft deep Temporary loss of surface vegetation and revegetation of low-growing vegetation only Potential soil layer mixing and topographic alteration because cut and fill required for access Potential to disrupt surface cultural resources within ROW Requires extensive survey and salvage plan **Operation** Potential to excavate pipe for repair of line Potential for fluid leaks as a result of line rupture	**Electromagnetic Field** No electric field Magnetic field of 1 to 20 milliGauss at soil surface directly above pipe **Visual** No impact from underground cable Fluid handling equipment would benefit from screening	**Construction** Longer period of traffic disruption for trenching and laying pipe than for conventional overhead **Maintenance** Periodic utility hole inspections may disrupt traffic Potential traffic disruption during maintenance	Potential for heavy traffic disruption during maintenance or repairs Daily maintenance of oil handling equipment is necessary Difficult to locate faults: hours to days Repair period: weeks

Underground Transmission Cable. The amount of excavation required for the installation of a 138 kV HPFF system depends on the number and sizes of pipes to be installed, which in turn depend on the ampacity of the line and the requirement for spare or emergency circuits. The degree of the excavation determines the degree of disturbance of surface and subsurface soil or rock. The Waiau-CIP line would require three 8-inch-diameter pipes and an excavation 6 feet deep by 5 feet wide.

Soil compaction and mixing of soil layers may result from cable trenching and backfill. This in turn may affect soil particle sizes and chemical characteristics. The surface of the trench is vulnerable to soil erosion until the vegetation or concrete/asphalt surfaces are reestablished. The surface land form might be altered by cut and fill grading within the easement where required for construction equipment access.

Splice vaults might be as large as 10 feet by 14 feet by 7 feet deep and might require excavations of 6 feet by 20 feet by 12 feet deep. These vaults could be required at 2,000- to 4,000-foot intervals, depending on the topography and number of turns in the route. For Part 1, as many as 18 such excavations would be needed. The pipe system would be designed to reduce the possibility of damage resulting from seismic activity or soil movement.

Biological Considerations

Overhead Transmission Line. Impacts to vegetation in agricultural land, grasslands, and low shrubland would be limited to areas required for line construction and maintenance access. Construction activities usually require selective clearing or removal of vegetation from construction pads and pole sites. Natural revegetation usually occurs on these sites within one to three growing seasons, except in areas occupied by poles.

Underground Transmission Cable. Trench excavation may adversely affect existing vegetation (both natural communities and landscaping). Where the transmission line route parallels a roadway, street trees may need to be removed to provide access for equipment. All surface vegetation along the route would have to be removed during construction; however, revegetation would take place naturally or could be expedited by planting a ground cover. Because reexcavation for maintenance or repairs could occur, and to minimize damage to the cable as a result of tree roots, trees and large shrubs should not be planted over the pipeline route.

Another consideration is the potential for rupture in the underground pipe as a result of seismic activity, mechanical flaws, or other causes resulting in fluid leakage. The degree of impact would depend on the extent of the leak and the biological sensitivity of the area.

Electric and Magnetic Fields

An electric field is produced in the area surrounding a conductor (such as a transmission line or cable) when voltage is applied to the conductor. Magnetic fields occur when electric

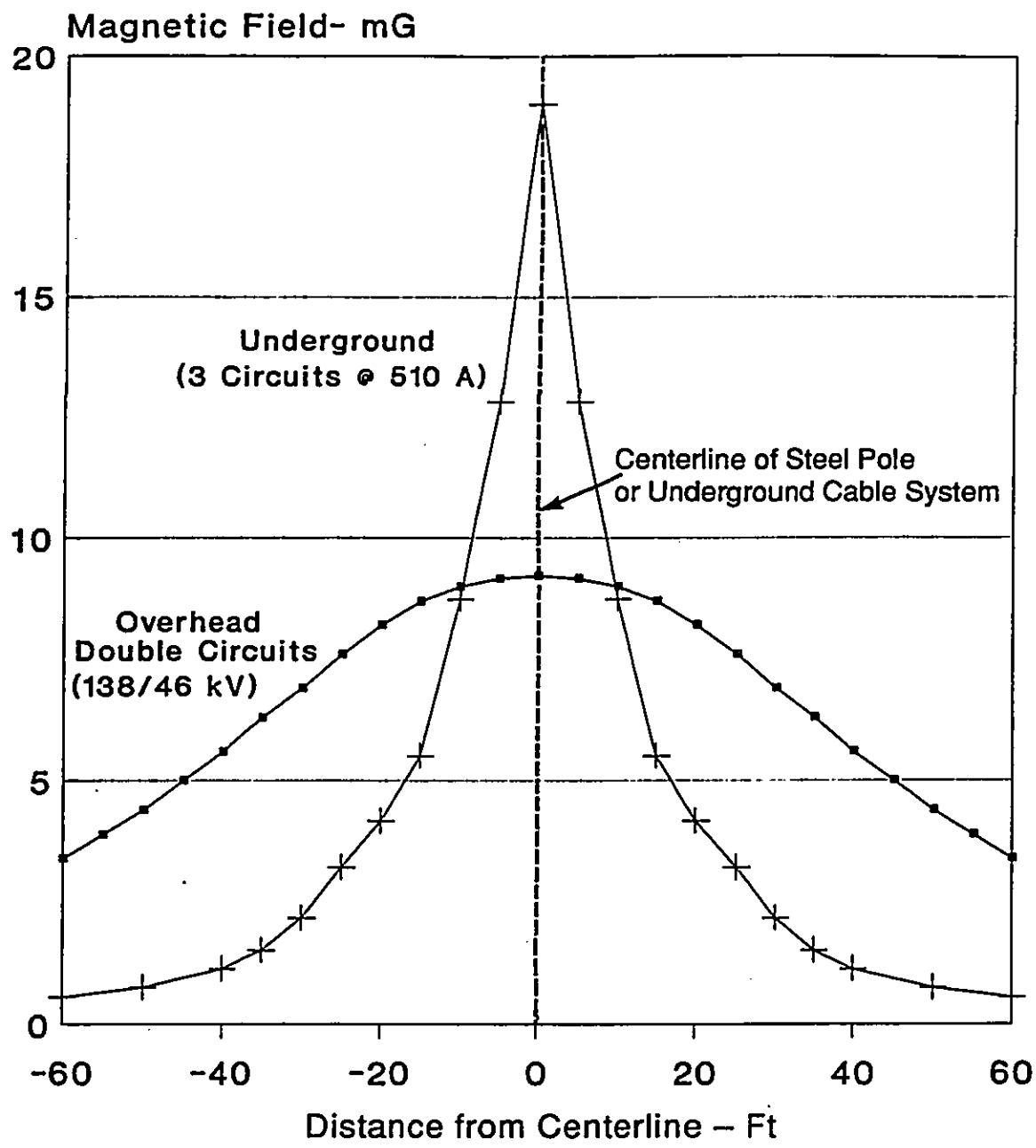
current flows through a conductor. Any electrical device, including transmission lines and household appliances, will create electric and magnetic fields (EMF).

In recent years, there has been growing interest in the potential for adverse health effects related to exposure to EMF. Concern was initially raised (and studies were conducted) in regard to the fields associated with lines that have much higher voltage (up to 765 kV) than that of the 138 kV lines planned for this project. However, recent concern has focused on all power lines and other sources of EMF. Current research on EMF and field strengths along the proposed alignment is detailed in Chapter 5. The following subsections compare the likely fields near the two transmission alternatives.

Overhead Transmission Line. Overhead transmission line conductors are insulated from each other and the ground by porcelain insulators and the surrounding air. Electric and magnetic fields exist around each conductor. The strength of these fields diminishes in proportion to distance from the conductor. At the ground level, field strengths are highest almost directly under the conductors at the point where the conductors sag closest to the ground (usually at the midpoint between transmission poles). At that point, the maximum electric field underneath typical double-circuit 138 kV transmission lines with double-circuit 46 kV lines strung on the same poles is about 0.25 kilovolts per meter (kV/m) or less. The corresponding maximum magnetic field would be on the order of 20 to 30 milliGauss (mG) under normal average line loadings. Because the 46 kV lines tend to cancel out some of the electric and magnetic fields, in locations where the 138 kV line does not share poles with a 46 kV line, field strengths directly under the 138 kV conductors would be somewhat higher—up to about 1.5 to 2 kV/m (electric field) and about 40 to 50 mG (magnetic field). Field strengths would be lower at the edge of the ROW. "Unlike" or low-reactance phasing would lower magnetic field strength to about 5 to 10 mG under normal conditions. Actual electric and magnetic field strengths will vary somewhat for specific projects with different designs and loading.

Underground Transmission Cable. The paper insulation, fluid, and pipe that encase the conductor in typical HPFF underground cable systems effectively eliminate any measurable electric field outside the pipe. Magnetic fields could measure 1 to 20 mG at the surface of the soil directly above the pipe. The magnetic field of underground cables would attenuate over a much shorter distance from the line than for an overhead line because underground cables can be bundled closely together.

Figure 3-3 graphically compares the magnetic field levels for overhead and underground 138 kV transmission lines. The lateral plot shows the level of magnetic field (in mG) by the distance from the center line of an underground cable system or the steel poles for overhead lines. The overhead configuration represents double-circuit 138 kV lines with a double-circuit 46 kV underbuild, as is proposed for the Waiau-CIP Part 1 Project. The underground configuration represents three 138 kV circuits to provide a level of reliability that is comparable to the overhead configuration.



Normal Loading and Unlike (Low-Reactance) Phasing Assumed

FIGURE 3-3

LATERAL PLOT OF MAGNETIC FIELD: UNDERGROUND VERSUS OVERHEAD

Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
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Visual Quality

Overhead Transmission Line. An overhead transmission line is visible to the public. Assessing the visual effect requires considering the displacement or addition of visual elements in the landscape, the degree of change to existing visual resources, the configuration of the overhead line and its supporting structures, and the number and subjective preferences of people affected by these changes.

Underground Transmission Cable. After an underground cable is installed, there is no visual impact from the underground cable itself. Underground systems require fluid handling and ground-to-air transition stations at either end of the underground portion. Although these stations would be fenced or screened, they might be considered visually intrusive in some locations.

Television and Radio Interference

Overhead Transmission Lines. Overhead transmission lines do not usually interfere with normal radio or television reception. There are two potential sources of interference: corona and gap discharges. Corona can affect AM radios, and gap discharge can affect both television and radio reception.

Corona activity is usually minimized through proper design of the line and is, therefore, almost never a source of interference. Gap discharges are a different problem. They are caused by electrical discharges between damaged or poorly fitting hardware such as insulators, clamps, or brackets. Hardware is designed and installed to be problem-free, but gunshot damage, wind motion, and corrosion damage sometimes can create gap discharges. The discharges act as small transmitters at frequencies that can be received on some radio and television receivers. Gap discharge sources can be located by HECO engineers and repaired.

HECO engineers design all transmission lines to be as free as possible from corona and other sources of interference and, generally, interference is not a problem. Radio and television interference complaints are recorded, evaluated, and investigated when necessary, and corrective measures are taken as required.

Underground Transmission Cable. Radio and television interference would be virtually nonexistent from an underground cable system.

Traffic Disruption during Construction and Maintenance

Overhead Transmission Line. For an overhead line, the major traffic disruption would occur during construction. All construction within and restoration of roadways would be performed in accordance with applicable standards set by federal, state, and county authorities.

Preparing foundations, setting poles, and stringing conductor could require closing a lane of traffic temporarily. HECO's construction crews might need to close a lane of traffic on

multilane roads during off-peak traffic periods (8:30 a.m. to 3:00 p.m.). At any one spot along the line, construction would occur in stages, separated by days or weeks.

After construction, traffic disruption for routine maintenance would be less frequent and for shorter durations. Because overhead lines are easily visible, HECO's inspection would essentially be a "drive-by" inspection. A detailed inspection and structure upgrade is conducted according to HECO's maintenance schedule. This requires about 1 day per circuit per pole. The road would be coned off for a few hundred feet on either side of the pole being maintained.

Overhead lines near airports, such as the Barbers Point Naval Air Station, must be located and designed (e.g., height of poles) to avoid interference with air traffic operations.

Underground Transmission Cable. Because an underground cable would require trenching along its entire route, traffic disruption during construction would be more extensive and would take a longer time than for overhead lines. A traffic study would probably be required by the state Department of Transportation to determine during what hours and in what areas lanes of traffic could be coned off during construction.

When a fault occurs on underground lines, it could take days or weeks to locate and repair the problem. Traffic disruption during repair could be more prolonged than for overhead lines because excavation and backfilling would be required.

Underground cables would not have any effect on air traffic and therefore may be located near existing airports.

Cultural Resources

Overhead Transmission Line. During the route selection process for an overhead line, a survey of the proposed alignment is prepared by a professional archeologist. The survey identifies locations of cultural resources in or near the proposed route and in areas where there is a significant probability of finding artifacts below the soil surface. Route selection takes into account the cultural resource survey to avoid areas that could have cultural resources. During design, careful pole siting can help avoid disrupting cultural resources.

Underground Transmission Cable. The potential for disrupting cultural resources (especially subsurface resources) is higher with an underground cable than for an overhead line because of the greater extent of excavation. A cultural resource survey could be used to screen surface features before selecting the cable alignment, but some potential to disrupt cultural resources during the trenching would remain.

Maintenance and Repair Considerations

Maintenance techniques vary for each type of transmission system. Time for repair depends on maintenance techniques, degree of repair required, and location of the outage or area requiring repair.

Overhead Transmission Line. Operation and maintenance for overhead lines are routine and relatively inexpensive when compared with underground options. HECO will implement new "live line" maintenance techniques on steel poles to increase the system efficiency and cost-effectiveness of performing routine maintenance and repair. Although overhead lines are more vulnerable to vandalism and damage, repairs of outages can usually be accomplished within hours.

Underground Transmission Cable. The fluid-handling equipment requires periodic maintenance and continual remote monitoring. The paper-insulated cables are quite reliable; however, trouble with fluid flow can cause overheating, which can shorten service life or cause a failure. The repair of this system requires skilled workers trained and experienced in cable splicing.

Because of the difficulty of locating faults in an underground cable and getting access for repair crews and equipment, repair of outages would take far longer than for an overhead line (i.e., days or weeks rather than hours).

Cost

The estimated relative construction costs for the two transmission alternatives differ significantly, as shown in Table 3-2. A range of costs is shown for the overhead and underground alternatives to reflect the different routes (e.g., H-1 Freeway, Farrington Highway). The costs do not include land or substation costs.

Table 3-2
Comparative Construction Costs for Alternative Transmission Technologies (millions of dollars)

Overhead	Underground
$20 to 25	$75 to 113

Notes:
1. Costs based on HECO data, 1991.
2. Land costs are not included.
3. Substation costs are not included.

Conclusion

After reviewing the alternatives to an overhead transmission line, HECO concluded that the conventional overhead line technology is the most reasonable for the Waiau-CIP 138 kV Transmission Line, Part 1, Project. (Table 3-1 summarizes the characteristics and potential environmental effects of overhead and underground lines.)

The underground cable alternative has both advantages and significant disadvantages. The principal advantage is the lack of visual impact. Another advantage is that underground lines eliminate measurable electric fields. However, magnetic fields would still be measurable at the surface of the soil above and around the underground cable. The disadvantages are significantly higher construction and maintenance costs and a much longer time required for construction and repair than for a conventional overhead line. In addition, the extensive excavation required for construction of an underground cable would pose a greater risk to biological and cultural resources. Locating and repairing faults would be costly and time consuming. The costs of an underground cable would be higher than those of an overhead line and it would increase the cost of electricity for customers.

Corridor Alternatives

An opportunities and constraints analysis was conducted to identify possible corridor alternatives (Appendix C). Corridors were defined as being ¼ to ½ mile wide. The alternative corridors were located primarily along existing transportation corridors or linear facilities, such as existing 46 kV transmission line ROWs. Ten corridor segments were identified (Figure 3-4); these segments combined to create 12 different corridor alternatives (i.e., a series of corridor segments forming complete corridors that line the route from the CIP Substation to the Ewa Nui Substation). After completion of a two-stage sensitivity analysis that reviewed the environmental and land use characteristics; permitting issues; and public, agency, and landowner comments, each corridor segment and corridor was compared with the others and either retained or dropped. The following paragraphs give a brief description of each corridor segment and a summary of its positive and negative features.

E1 Segment—H1 Freeway

The E1 segment follows the H1 Freeway. This segment crosses land under construction for new residential development at Makakilo City and the Kapolei developments at the west end, and is next to the Hale Ola and Gentry Kunia residential developments near the diamond head end. If the line were sited in this corridor, it would be next to existing residential areas, highly visible to large numbers of residents, and also visible from the H-1 Freeway. For these reasons, the E1 corridor combinations were eliminated.

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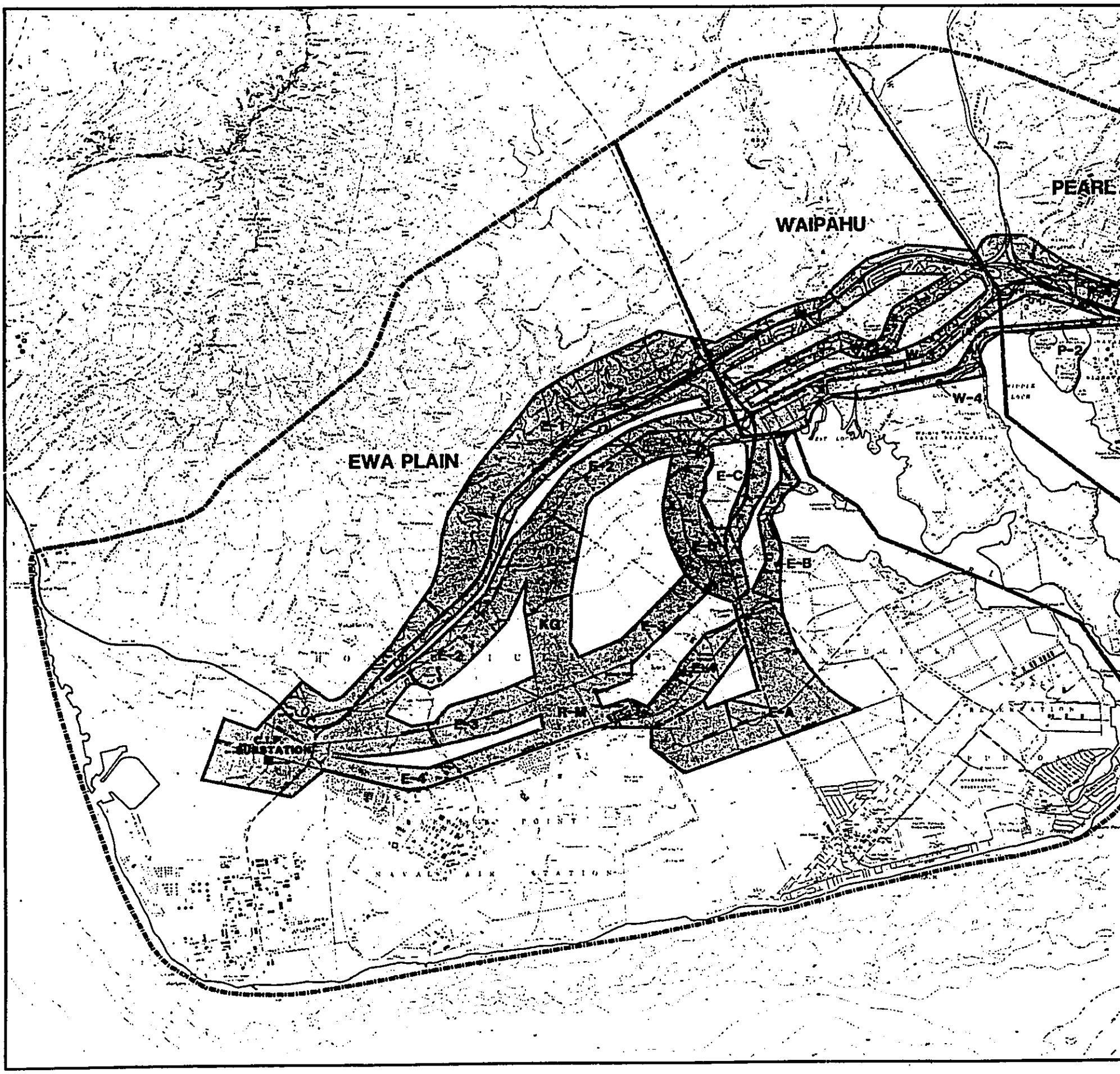
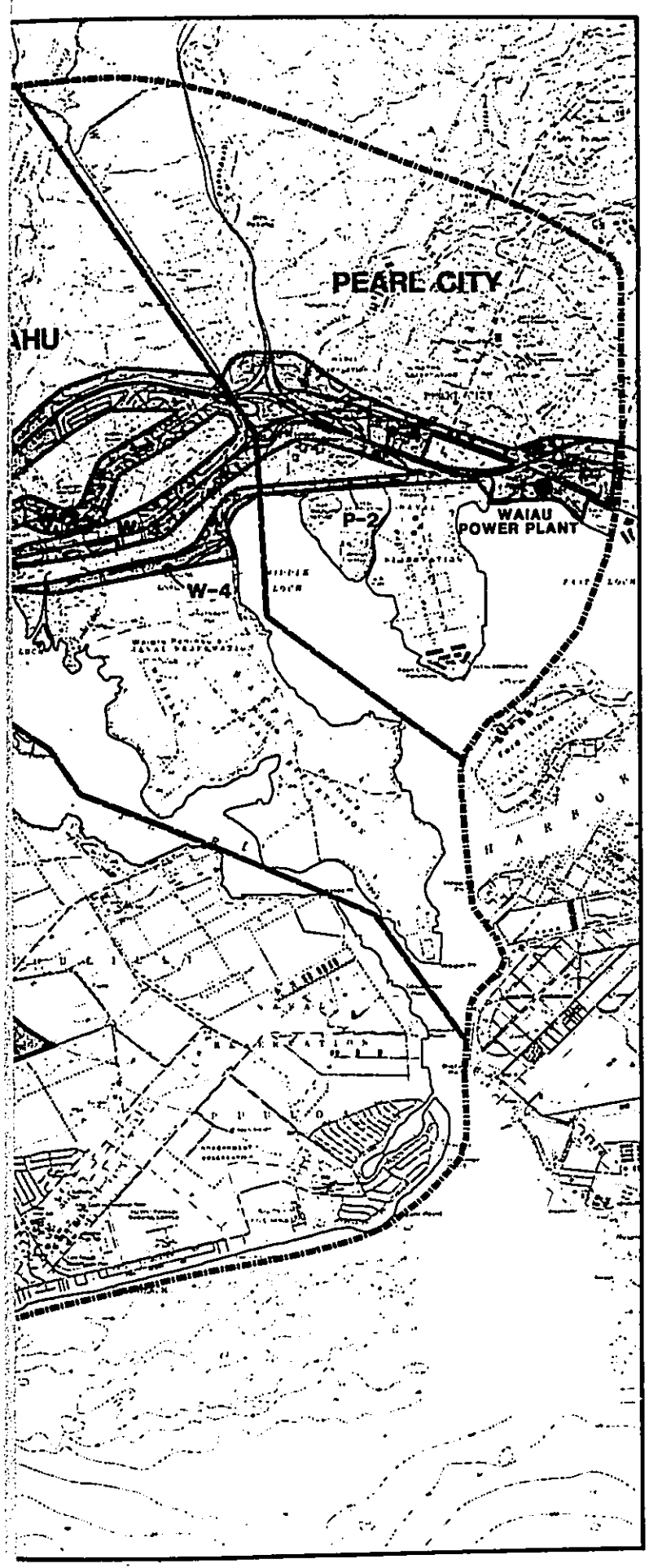




ALTERNATIVE CORRIDORS

Study Area Boundary

Alternative Corridor Boundary

FIGURE 3-4

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2MHILL

E2 Segment–Farrington Highway

The E2 segment runs along Farrington Highway. The western portion of this corridor segment passes through the center of the Kapolei residential development. The estate of James Campbell (the landowner of major portions of this area) stated that it did not favor the use of the E2 segment because of possible future plans to reroute Farrington Highway to become the entrance to Kapolei Town Center. If Farrington Highway were rerouted, the transmission lines might have to be relocated. The lines would also be next to existing residential areas and highly visible to residents and businesses if located in this corridor. For these reasons, the western portion of corridor E2 was eliminated (the diamond head portion was retained in combination with the KG corridor, as explained in a later subsection).

E3 Segment-Waimanalo and Mango Tree Roads

The E3 segment follows Waimanalo and Mango Tree Roads. It passes through the Kapolei developments at its western end and through the mauka side of the Ewa Villages area at the diamond head end. This segment would follow roads now used for hauling cane, and the Oahu Sugar Company was opposed to this segment because of potential interference with agricultural operations. Corridors used for this segment were the lowest rated (most constrained) corridors in the Stage 2 sensitivity analysis. For these reasons, this segment was eliminated.

E4 Segment-Renton Road and the OR&L Right-of-Way

The E4 segment follows Renton Road and the OR&L ROW. The diamond head end of this corridor segment was eliminated because it crosses the existing residential areas at Ewa, Varona, and Renton Villages. The makai portion of the segment at the diamond head end also crosses the new Ewa by Gentry residential development. A new alignment in this area would be highly visible to residents. For these reasons, the portion of this segment diamond head of Kaloi Gulch was eliminated. The western end of the segment was retained, however, in combination with the KG corridor (as explained later).

KG Segment-Kaloi Gulch

The KG segment was identified as a corridor that could avoid many of the conflicts recognized in the corridor segments described earlier. The Kaloi Gulch segment links the E3 (Mango Tree Road) and E2 (Farrington Highway) segments and generally follows the alignment of Kaloi Gulch. This crossover location was selected because the gulch forms a natural topographic break in the Ewa Plain; the location has been recognized by the state, the county, and the landowner as the possible general location of a future north-south arterial; and the gulch is within the state's proposed land bank area for the preservation of agriculture. The Office of State Planning indicated to HECO that it would support a transmission line corridor in this general area.

RM Segment-Renton and Mango Tree Roads

The Renton and Mango Tree Roads segment links corridors E3 (along Mango Tree Road) and E4 along a canehaul road in the vicinity of Kaloi Gulch. By linking corridors E3 and E4, the RM segment creates a corridor (E4/RM/E3) that avoids existing residential areas in the plantation villages area and proposed residential areas in the Villages of Kapolei area. It also reduces interference with existing agricultural operations and makes use of existing dirt roads and 46 kV overbuild opportunities.

EA Segment-Geiger and Fort Weaver Roads

The EA segment follows Geiger and Fort Weaver Roads. This segment crosses portions of the Ewa by Gentry residential development. The U.S. Navy did not support this segment because of its proximity to the air interference zones surrounding the Barbers Point Naval Air Station. For these reasons, this segment was eliminated.

EB Segment-West Loch Shoreline

The EB segment runs along the West Loch shoreline in Honouliuli. This segment was eliminated because it crosses substantial areas of the special management area and wetlands next to Pearl Harbor, and it runs the length of the West Loch Shoreline Park. This segment was not supported by the City and County of Honolulu.

EC Segment-New Fort Weaver Road

The EC segment follows the New Fort Weaver Road. This segment was eliminated because it crosses portions of the West Loch Estates residential development and the West Loch Golf Course. This segment was not supported by the City and County of Honolulu.

ED Segment-Old Fort Weaver Road

The ED segment follows Old Fort Weaver Road in Honouliuli. This segment was eliminated because it crosses portions of the proposed West Loch Bluffs residential development and the West Loch Golf Course. This segment was not supported by the City and County of Honolulu.

Preferred Corridor

The sensitivity analysis (Appendix C) indicated that a corridor alternative made up of the segments E4, RM, KG, and E2, called the Kaloi Gulch corridor, was one of the top two corridors in the sensitivity analysis, reflecting its relative lack of constraints for use as a transmission corridor. For these reasons, the KG corridor was selected as the preferred corridor.

This corridor uses the KG segment as a link between the OR&L ROW and Farrington Highway to create a corridor that provides a fairly direct route from the CIP Substation to an Ewa Nui Substation site on Farrington Highway. Along its western end, the KG corridor stays makai of the Kapolei developments, and makes use of the existing transmission corridor makai of the OR&L ROW. It follows the alignment of Farrington Highway, diamond head of the portion of Farrington Highway that may be realigned to become the entryway to the Kapolei developments.

Alignment Alternatives

After the characteristics of the preferred corridor had been investigated, the next step in the route selection process was to identify alternative alignments approximately 100 feet wide, as well as possible substation sites along these alignments. With the use of environmental, land use, and engineering criteria developed by HECO and public, agency, and landowner comments, alignment alternatives were identified and mapped (Figures 3-5, 3-6, and 3-7). To facilitate further analysis and discussion, the alignment alternatives were given names based on their general location and assigned numbers to distinguish segments.

Ewa

Existing and proposed land uses in the Ewa segment limit alignment options to a single alternative makai of the OR&L ROW. Barbers Point Naval Air Station is located makai of the proposed alignment. The area mauka of the OR&L ROW is slated for development as Oahu's "Second City," with the initial stages (Villages of Kapolei and Kapolei Town Center) planned to be developed mauka of Renton Road.

Ewa-1 Segment

This segment follows the alignment of two existing 46 kV transmission lines from the CIP Substation, just makai of the OR&L ROW and Renton Road and mauka of Barbers Point Naval Air Station to a point about 1,000 feet west of Varona Village.

Ewa-2 Segment

This segment avoids the plantation villages by cutting mauka generally along a canehaul road. It begins where Ewa-1 ends, crosses Renton Road, and follows a canehaul road across sugarcane fields to Kaloi Gulch.

Kaloi Gulch

Kaloi Gulch-1 Segment

This segment follows Kaloi Gulch to Farrington Highway. Two alternative alignments are shown on the west and east sides of the gulch to address the uncertainty of exactly where future development will be next to the gulch. The *Kapolei Area Long-Range Master Plan* prepared for Campbell Estate (Halber Hastert & Kimura, March 1991) shows a proposed mauka-makai road along the east side of the gulch that crosses to the west side near Farrington Highway. The City and County of Honolulu and the state intend to use Kaloi Gulch as a major drainageway but improvements have not yet been designed.

The state's Housing Finance and Development Corporation has started the process of developing the master plan for the 1,100 acres around Kaloi Gulch. In July 1992, the Housing Finance and Development Corporation staff met with HECO and the directors of DLNR and the Office of State Planning to discuss the Kaloi Gulch alignment. Housing Finance and Development Corporation staff presented the following three alternative alignments in the area of the 1,100 acres:

- Generally along the eastern edge of the 1,100 acres in a straight line from the OR&L ROW to Farrington Highway (and combined with a possible alignment of the future north-south road)

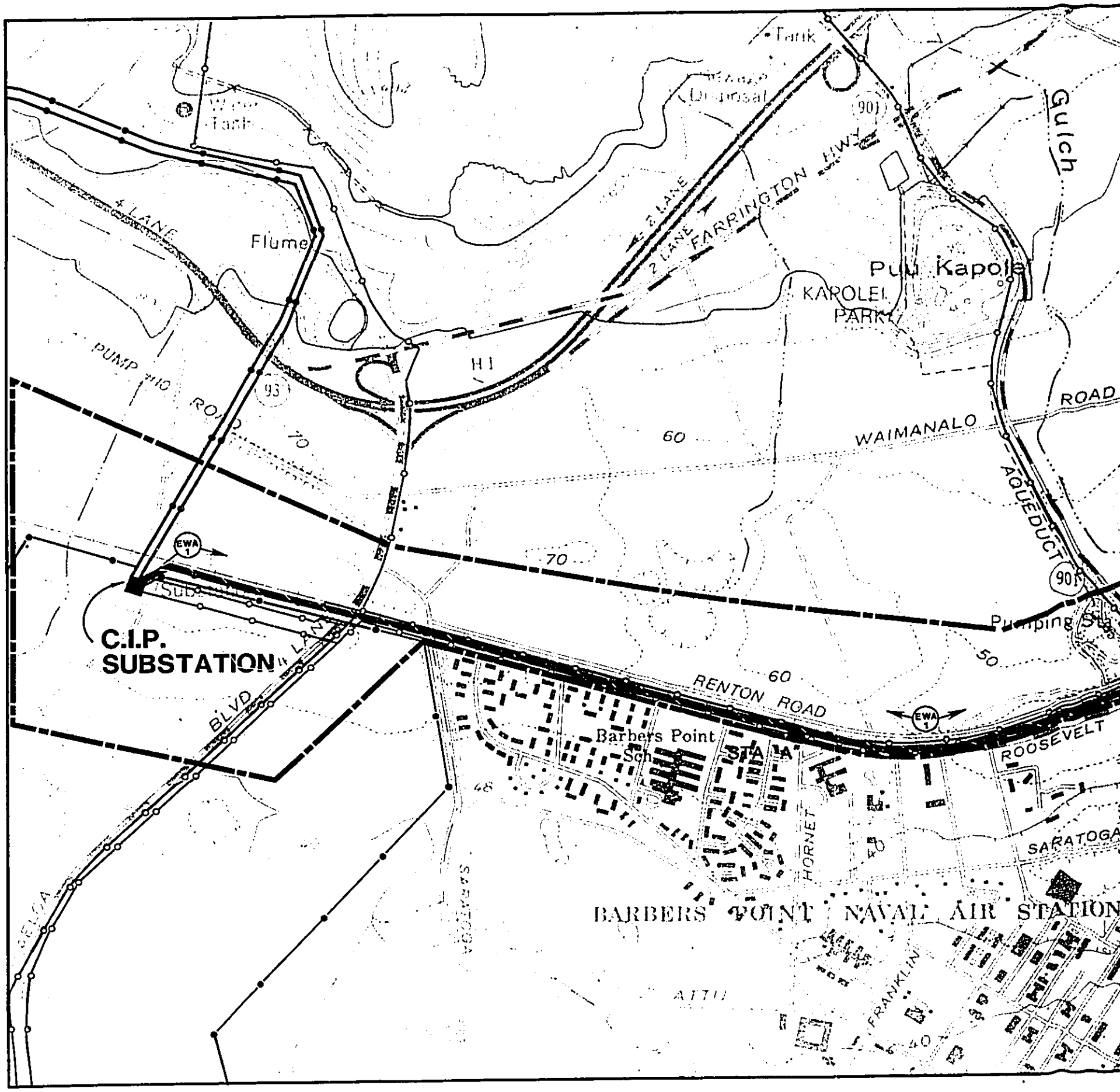
- Along Kaloi Gulch midway to Farrington Highway, then following the gulch's western fork (Huhehune Gulch) to the highway (and combined with another possible alignment of the north-south road)

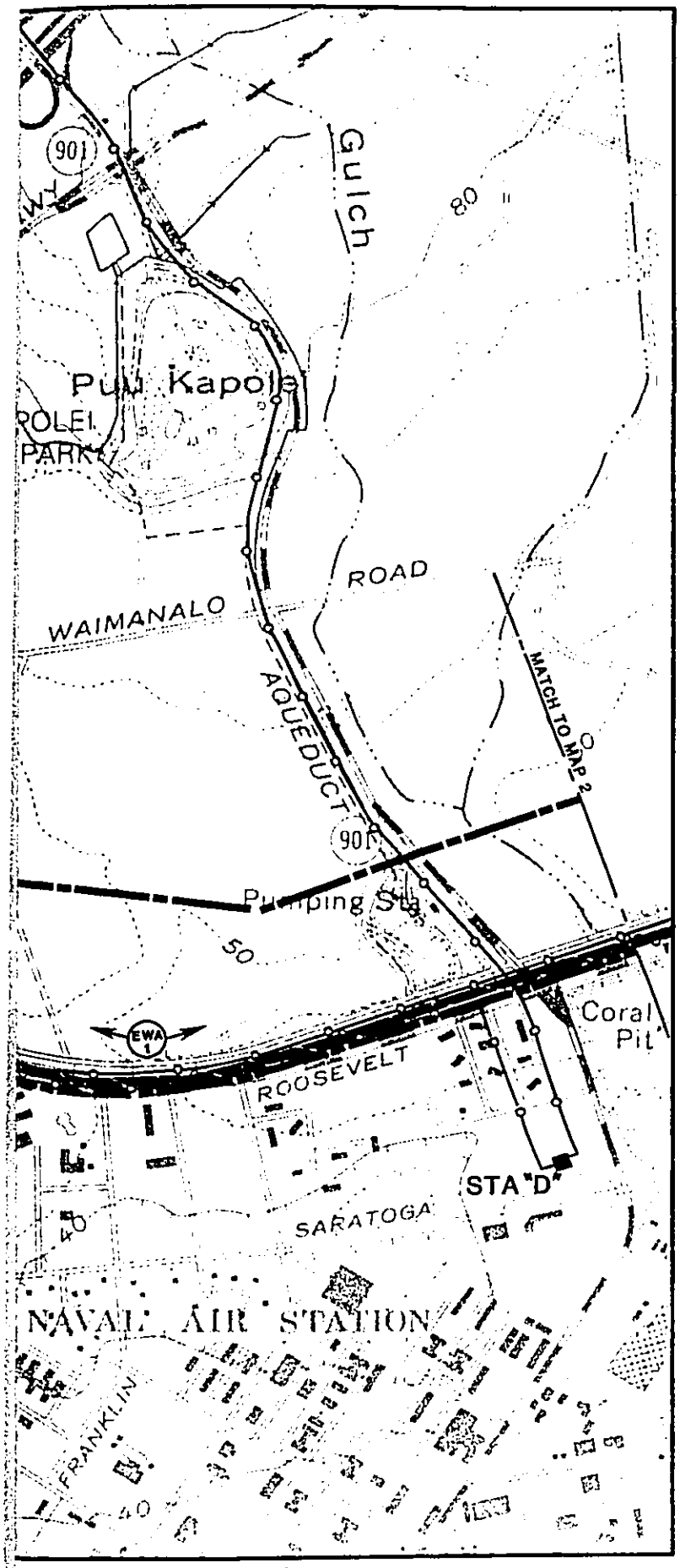
- Along the eastern edge of Kaloi Gulch all the way to Farrington Highway (and combined with another possible alignment of the north-south road)

After discussion of the advantages and disadvantages of these alignment alternatives, all parties agreed that the third alternative was the least objectionable and was therefore selected as the preferred alignment. The reasons for not selecting the other two alternatives are as follows:

- The first alternative does not follow an existing natural boundary and therefore would arbitrarily create a constructed boundary. This would disrupt existing cultivation practices by Oahu Sugar Company and result in two boundaries (Kaloi Gulch and the transmission lines) that would need to be considered in future urbanization plans.

- The north-south road is still in its preliminary planning stages (by the state Department of Transportation), and an alignment has not been selected. Construction of the transmission lines must start in June 1993 to avoid reliability problems, so an alignment must be selected now. A decision


Tank
Flume
4 LANE
2 LANE
FARRINGTON HWY
Gulch
Puu Kapolei
KAROLEI
PARK
H1
PUMP 110
ROAD
93
90
60
70
WAIMANALO
ROAD
AQUEDUCT
EWA
1
C.I.P.
SUBSTATION
BLVD
Pumping Sta
50
60
RENTON ROAD
Barbers Point
Sch
STA A
ROOSEVELT
SARATOGA
HORNET
40
BARBERS POINT NAVAL AIR STATION
FRANKLIN

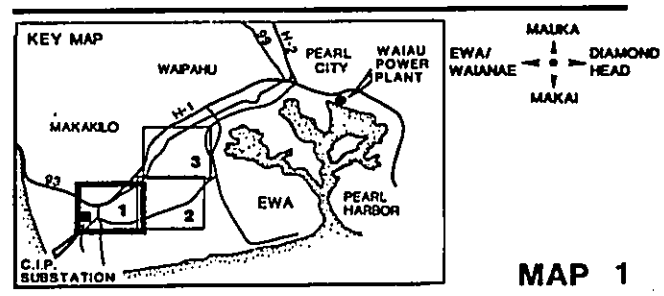


ALIGNMENT DATA MAP

ALIGNMENTS

- Corridor Boundary
- Alternative Alignment
- Preferred Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

EWA 1 → Alignment Segment



MAP 1

SCALE
0 500 1000 FEET
0 1/8 1/4 MILE

NORTH
WEST EAST
SOUTH

FIGURE 3-5

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

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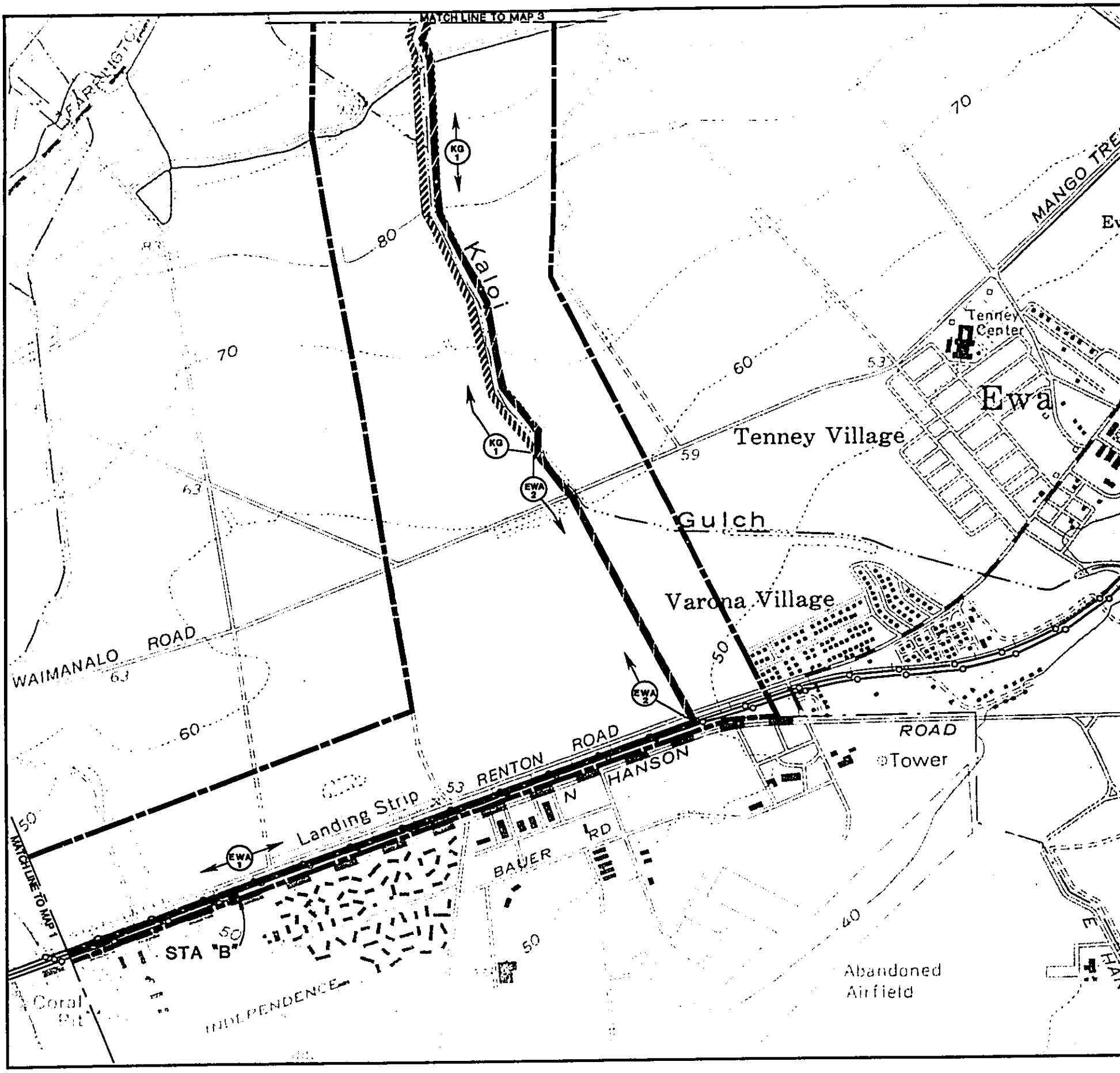
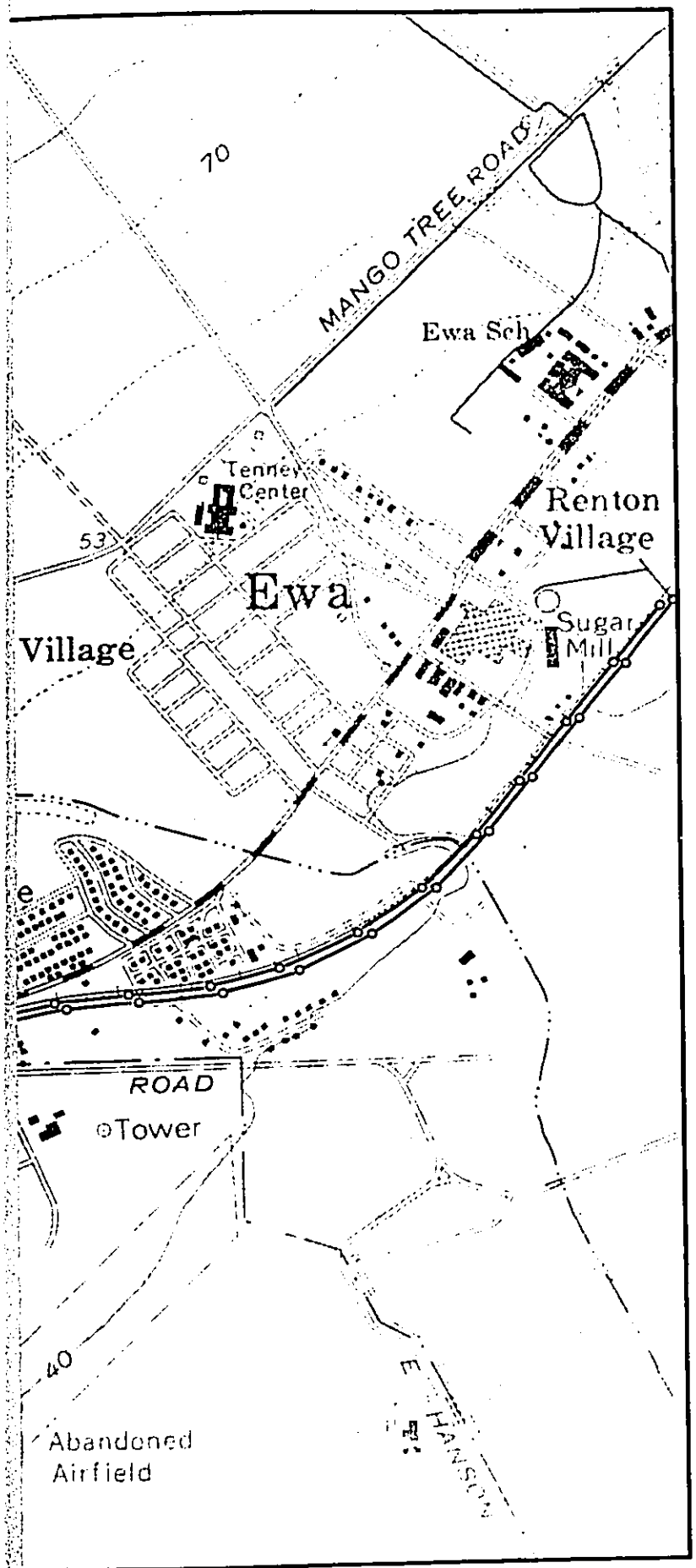

MATCH LINE TO MAP 3
FARRINGTON
KO 1
80
70
Kaloi
Gulch
Tenney Center
Tenney Village
Ewa
60
59
53
63
EWA 2
Varona Village
50
WAIMANALO ROAD
RENTON ROAD
HANSON ROAD
Tower
Landing Strip
EWA 1
BAUER N RD
STA "B"
MATCH LINE TO MAP 1
Coral Pit
INDEPENDENCE
Abandoned Airfield
40

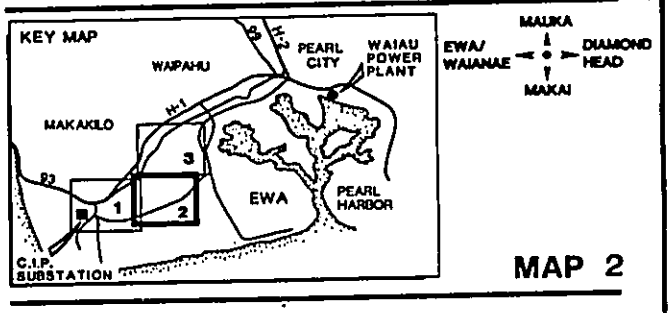


ALIGNMENT DATA MAP

ALIGNMENTS

- Corridor Boundary
- Alternative Alignment
- Preferred Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

EWA 1 → Alignment Segment



MAP 2

SCALE
0 500 1000 FEET
0 1/8 1/4 MILE
NORTH
WEST EAST
SOUTH

FIGURE 3-6

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

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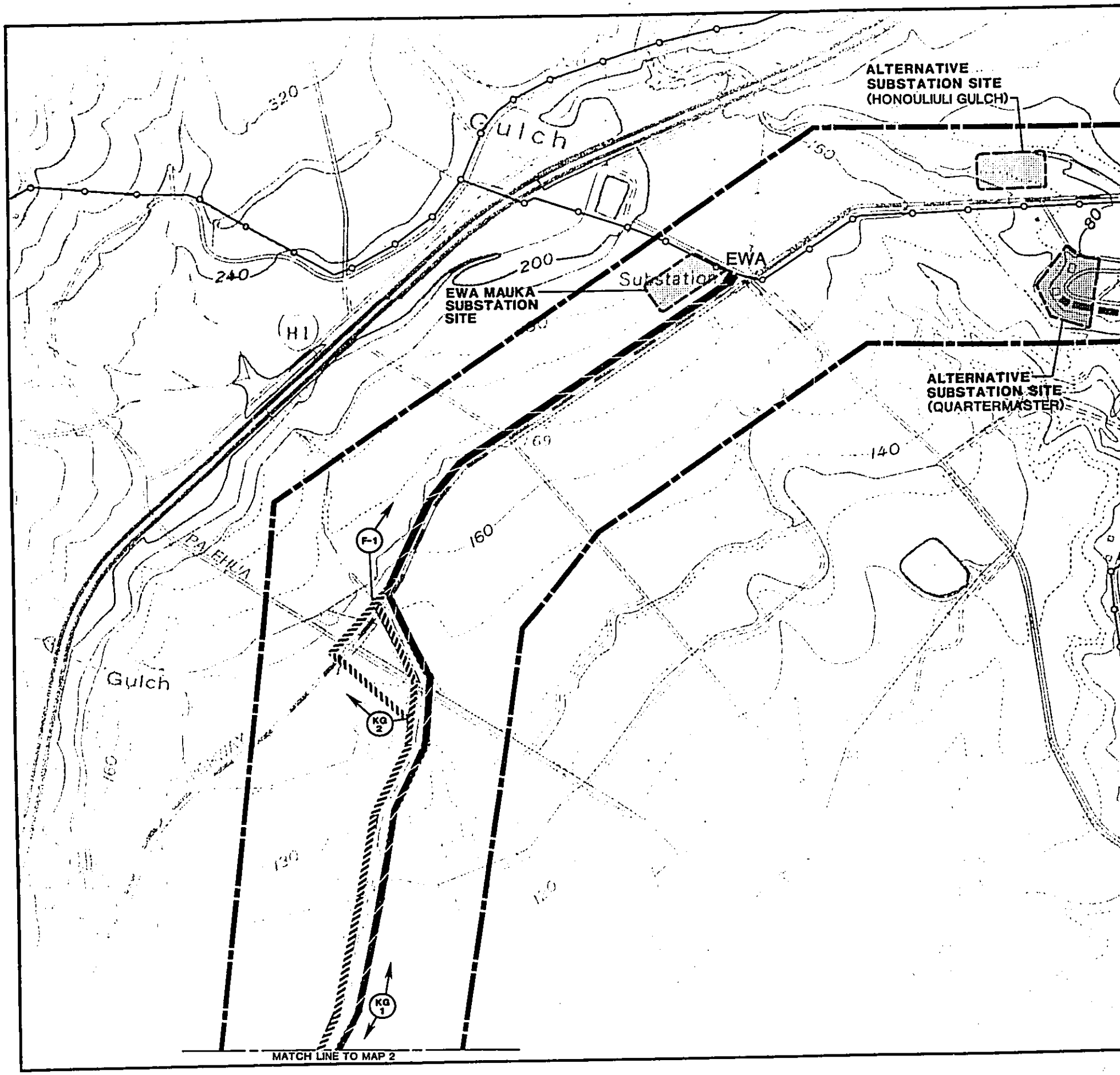
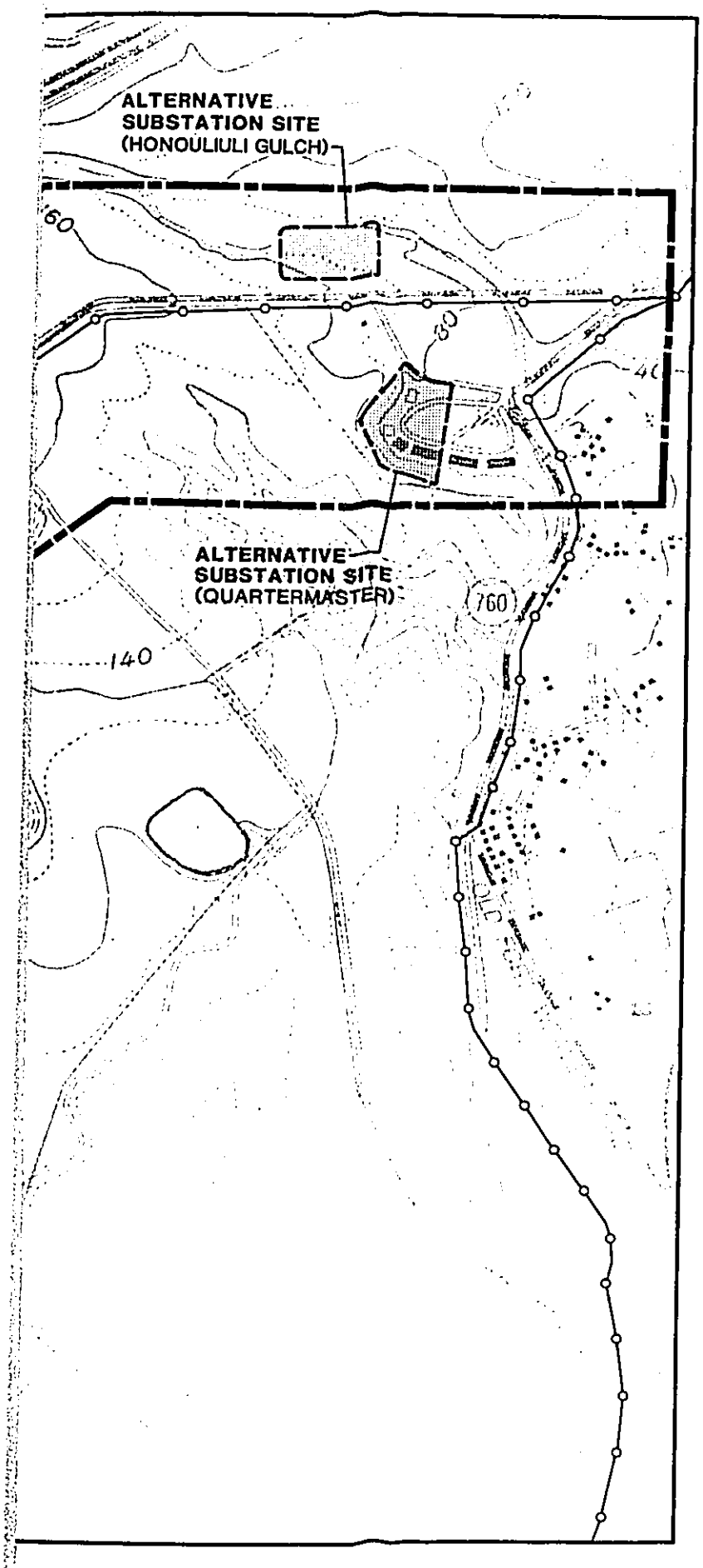

ALTERNATIVE
SUBSTATION SITE
(HONOULIULI GULCH)
Gulch
320
240
200
160
EWA
Substation
EWA MAUKA
SUBSTATION
SITE
H1
69
140
ALTERNATIVE
SUBSTATION SITE
(QUARTERMASTER)
F-1
KQ 2
KQ 1
PALEHUA
Gulch
160
130
120
MATCH LINE TO MAP 2

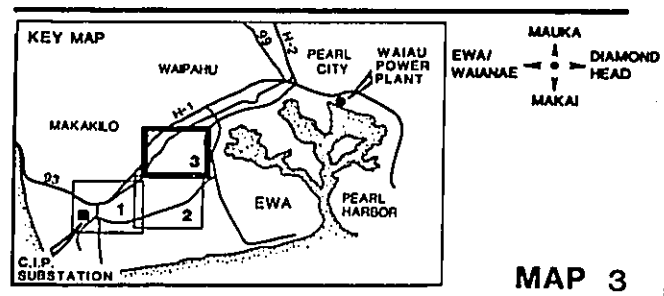


ALIGNMENT DATA MAP

ALIGNMENTS

- Corridor Boundary
- Alternative Alignment
- Preferred Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

KG 2 → Alignment Segment



MAP 3

SCALE
0 500 1000 FEET
0 1/8 1/4 MILE

NORTH
WEST EAST
SOUTH

FIGURE 3-7

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

regarding the north-south road would not be made in time for HECO to meet its deadlines.

- The state envisions an open space corridor along Kaloi Gulch. Such a use of Kaloi Gulch would be consistent with transmission lines.

Kaloi Gulch-2 Segment

This segment is an alternative alignment at the northern portion of KG-1. It follows the boundary of the state's future land bank property near Farrington Highway.

Farrington Highway

In this area, one alignment (the Farrington-1 Segment) is shown along Farrington Highway to the existing Ewa Substation. The makai side is not shown as an alternative for several reasons. The City and County of Honolulu plans to widen the highway by 50 feet, and it is possible that the widening will occur on the makai side because of the buried oil and gas pipelines in the energy corridor on the mauka edge of the ROW. In addition, a rapid transit fixed guideway to Ewa along Farrington Highway (possibly in the center of the highway) may be proposed, and construction of the transit fixed guideway would be facilitated if it were installed away from the energy corridor. The transmission line poles would be located inside and at the edge of the mauka side of the ROW.

Alignment Decision

Only a single alignment alternative was identified in the OR&L ROW-canehaul road area and, therefore, no alignment selection was needed in this area. Both Ewa-1 and Ewa-2 segments were retained.

KG-1 is preferred over KG-2 because it follows an existing natural boundary, Kaloi Gulch, through an area in which the long-term future development is subject to a current master planning process. KG-1 is also slightly shorter in length than KG-2 and requires a smaller area in which cathodic protection may be needed to protect fuel oil and gas pipelines in the energy corridor from corrosion. There are no significant differences between an alignment east or west of Kaloi Gulch in the KG-1 segment. The east-side alignment was chosen at the direction of the state.

Only a single alignment alternative was identified for the Farrington Highway zone; therefore, no alignment selection was needed for this zone.

Alternative Substation Sites

The Part 1 transmission lines terminate at a new 138/46 kV substation from which power can be distributed to the surrounding area. The following sites were considered by HECO:

- Ewa Mauka site next to the existing Ewa Substation
- Quartermaster site along Old Fort Weaver Road
- Honouliuli Gulch site mauka of Farrington Highway

These sites are shown in Figure 3-7. Each of these sites is in the preferred corridor for the transmission lines and depending on which site is preferable, the length of the transmission line along Farrington Highway can be adjusted accordingly.

Environmental and Land Use Criteria

Ewa Mauka Site

This site is not next to high public use facilities, and existing and future land uses in the area are agriculture. The land is owned by Campbell Estate. The site is visible from Farrington Highway and the H-1 Freeway.

Quartermaster Site

This is an industrial site. Mauka of the site is a high public use facility, Kahi Mohala Psychiatric Hospital. Future land use in the area is proposed to be residential (e.g., West Loch Bluffs). The site is not as visible as the Ewa Mauka site.

Honouliuli Gulch Site

This site is at the edge of a gulch on the mauka side of Farrington Highway. The surrounding land is used for sugar cane cultivation. No use other than agriculture is proposed for the area. The site is subject to flooding. The site is not as visible as the Ewa Mauka site.

Engineering Criteria

Ewa Mauka Site

This site is next to an existing 46 kV substation, and the substation's functions can be incorporated into a larger substation. Access is easy from Farrington Highway. This site is flat; there are no construction constraints.

Quartermaster Site

The soil on this site may be contaminated because of the site's present and past industrial uses. The site may have to be cleaned before a substation is constructed. Cleanup costs would be high. Access is available from Old Fort Weaver Road. Installing transmission lines between Farrington Highway and the site would be difficult.

Honouliuli Site

This site will require extensive cut and fill of slopes to create a large enough flat area on which to construct a substation. The site is subject to flooding and any structure would require extensive flood proofing. Access is possible from Farrington Highway.

Site Selection Decision

The Quartermaster and Honouliuli Gulch sites have environmental and engineering constraints much greater than those for the Ewa Mauka site; therefore, the Ewa Mauka site is the preferred site for the Ewa Nui Substation.

Preferred Alternative

The product of the environmental and engineering analysis was the identification of a single preferred alignment from the CIP Substation to the Ewa Nui Substation preferred site. From the CIP Substation, HECO's preferred alignment follows an existing utility corridor makai of the OR&L ROW and mauka of the Barbers Point Naval Air Station to a canehaul road west of Varona Village. At that point it turns mauka near the canehaul road and follows the east side of Kaloi Gulch to Farrington Highway, where it crosses to the mauka side of the highway. Then the alignment turns east to follow Farrington Highway to the existing Ewa Substation where the new Ewa Nui Substation will be constructed. The Ewa Nui Substation will be situated mauka of Farrington Highway adjacent to the existing substation.

Chapter 4
Project Description

The Waiau-CIP 138 kV Transmission Line, Part 1, Project includes the following activities and facilities:

- Construction of approximately 6.8 miles of 138 kV, double-circuit, AC transmission lines from the CIP Substation to the new Ewa Nui Substation mauka of Farrington Highway and west of Kunia Junction (see Figure 1-2). One circuit will tap into the existing Kalaeloa-CIP 138 kV line near the desalting plant in Ewa. The other circuit will use existing lines near the desalting plant to cross Kalaeloa Boulevard and connect to the CIP Substation.

- Restringing of existing 46 kV lines along the northern boundary of Barbers Point Naval Air Station and makai of the OR&L ROW to attach to the new poles of the project in this location.

- Construction of the new 138 kV Ewa Nui Substation on a site next to the existing Ewa Substation, mauka of Farrington Highway and approximately 1½ miles west of Kunia Junction. The functions of the existing substation will be incorporated into the new one.

The project is scheduled to be operational by June 1994.

Proposed Alignment and Ownership

Beginning at the CIP Substation, the proposed transmission line will follow an existing 46 kV easement on the makai side of the OR&L ROW and mauka of the Barbers Point Naval Air Station to a canehaul road approximately 1,000 feet west of Varona Village. As proposed, the existing 46 kV lines will be attached to the new 138 kV steel poles. The transmission line from the CIP Substation to the canehaul road will require a 75-foot-wide easement. In addition to the existing utility easement, new easements will encumber lands owned by Campbell Estate, GTE Hawaiian Tel, and the U.S. Navy.

The alignment then turns mauka across Renton Road and the OR&L ROW and follows the east side of an existing canehaul road to Kaloi Gulch. The alignment will follow the eastern side of the gulch in a new 75-foot-wide easement. The new easement will encumber land owned by Campbell Estate; however, most of this land is under condemnation proceedings by the state of Hawaii. The state is acquiring the land for land banking and agricultural preservation. The new poles will be equipped to allow the installation of future 46 kV lines.

At the intersection of the gulch with Farrington Highway, the alignment turns diamond head and follows the mauka side of the highway for 0.9 mile to the proposed Ewa Nui Substation.

Along Farrington Highway the transmission lines will be located just inside the mauka edge of the highway ROW. This allows one circuit to overhang the highway and the other to overhang the existing energy corridor. The site of the proposed Ewa Nui Substation is adjacent to HECO's existing Ewa Substation mauka of Farrington Highway and west of Kunia Junction. The 8.7-acre site is currently owned by Campbell Estate. HECO is in the process of acquiring this property for development as a substation.

Engineering Description

Design, construction, and operation and maintenance of the project will be in accordance with HECO's standards for safety and protection of the public, landowners, and property. Requirements of PUC GO-6 (Rules for Overhead Electric Line Construction); the National Electric Safety Code (NESC); and the U.S. Department of Labor, Occupational Safety, and Health Standards govern the transmission design.

Transmission Lines

The proposed 138 kV lines will be strung on tubular steel poles equipped with arms to also allow installation of 46 kV lines and in some locations, 25 kV lines. Figure 3-1 illustrates the typical double-circuit pole, conductor, and insulator configuration with a 46 kV underbuild and with a 25 kV underbuild. Table 4-1 presents the design characteristics of the project. The gray galvanized poles can be painted to conform to local conditions or easement requirements.

Pole heights, locations, and span lengths vary and are determined by the following factors:

- Natural terrain and topography
- Structural limitations
- Costs
- Visual considerations
- Existing and proposed land uses
- Crossings of constructed features such as roads and telephone lines
- Other criteria that may be unique to the project

Along most of the proposed alignment, soils are of types that are usually capable of supporting heavy foundation loads (Koolau Basalt, older alluvium, and coral-algal deposits). In these areas, conventional pier foundations would generally be used to support the proposed transmission line. The types of foundations to be used in each pole location will be determined following full-scale geotechnical investigations including borings and field and laboratory testing before the final design of the project.

Table 4-1 Waiau-CIP Part 1 138 kV Transmission Line Design Characteristics	
Characteristics	**Units**
Line length	6.8 miles (approximate)
Type of structure	Tubular steel, single-pole
Structure height	80 to 135 feet
Structure weight	6,000 to 24,000 pounds
Structure foundation type	*Augured/reinforced concrete piers*
Structure foundation dimensions	Piers: 20 to 30 feet deep; 5 to 6 feet in diameter
Average span length	300 to 600 feet (longer if needed because of terrain)
Number of structures per mile	9 to 18
Right-of-way width	75 feet average
Land temporarily disturbed • Foundation • Conductor pulling site	 12 ft by 40 ft, or 480 ft^2 (approximately) 50 ft by 100 ft, or 5,000 ft^2 (approximately)
138 kV conductor configuration • Description • Conductor size and type • Conductor ground clearance • Shield wire	 Single conductor per phase (three phases per circuit) 1942.6[a]; ACSR/AW/TWD "Lapwing"[b] 30 ft. minimum at 212° F, final sag 3/8" EHS GALVANIZED
Normal operating voltage	138,000 volts AC (138 kV) $\pm$5%
138 kV conductor thermal limit	215 milliVolts ampere (MVA) normal (900 amps) 247 MVA emergency (1,035 amps)
138 kV conductor capacity	430 MVA normal (1,800 amps) 480 MVA emergency (2,000 amps)

[a]Cross-sectional measure of the conductor area in thousands of circular mils.
[b]Aluminum industry standard code for the conductor and size of strands.

Substation Improvements

The new Ewa Nui Substation will provide additional power distribution capacity and voltage level support on the 46 kV subtransmission network in southwest Oahu. This capacity is essential for serving parts of Waipahu and the Ewa Plain as planned urbanization proceeds according to state and county plans in Ewa.

The substation will be located mauka of Farrington Highway, next to the existing 46 kV Ewa Substation, about 1½ miles west of Kunia Junction. A site size of approximately 8.7 acres is needed to allow for future improvements that will accommodate growth in electrical distribution demand. A plan view of the substation is shown in Figure 4-1.

The substation will initially include one 138 to 46 kV transformer, six 138 kV and two 46 kV circuit breakers, a 46 to 12 kV transformer and two 12 kV feeders, disconnect switches, and protective equipment. More electrical equipment will be added to the facility as future growth requires. Underground ducts for 46 kV, 25 kV, and 12 kV circuits will be installed in Farrington Highway to allow for future connections when development occurs on the makai side of the highway. Connections to water and sewer lines also will be constructed in the highway.

Each circuit breaker will have an assembly of two columns with beams that support electrical power lines. The conductors will be supported by columns 66 feet high. The columns extend 10 feet above the topmost beam to provide safety clearance between the shield wire that diverts lightning strikes at the tops of the columns from the equipment below. This substation will be similar to the existing CIP Substation.

The substation would include paved internal driveways with the remaining area covered with gravel. The substation would also have a 20-foot-wide, paved driveway with access onto Farrington Highway. A chain link fence set back at least 30 feet from the property lines on all sides would be provided for security and safety. Landscaping would be provided according to standards set by the land use code and in consultation with Campbell Estate.

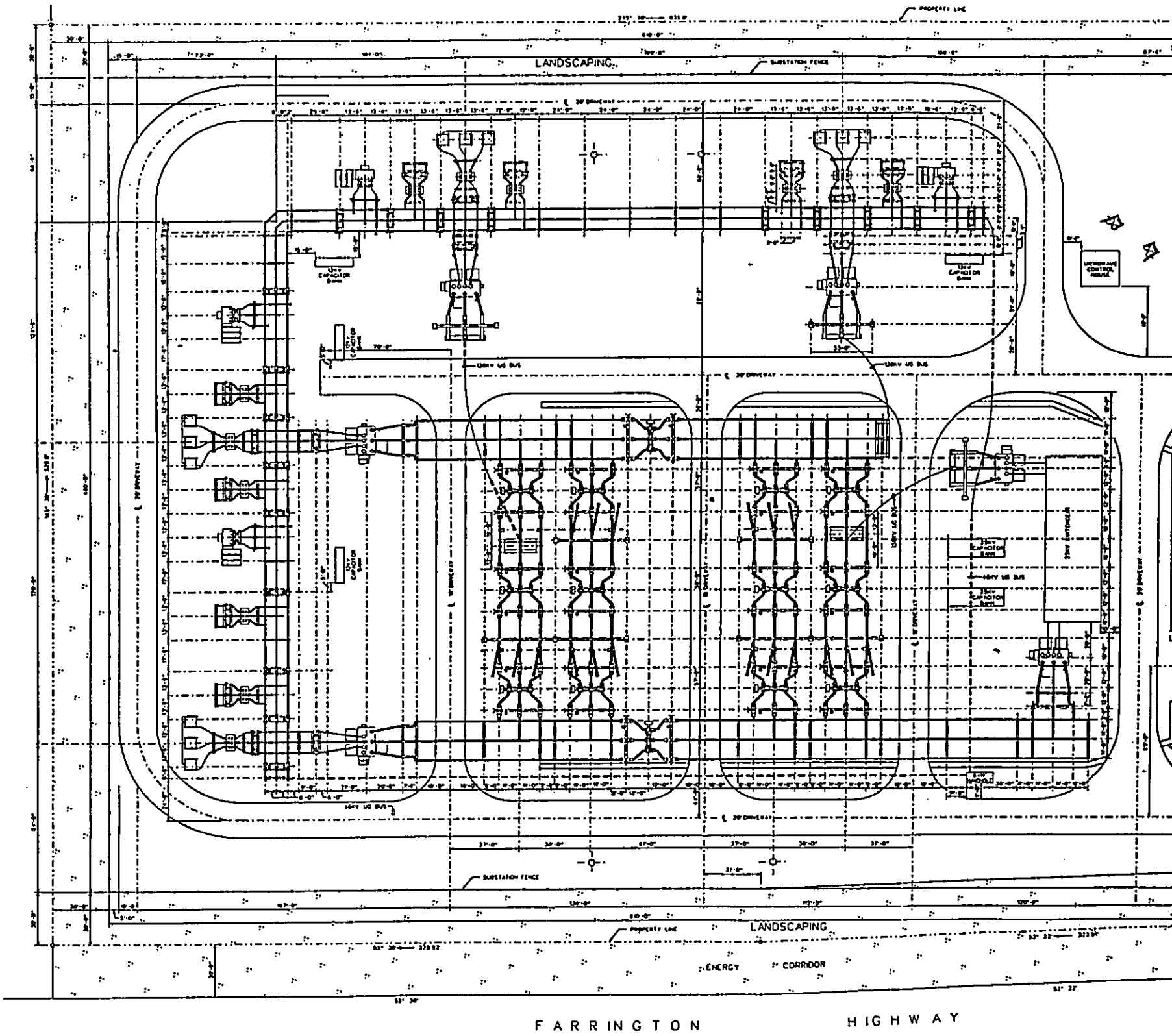
The functions of the existing 46 kV substation will be incorporated into the new substation. The existing 46 kV lines along the mauka canehaul road and along Farrington Highway will tie into the new substation.

Some internal modifications to the CIP and Kalaeloa Substations are needed to accommodate the new Waiau-CIP Part 1 circuits. The existing Kalaeloa-CIP 138 kV line near the desalting plant will be intercepted to form two 138 kV circuits: CIP to Ewa Nui, and Kalaeloa to Ewa Nui.

Right-of-Way Acquisition

Along the preferred alignment, easements will be acquired for the construction, operation, and maintenance of the transmission lines. The new transmission lines will require the expansion of existing easements and the acquisition of new easements. In either case, HECO is negotiating with private and public landowners to obtain the necessary easements and rights of entry.

When easement negotiations with private landowners are unsuccessful and adjustments to construction or routing requirements are impractical, HECO may pursue a legal alternative. The state constitution grants certain public bodies and utilities the right of eminent domain.



EWA NUI SUBSTATION
PLAN VIEW

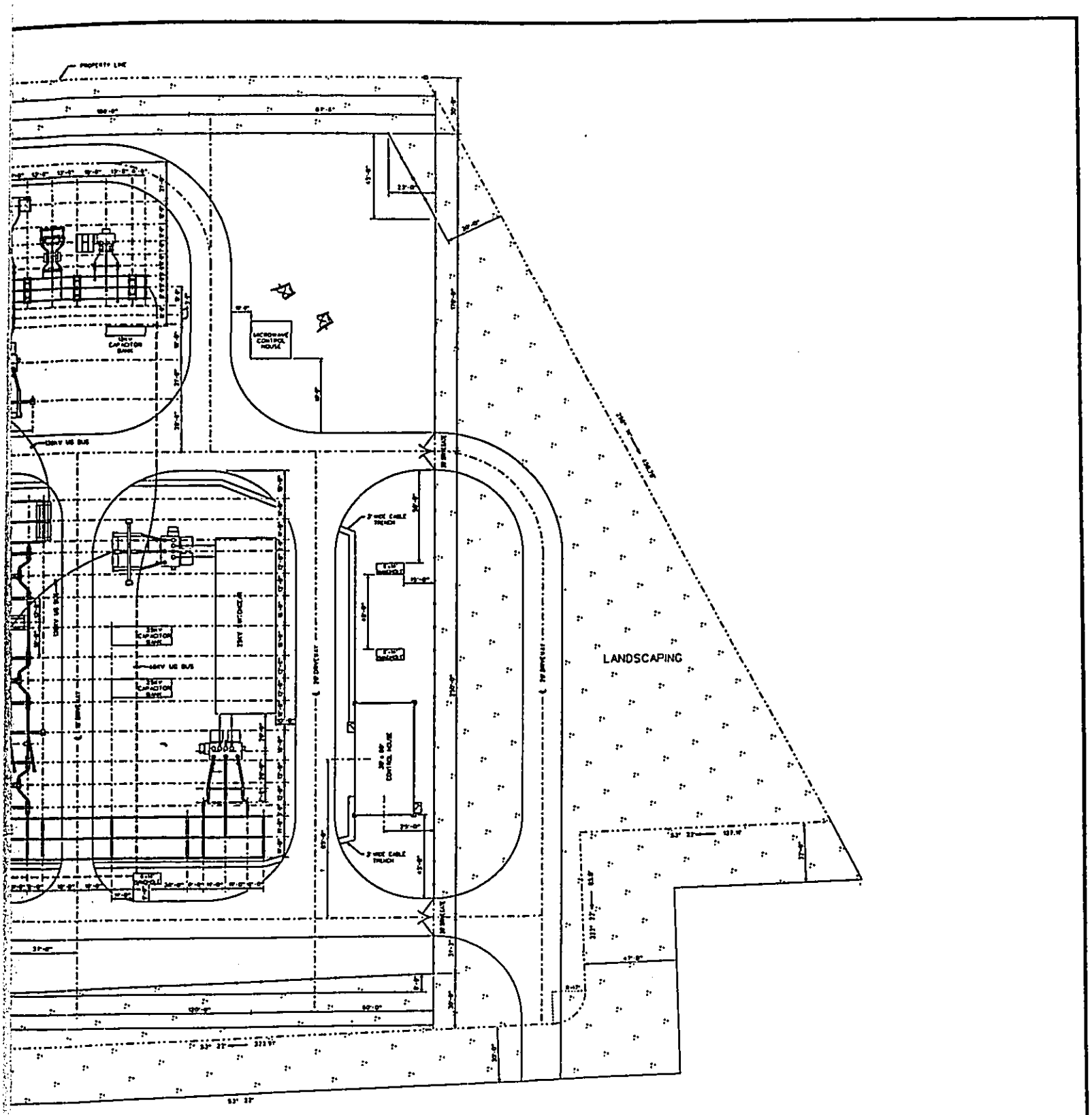


FIGURE 4-1

Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL

This right gives utilities the power to acquire property rights, when in the best interest of the public, through the court system. Eminent domain (condemnation) is used as a last resort if an agreement cannot be negotiated.

The courts provide for fair compensation to be paid for the rights acquired through condemnation. In August 1992, HECO filed an application with the PUC for approval to exercise its right of eminent domain for the acquisition from Campbell Estate of certain Part 1 transmission line easements and the proposed Ewa Nui Substation site.

HECO attempts to limit the amount of interference construction activities have on the landowners. In addition, claims for damages to land and crops are compensated when the construction has been completed.

Construction Practices

During the construction of typical HECO transmission lines, most or all of the following phases of work must be accomplished: surveying, determining access requirements, establishing construction facilities or base yards, installing foundations, erecting poles, installing conductors, and cleaning up and removing construction equipment. Table 4-2 lists equipment that is typically used during construction.

Surveying

Surveying for construction of transmission lines includes property, ROW, ground profile, access road, and construction surveys. A typical survey crew is made up of three people. Geotechnical investigations at selected locations will determine the types of foundations required at each pole site.

Clearing Requirements

When required, ROW clearing is done to prepare for efficient installation of poles and conductors and to provide for required electrical clearances.

Access Requirements and Traffic Management Practices

Surface access to each pole location is required during construction. Existing roads are used wherever possible. When poles are installed next to roads, such as Farrington Highway, part of the road must sometimes be occupied by equipment used to install foundations, poles, and conductors. Work on public roads must be done according to traffic control procedures prescribed by the Federal Highway Administration, the state Department of Transportation Highways Division, and the City and County of Honolulu Department of Transportation Services. Work next to a state road or highway requires a permit to perform work on state highways, which must incorporate a traffic control plan approved by the Highways Division. The City and County of Honolulu requires observation of state and federal traffic control regulations for any work on county roads.

Table 4-2
Equipment Typically Used during Construction

Construction Category	Purpose
1. Access, Clearing, and Cleanup	
1/2-ton pickup truck	Transport personnel and hand tools
Crew-cab truck	Transport personnel and hand tools
2-ton truck	Haul materials and debris
Chipper	Dispose of cleared trees and limbs
2. Steel Pole Construction	
A. Pier foundations	
1/2-ton pickup trucks	Transport personnel
Crew-cab trucks	Transport personnel
Mechanic's service trucks	Make field repairs
Truck-mounted auger	Excavate foundations
Compressors	Drive pneumatic tools
5-ton trucks	Haul materials
10-ton trucks	Haul materials
20-ton trucks	Haul materials
Tilted trailer	Haul equipment
Concrete mixer trucks	Haul concrete
Tool van	Tool storage
Mobile office trailer	Serve as supervision and clerical office
Front-end loader	Load excavated material
Concrete pump truck	Pump concrete
B. Pole erection	
1/2-ton pickup trucks	Transport personnel
Crew-cab trucks	Transport personnel
5-ton trucks	Haul materials
10-ton trucks	Haul materials
20-ton trailer	Haul materials
30-ton cranes (mobile)	Erect structures
15-ton cranes (mobile)	Erect structures

Table 4-2
Equipment Typically Used during Construction

Construction Category	Purpose
80-ton or larger crane, depending on need (mobile)	Erect structures
3. Conductor Installation	
1/2-ton pickup trucks	Transport personnel
Crew-cab trucks	Transport personnel
Tensioners (truck-mounted)	Install conductor
Pullers (truck-mounted)	Install conductor
Reel trailer with reel stands (semi-trailer type)	Haul conductor
Tractors (semi-type)	Haul conductor
Low-bed trailer	Haul materials
5-ton trucks	Haul materials
10-ton trucks	Haul materials
Take-up trailers (sock line)	Install conductor
Reel winders	Install conductor
Crawl tractors	Install conductor
Auger (truck-mounted)	Excavate pole holes
Line truck	Install clearance structures
Tool vans	Tool storage
Mobile office trailer	Serve as supervision and clerical office

According to state procedures, only one lane at a time may be closed on a multi-lane highway and, on a two-lane highway, wherever possible, lanes of adequate width in both directions must be provided. All lanes must be open to traffic during morning peak hours (6:00 a.m. to 8:30 a.m.) and afternoon peak hours (3:30 p.m. to 6:00 p.m.). HECO and its construction contractors follow state guidelines for the types of signs, lights, markers, position of traffic cones, areas coned off, and the use of flaggers and police officers (State of Hawaii Department of Transportation; U.S. Federal Highway Administration).

Coning off a lane of traffic is usually required during foundation, pole, and conductor installation phases of line construction. At any point along the new route, traffic might have to be interrupted for several relatively brief periods over the course of a few months. The time required to complete each phase of construction is given in the following subsections.

Construction of Support Facilities

A construction yard headquarters will be identified in a location near the new line's route. The construction yard headquarters is the base station where employees report at the start and end of each day's activities. These facilities are used for other activities including a field office; pole and davit arm laydown areas; storage of materials, equipment, and vehicles; and security.

Possible material storage yards or staging areas to be used during construction of the project are the CIP Substation and the Ewa Nui Substation site.

Foundation Installation

The next phase in the construction of transmission lines is foundation installation. Foundations for the project will be of the conventional pier type. Typically, two to three foundations at a time are excavated, formed, and poured, requiring 2 to 3 weeks to complete. If the poles are located next to a roadway, foundation installation requires coning off a single lane of traffic for approximately 1,000 to 1,500 feet. This coned area is moved forward as the foundations are completed.

Pole Assembly and Installation

After the foundation concrete is cured, the poles are transported to the pole locations and are assembled and erected. A mobile crane is used to lift each assembled pole or section into place. Four to seven workers can erect approximately two to four poles per day.

Conductor Installation

Before conductor installation begins, temporary clearance structures may be installed at road crossings and at locations where the conductors might inadvertently contact existing electrical or communication facilities and vehicular traffic during installation.

"Tension-stringing" will be used to install the conductors. This method prevents the conductors from touching the ground or other objects by maintaining a certain tension and sag during the stringing operation.

In pole locations next to roadways, one lane would be closed to traffic during pulling and sagging operations. Approximately 1 month is required to complete 1 mile of conductor installation.

Quality Control, Cleanup, and Removal of Construction Materials

As sections of the transmission lines are completed, HECO makes thorough inspections of the work to verify that they are built according to specifications and standards. Anything that does not comply is corrected.

Cleanup work includes:

- Removing all temporary crossing and clearance structures and backfilling any remaining holes used for temporary poles
- Disposing of packing crates, reels, shipping material, and debris
- Dressing roads, work sites, and pole sites to remove ruts and leveling and preparing areas for seeding, if required
- Repairing gates and fences to their original condition or better
- Grounding fences and trellises, as needed
- Repairing any damage that occurred during construction

Substation Improvements

Construction of the new Ewa Nui Substation will involve clearing the site, currently used for sugar cane cultivation. Steel and concrete foundation structures will be installed to support the columns and beams to guide the transmission lines to the appropriate substation equipment. A chain link fence will be installed around the substation for safety and security. A road about 20 feet wide will provide access to the substation from Farrington Highway. Underground ducts for 46 kV, 25 kV, and 12 kV circuits will be installed in Farrington Highway to allow for future connections when development occurs on the makai side of the highway. Connections to water and sewer lines also will be constructed in the highway.

Modifications to the CIP Substation will involve installation of equipment required to connect one circuit of the line to the substation. All work will take place on existing HECO property.

Project Schedule, Cost, and Work Force

Figure 4-2 shows the project schedule and duration of major activities. Construction of the transmission line will take about 12 months, from June 1993 to June 1994. Construction of the civil and structural elements of the Ewa Nui Substation will take about 9 months, with an additional 5 months for electrical work. Work will be completed in June 1994.

Operation of the transmission lines and Ewa Nui Substation is scheduled for the end of June 1994. The preliminary capital cost for the transmission lines is $24.9 million (1991 dollars). The preliminary capital cost for the Ewa Nui Substation is $7.8 million (1991 dollars).

The construction work force for the project will be made up of 30 to 40 workers. There will be two separate work forces, one for substation construction and another for transmission line construction. Foundation construction, pole erection, and stringing probably will be

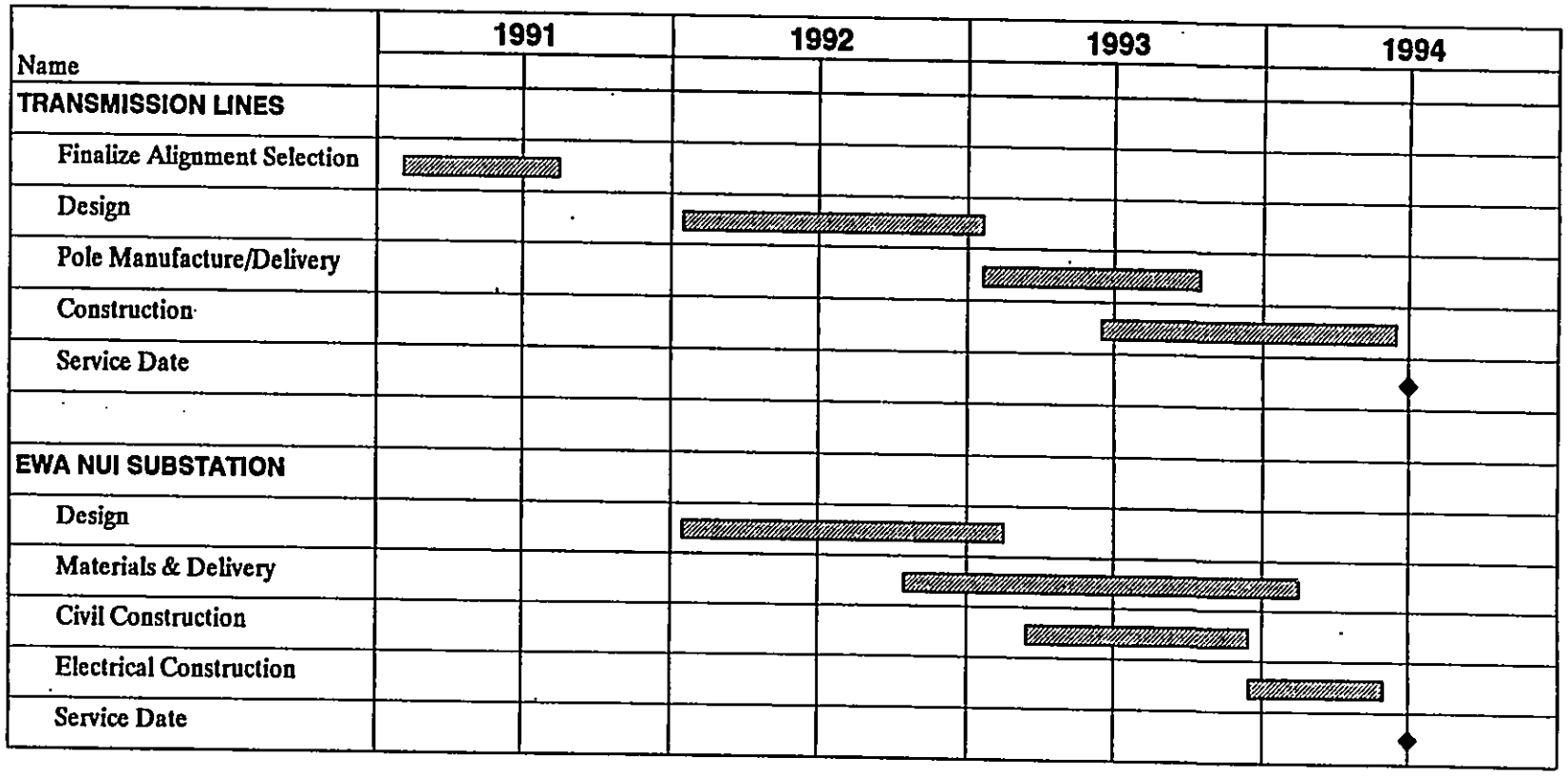


FIGURE 4-2

PROJECT SCHEDULE

Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL

performed by contractors. Contracted construction crews also may be used to make necessary substation improvements.

Operation and Maintenance

Operational Characteristics and Procedures

The proposed transmission lines will be energized and operated at a *nominal voltage of* 138 kV, plus or minus 5 percent. Changes in load flow will cause minor fluctuations in the actual operating voltage.

Right-of-Way Use

Land use activities within and next to the transmission lines' ROWs will be permitted within the terms of the easement. Incompatible activities within the ROW include constructing buildings, drilling wells, growing trees that may interfere with line operation, or other activities that may compromise safety. If necessary, appropriate techniques would be used within the ROW to control vegetation that might interfere with reliable service. Low-growing vegetation may be left in the ROW.

Maintenance Practices

The proposed transmission lines' structures and ROWs will be regularly inspected and a detailed inspection and structure upgrade of the lines will be conducted according to HECO's maintenance schedules.

Emergency repair will be performed if the transmission lines are damaged and require immediate attention. Maintenance crews will use tools, trucks, assist trucks, aerial lift trucks, cranes, and other equipment necessary for repairing and maintaining insulators, conductors, and structures.

HECO's Engineering and Distribution Departments are developing a program for live line maintenance, which enables personnel to approach and work on transmission line hardware without deenergizing the transmission lines. Although specialized equipment and insulation are needed, live line maintenance procedures can be used to complete certain routine maintenance tasks with the lines energized to minimize outage requirements.

Chapter 5
Environmental Setting, Potential Impacts, and Mitigation

In this chapter, existing conditions within and adjacent to the proposed alignment of the Waiau-CIP Transmission Line, Part 1, Project will be described and potential project impacts will be evaluated. Where appropriate, short-term impacts related to construction are distinguished from postconstruction impacts.

Many of the potential impacts of the transmission lines were anticipated during the course of the routing study (CH2M HILL, 1991) and potential impacts were mitigated by avoidance (i.e., by selecting an alignment that created minimal impact on the environment and surrounding land uses). Where impacts (either temporary or permanent) could not be entirely avoided during the siting process, mitigation measures have been identified.

Land Use

Environmental Setting

Existing Land Use

The principal existing land uses in the study area are industrial, agricultural, residential, and military (Figure 5-1). The majority of the 6.8-mile proposed transmission line route is in or next to current or former lands used for agriculture. The area is being transformed from a largely agricultural area, dominated by sugar cane production, to an urbanized area consisting of several existing residential areas and the planned Kapolei Second City development. Approximately 600 single-family units have been completed in the Villages of Kapolei.

The western end of the transmission line route beginning at the CIP Substation follows an existing utility corridor makai of the OR&L ROW. Sugar cane cultivation currently dominates the general area. After crossing Kalaeloa Boulevard, the line passes a newly constructed desalinization plant. Sugar cane agriculture continues along the mauka side of the OR&L ROW. The Barbers Point Naval Air Station borders the makai side of the utility corridor. Uses within the naval station bordering the transmission line route consist of military housing, ordinance storage, recreation areas and conservation buffers, and administration and community facilities. The Barbers Point Elementary School buildings would be about 400 feet away from the proposed lines. Figure 5-2 shows existing uses at the western end of the corridor.

Land use in the central section of the transmission line route is shown in Figure 5-3. The route continues to follow the utility corridor, OR&L ROW, and mauka edge of the Barbers Point Naval Air Station. Where the proposed route turns mauka to Kaloi Gulch, it enters the part of the Ewa Plain still cultivated in sugar cane. Sugar cane cultivation predominates

the remainder of the route all the way to the Ewa Nui Substation. As shown in Figure 5-4, the last 0.9 mile of the alignment follows a portion of Farrington Highway. Sugar cane cultivation still predominates on either side of the proposed transmission line.

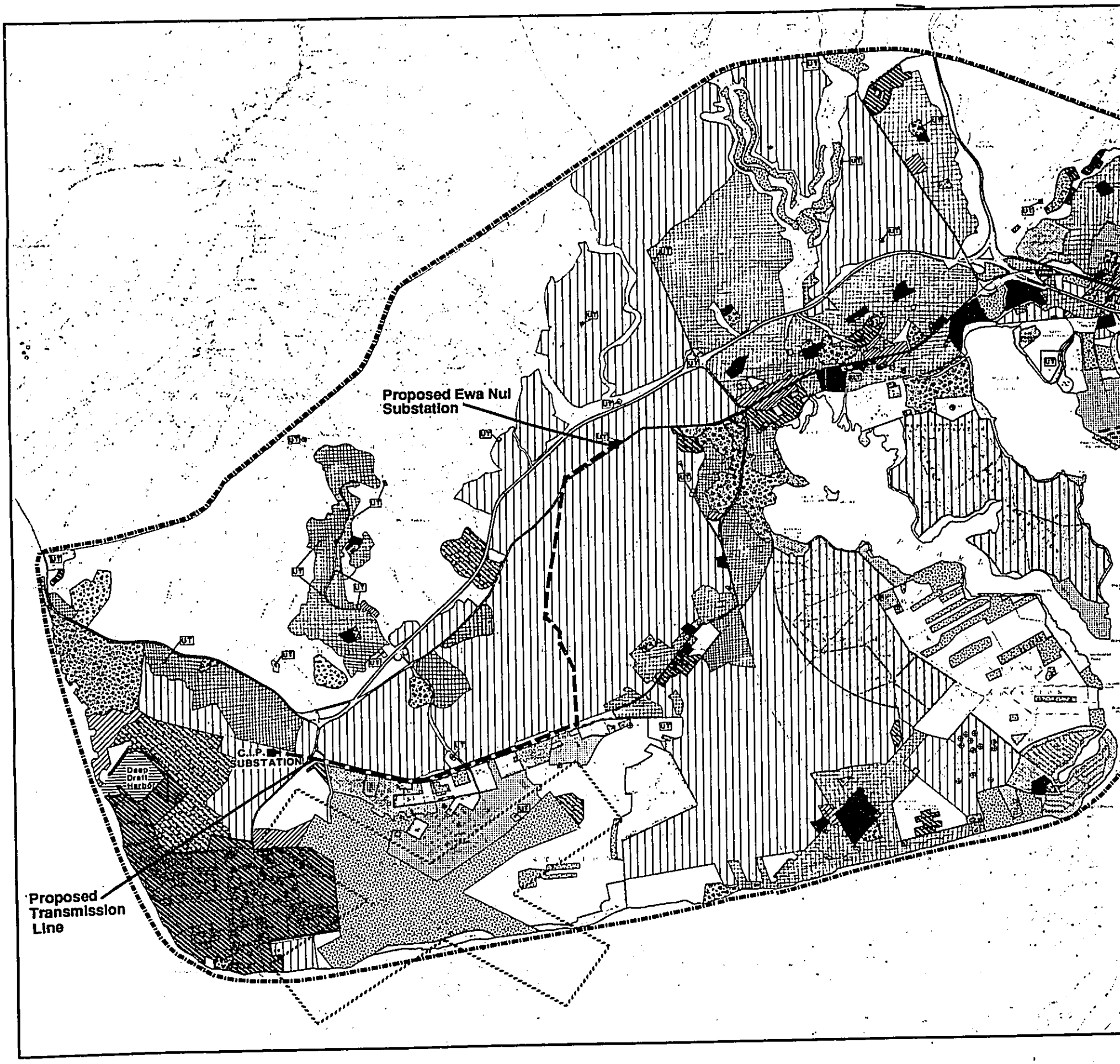
Approximately 3.3 miles of the proposed route along the OR&L ROW lie entirely within the air interference zone for Barbers Point Naval Air Station. The air interference zone for Barbers Point Naval Air Station is defined by Federal Aviation Administration (FAA) regulations and managed by the Navy. FAA Regulations, Part 77, Objects Affecting Navigable Airspace (1985), establish rules protecting the safety of aircraft landing and taking off from airports by limiting the height of objects that can be constructed near airports. The regulations establish a set of imaginary surfaces that define the maximum permissible heights of objects near airports. These imaginary surfaces are defined in terms of elevations above the runway surface at various distances from the runway, with sloping transitional surfaces connecting the horizontal surfaces.

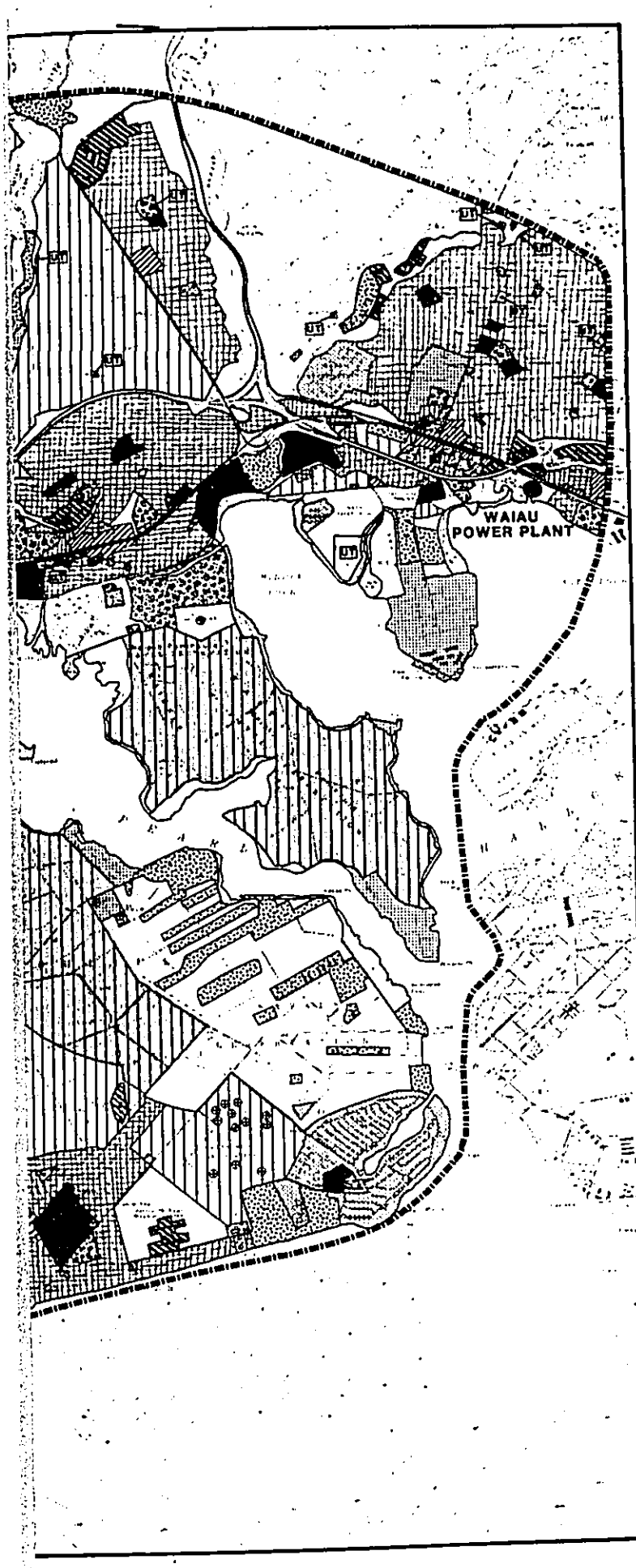
The air interference exclusion area for the transmission line project limits the height of any structure to 120 feet. This limitation allows for a maximum pole height of 110 feet plus an additional 10 feet as a buffer. The exclusion area was defined and mapped as the area surrounding the two runways at Barbers Point Naval Air Station within which any structure 120 feet high would penetrate the air interference zone's imaginary surface surrounding the runways.

In addition to the FAA regulations, structure heights and land uses near the Barbers Point Naval Air Station are restricted by easement agreements between the U.S. Navy and Campbell Estate (June 1989). The easements establish maximum elevations above mean sea level (msl) above which structure heights, including utility poles, may not extend. The easements cover an area mauka of the naval air station's and affect about 1.5 miles of the transmission lines' alignment along the naval air station's boundary and Kaloi Gulch. The maximum elevations are 183 feet msl next to the Barbers Point Naval Air Station boundary and increase with distance northward toward Farrington Highway to a maximum elevation of more than 330 feet msl.

Three private companies own and operate oil or gas pipelines in the study area: Chevron USA, Inc.; The Gas Company, Inc.; and Hawaiian Independent Refinery, Inc. (HIRI). HIRI maintains a 10-inch jet fuel and gasoline pipeline, and The Gas Company maintains a 16-inch propane pipeline within the study area (Figures 5-2, 5-3, and 5-4). The HIRI and The Gas Company lines are located in the energy corridor, an ROW established by the state of Hawaii for the transportation of sources of energy. The ROW is generally 30 feet wide and consists of five slots for pipelines, two of which are occupied by The Gas Company and HIRI lines. The energy corridor begins at the refinery in CIP and runs along Farrington Highway to Kunia Road.

Chevron maintains two 8-inch lines (one black oil and one white oil) and a 4-inch heater oil line within the study area. These lines originate at CIP and follow the alignment of the OR&L ROW adjacent to Renton Road and Barbers Point Naval Air Station; they then join the shoreline of Pearl Harbor near Honouliuli.


Proposed Ewa Nui Substation
C.I.P. SUBSTATION
Deep Draft Harbor
Proposed Transmission Line



EXISTING LAND USE

- Study Area Boundary
- Residential
- Commercial
- Industrial
- Agricultural
- Public and Semi-Public Facilities
- Schools
- Parks, Recreation Areas and Cemetaries
- Utilities
- Land Fills and Refuse Areas
- Quarry/Coral Pit
- Air Interference Zone
- Communication Sites
- National Wildlife Refuge
- Undeveloped/Open Space

USES WITHIN MILITARY LANDS

- Housing
- Ordnance Storage, Training & Operations and Maintenance Areas
- Administration and Community Facilities
- Leased for Agriculture
- Recreation Areas and Conservation Buffer
- Undeveloped

NORTH
WEST EAST
SOUTH

MAUKA
EWA/ WAIANAE — DIAMOND HEAD
MAKAI

0 1000 2000 5000 10,000 FEET

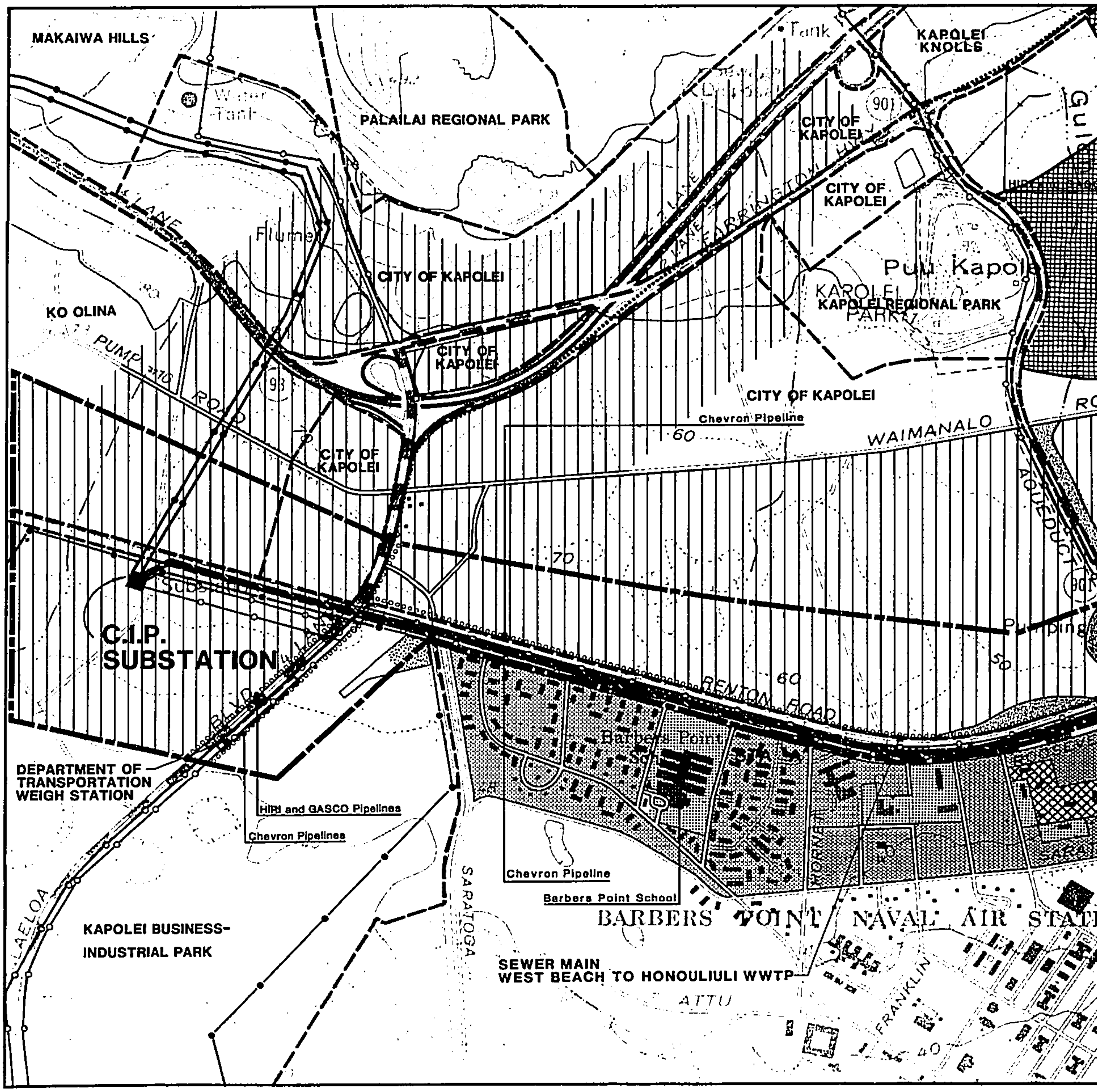
0 1/4 1/2 1 2 MILES

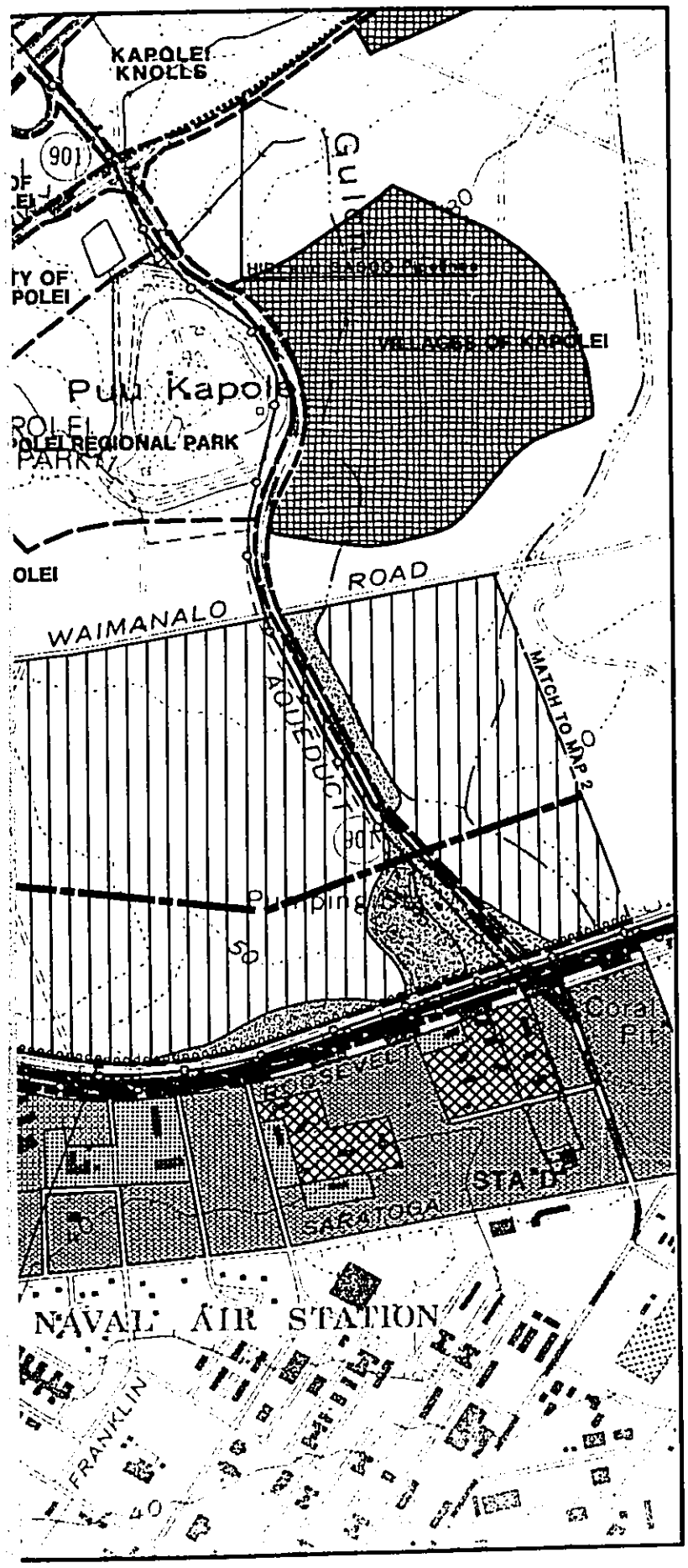
FIGURE 5-1

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2MHILL


MAKAIWA HILLS
Water Tank
PALAILAI REGIONAL PARK
Tank
KAPOLEI KNOLLS
CITY OF KAPOLEI
CITY OF KAPOLEI
Flume
CITY OF KAPOLEI
KO OLINA
PUMP ROAD
CITY OF KAPOLEI
Puu Kapolei
KAPOLEI REGIONAL PARK
CITY OF KAPOLEI
Chevron Pipeline
WAIMANALO
CITY OF KAPOLEI
AQUEDUCT
C.I.P. SUBSTATION
RENTON ROAD
Barbers Point School
DEPARTMENT OF TRANSPORTATION WEIGH STATION
HIRI and GASCO Pipelines
Chevron Pipelines
Chevron Pipeline
Barbers Point School
SARATOGA
BARBERS POINT NAVAL AIR STATI
LAELOA
KAPOLEI BUSINESS-INDUSTRIAL PARK
SEWER MAIN
WEST BEACH TO HONOULIULI WWTP
ATTU
FRANKLIN



ALIGNMENT DATA MAP

EXISTING AND PROPOSED LAND USE

- Corridor Boundary
- Project Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

EXISTING LAND USES

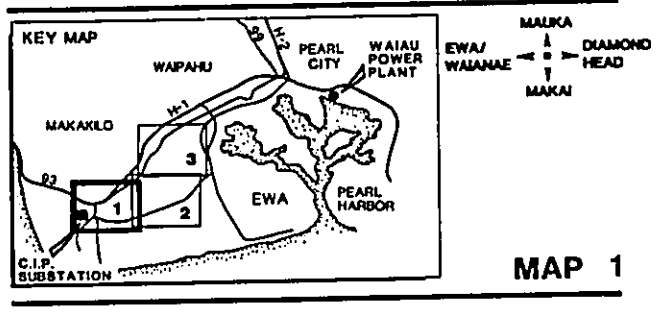
- Residential (Single Family)
- Residential (Multi-Family)
- Commercial
- Industrial
- Public and Semi-Public Facilities
- Parks, Recreation and Preservation
- Agriculture
- Utilities
- Undeveloped Land
- Pipelines
- Energy Corridor

USES WITHIN MILITARY LANDS

- Housing
- Training and Operations
- Supply, Storage and Maintenance
- Administration, Community & Medical Facilities
- Recreation and Conservation Buffer

PROPOSED LAND USES

- Proposed Land Use
- Proposed Sewer Main
- Proposed Water Main



MAP 1

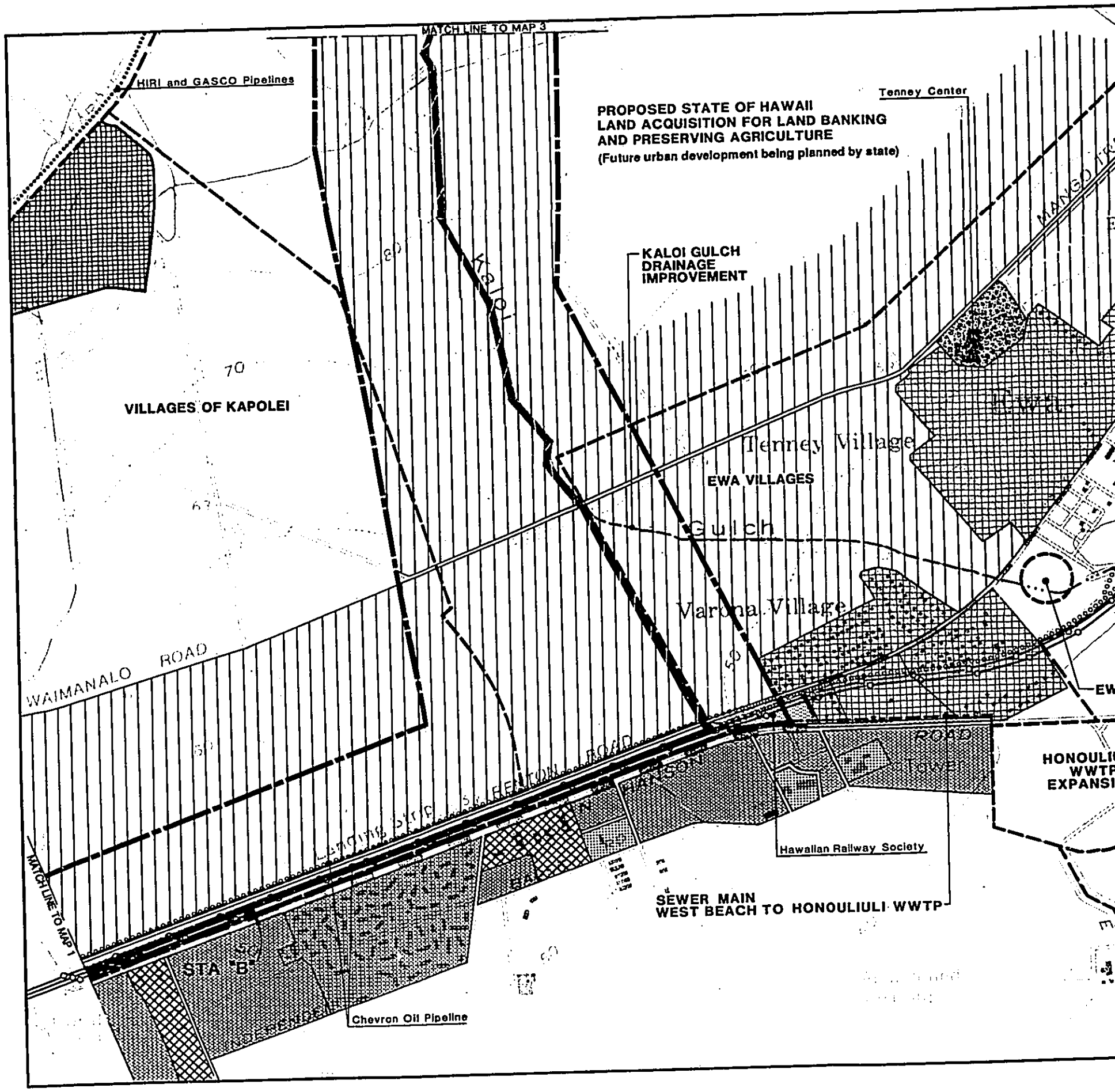
SCALE
0 500 1000 FEET
0 1/8 1/4 MILE
NORTH WEST EAST SOUTH

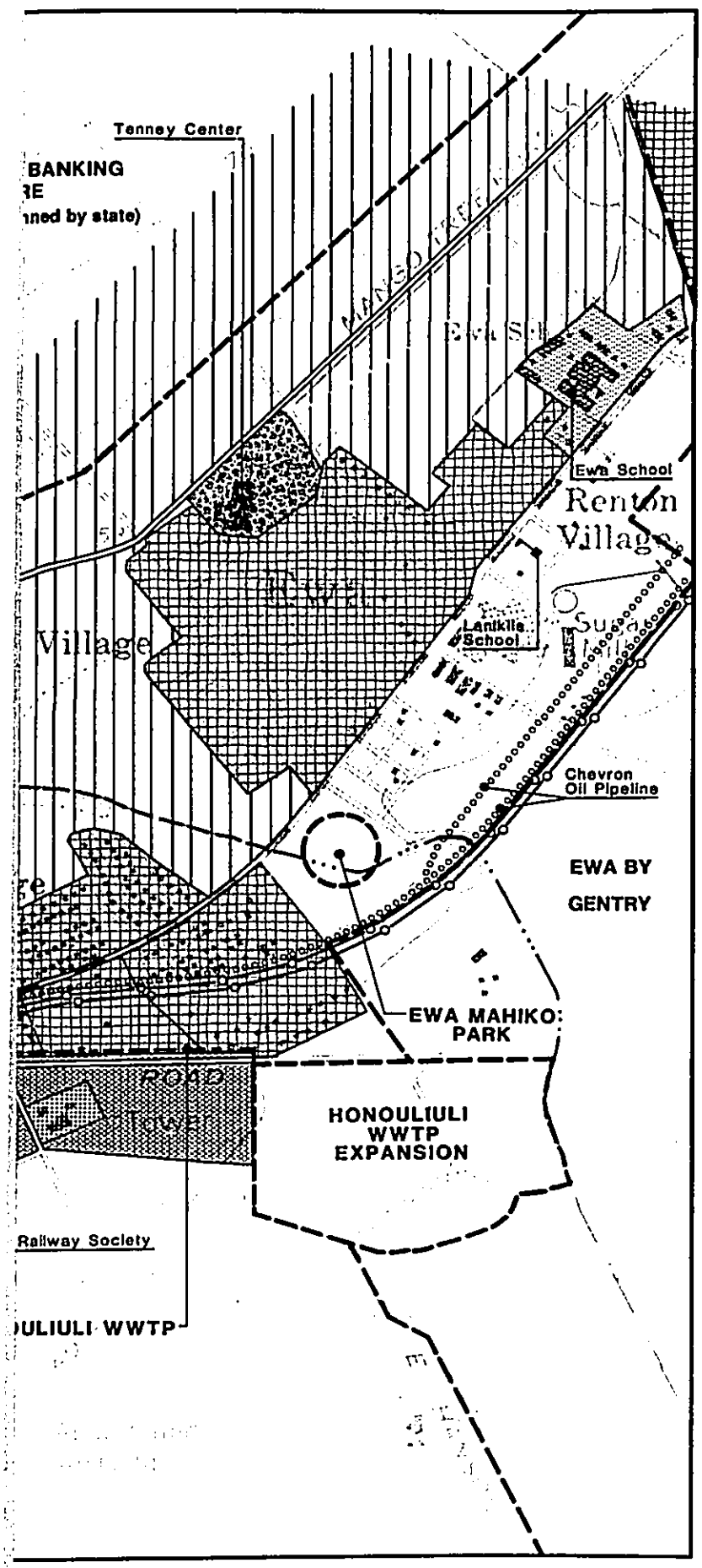
FIGURE 5-2

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL


MATCH LINE TO MAP 3
HIRI and GASCO Pipelines
PROPOSED STATE OF HAWAII
LAND ACQUISITION FOR LAND BANKING
AND PRESERVING AGRICULTURE
(Future urban development being planned by state)
Tenney Center
KALOI GULCH
DRAINAGE
IMPROVEMENT
VILLAGES OF KAPOLEI
Tenney Village
EWA VILLAGES
gulch
Varona Village
WAIMANALO ROAD
HONOULIULI
WWTP
EXPANSI
Hawaiian Railway Society
SEWER MAIN
WEST BEACH TO HONOULIULI WWTP
MATCH LINE TO MAP 1
STA "B"
Chevron Oil Pipeline



ALIGNMENT DATA MAP

EXISTING AND PROPOSED LAND USE

- Corridor Boundary
- Project Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

EXISTING LAND USES

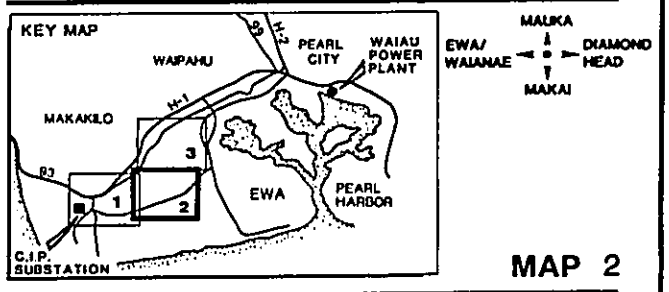
- Residential (Single Family)
- Residential (Multi-Family)
- Commercial
- Industrial
- Public and Semi-Public Facilities
- Parks, Recreation and Preservation
- Agriculture
- Utilities
- Undeveloped Land
- Pipelines
- Energy Corridor

USES WITHIN MILITARY LANDS

- Housing
- Training and Operations
- Supply, Storage and Maintenance
- Administration, Community & Medical Facilities
- Recreation and Conservation Buffer

PROPOSED LAND USES

- Proposed Land Use
- Proposed Sewer Main
- Proposed Water Main



MAP 2

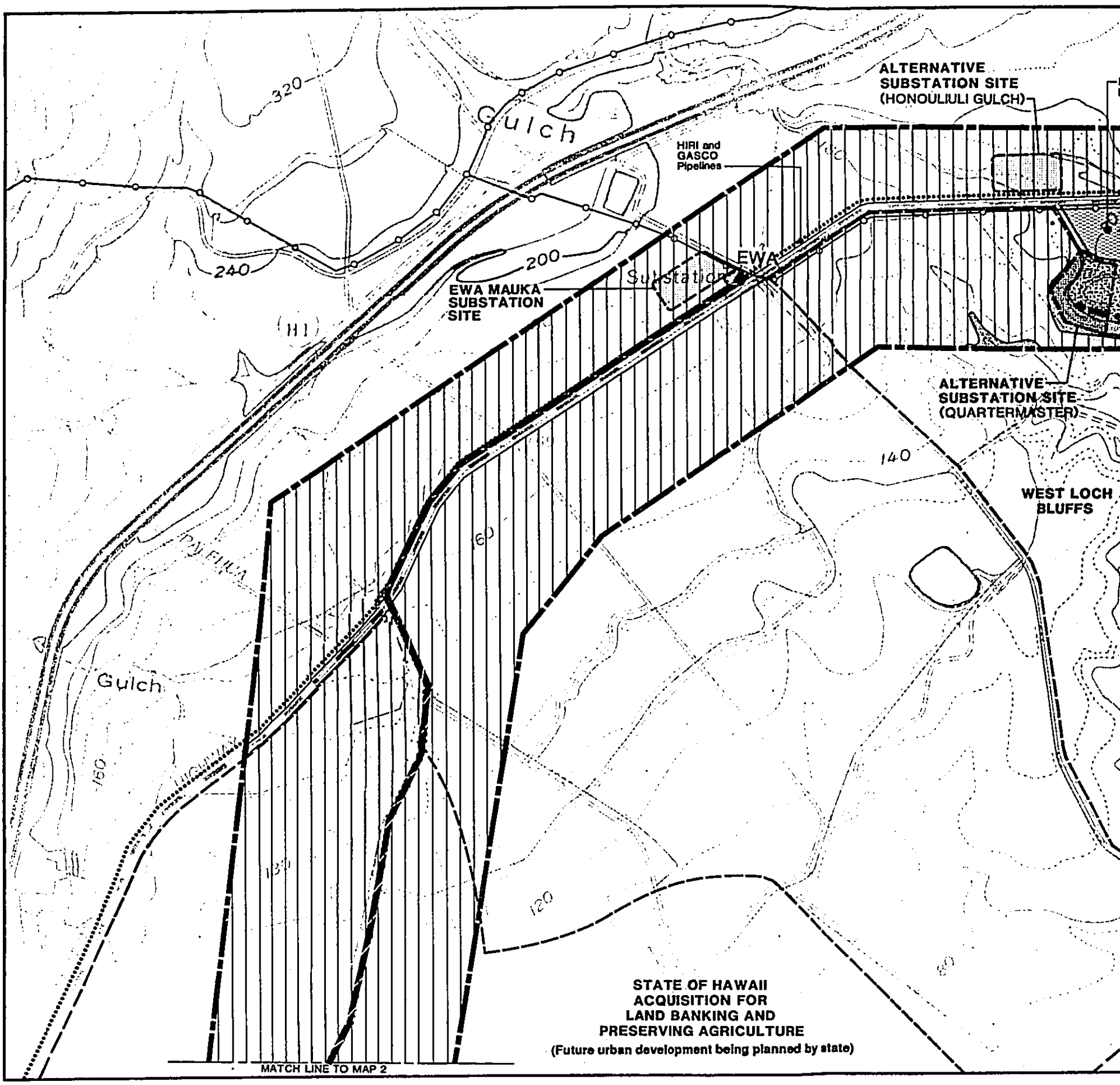
SCALE
0 500 1000 FEET
0 1/8 1/4 MILE
NORTH WEST EAST SOUTH

FIGURE 5-3

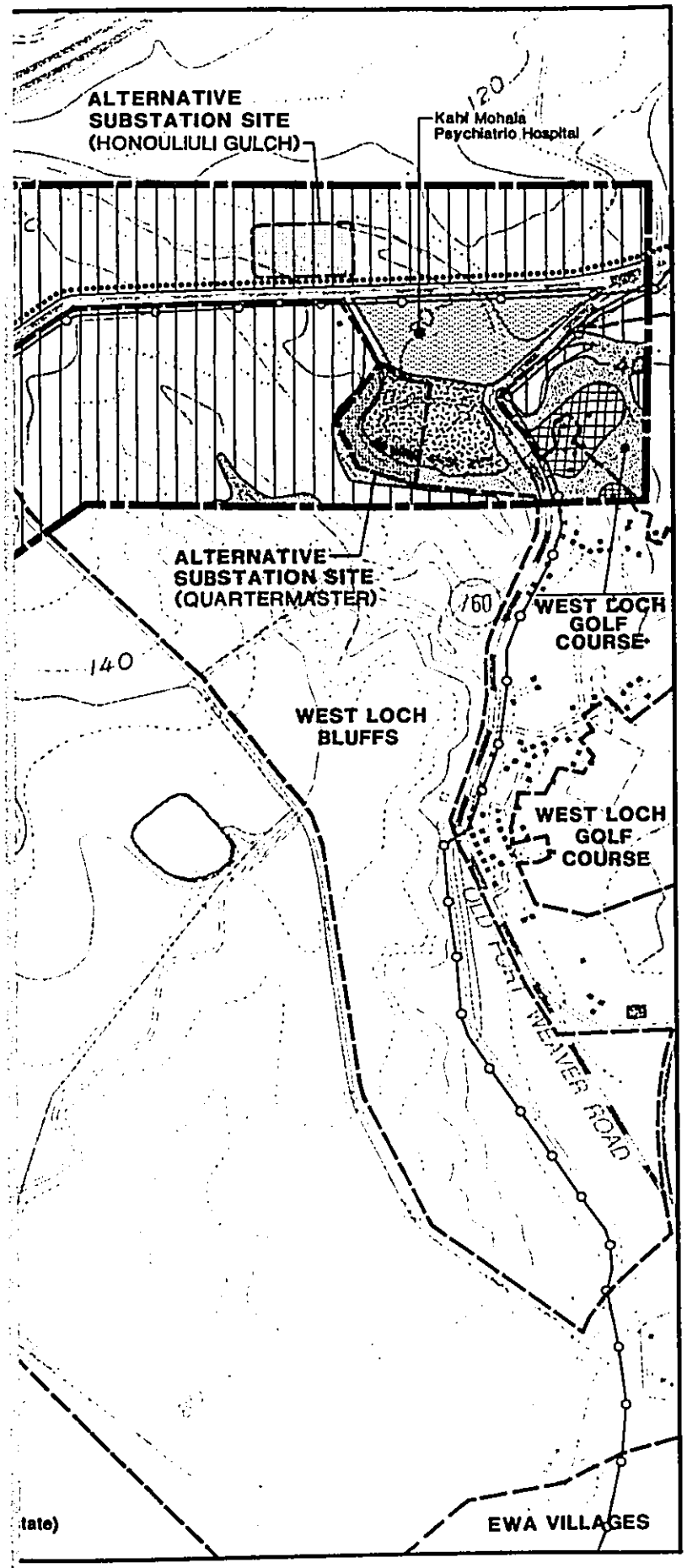
Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL



STATE OF HAWAII
ACQUISITION FOR
LAND BANKING AND
PRESERVING AGRICULTURE
(Future urban development being planned by state)



ALIGNMENT DATA MAP

EXISTING AND PROPOSED LAND USE

- Corridor Boundary
- Project Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

EXISTING LAND USES

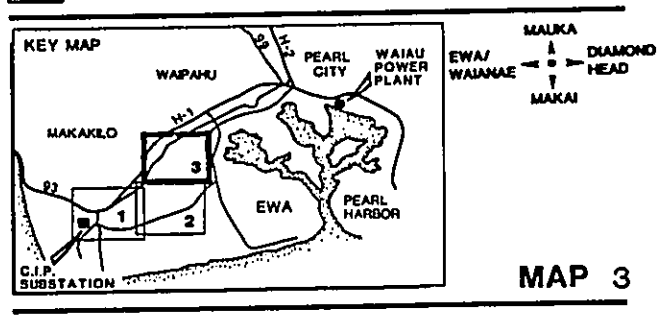
- Residential (Single Family)
- Residential (Multi-Family)
- Commercial
- Industrial
- Public and Semi-Public Facilities
- Parks, Recreation and Preservation
- Agriculture
- Utilities
- Undeveloped Land
- Pipelines
- Energy Corridor

USES WITHIN MILITARY LANDS

- Housing
- Training and Operations
- Supply, Storage and Maintenance
- Administration, Community & Medical Facilities
- Recreation and Conservation Buffer

PROPOSED LAND USES

- Proposed Land Use
- Proposed Sewer Main
- Proposed Water Main



MAP 3

SCALE
0 500 1000 FEET
0 1/8 1/4 MILE

NORTH
WEST EAST
SOUTH

FIGURE 5-4

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

Proposed Land Uses

In the vicinity of the transmission line project, proposed development consists of Campbell Estate's City of Kapolei and the state's Villages of Kapolei, both of which would be situated immediately mauka of the portion of the proposed transmission lines along the OR&L ROW (see Figures 5-2 through 5-4). The City of Kapolei would occupy 890 acres and include commercial uses, public facilities, low-density apartments, mixed use, and a regional park. The Villages of Kapolei is a major new residential development on 890 acres that will eventually include 5,000 dwelling units, parks, a golf course, and community facilities; the first houses were occupied in 1990. The land use plan (April 24, 1992) for the Villages of Kapolei shows a number of proposed land uses on the makai portion of the development including a high school, an elementary school, a community park, and residences. These proposed uses are separated from the proposed transmission lines by a distance of at least 255 feet because of an intervening drainage canal 125 feet wide, a buffer/access road 40 feet wide, the 40-foot-wide OR&L ROW, and a setback of 50 to 100 feet between the makai edge of the OR&L ROW and the center line of the transmission line alignment.

Another area proposed for future urban expansion is the state's 1,100-acre land bank, which is crossed by the Kaloi Gulch segment of the route (see Figure 5-3). The state is in the process of acquiring the 1,100 acres through eminent domain proceedings. The state's Housing Finance and Development Corporation has initiated the process of preparing a master plan for the 1,100 acres. Potential uses of the 1,100 acres are housing (single-family and multifamily units), civic buildings, educational centers, a sports complex, a golf course, a sewage treatment facility, stormwater drainage improvements, a north-south connector road, and extension of the Ewa Parkway from the Villages of Kapolei. Agricultural use of the land is expected to continue until about 1996. Timing of urban development in the area depends on market conditions. In the short term, however, the state will preserve agricultural use in this area.

The Rapid Transit System (RTS) proposed by the City and County of Honolulu is being considered for development in the future. A portion of a proposed future extension of the RTS is shown in the city's Development Plan Public Facility Map as a transit corridor and parallels Renton Road in the vicinity of the proposed transmission lines. Discussions with city staff in 1992 indicate a possibility that the extension of the RTS would follow Farrington Highway.

The city's Department of Transportation Services plans to widen Farrington Highway to a 100-foot ROW between Kalaeloa Boulevard and Kunia Road (meeting with the city's Department of Transportation Services and HECO on September 21, 1992). Widening will occur as development along Farrington Highway occurs. Land for the widening will be dedicated to the city by the abutting landowner. HECO requested that the city widen the highway by 50 feet on its makai side in the 0.9-mile section where the transmission line poles would be located. (The city's current plan is to widen the highway by 25 feet on each side of the highway.) In a letter dated December 17, 1992, the City Department of Transportation Services agreed to widen Farrington Highway on the makai side of the highway. The

advantages of widening on the makai side alone are less disruption to traffic flow during road construction and avoidance of the state's energy corridor on the mauka side of the highway.

The city's Department of Transportation Services also plans to widen and possibly extend Renton Road, an existing east-west road that runs through Ewa Villages. The extension would be mauka of the OR&L ROW and would intersect with the proposed north-south road. Renton Road, in the vicinity of the proposed transmission lines, is currently a crushed-coral road used for agricultural access. The city does not have a construction schedule for the proposed extension (meeting with Department of Transportation Services staff on September 29, 1992).

The Ewa Parkway in the Villages of Kapolei may be extended eastward as urbanization west of the villages occurs. The parkway would serve east-west traffic flow and would intersect with the proposed north-south road. Other east-west roads with connections to the north-south road also may be constructed as development occurs east of the Villages of Kapolei (meeting with the state's Department of Transportation on October 15, 1992).

In the preliminary planning stages is a new road, the north-south road, which would connect the H-1 Freeway with the development south of Renton Road. The general location of the north-south road is east of Kaloi Gulch. Conflicts between the proposed transmission lines and the north-south road are not anticipated (state Department of Transportation meeting with HECO on October 15, 1992).

A new trunk (interceptor) sewer is proposed in the existing utility corridor along the mauka edge of Barbers Point Naval Air Station. The new sewer would parallel an existing one and convey wastewater from developments in Kapolei and Ko Olina to the Honouliuli Wastewater Treatment Plant. Timing of construction depends on when improvements to the wastewater treatment plant are made. The sewer would be financed by a group of landowners and developers and subsequently dedicated to the city (various conversations with the city's Department of Public Works and Campbell Estate in September and October 1992).

Demographics

Within the Ewa Beach census-designated place, a population of 14,315 and housing units numbering 3,426 were reported. Although it was not possible to break down data to the area in the immediate vicinity of the project, aggregated data for the Ewa Beach census-designated place indicated that 98 percent of the housing units were occupied and that the housing unit occupancy by race was: 31 percent Caucasian, 64 percent Asian or Pacific Islander, 2 percent Black, and 3 percent other. The median age was 28.6 years. About 69 percent of the homes were owner occupied, and the median home value was $216,900.

With the decline of the sugar industry, and the ongoing replacement of lands with urban residential development, agriculture-related employment has been in a steady decline. The major employers in the project area are the businesses at the CIP and the Barbers Point Naval Air Station.

Potential Impacts

The proposed transmission lines will not cause the displacement of existing uses and therefore will not have significant direct impacts on existing land uses in the area. Indirect impacts that could affect existing land uses during the construction phase would be noise, air quality, and temporary disruption of traffic along Farrington Highway (addressed in the noise and transportation sections of this chapter). Indirect impacts from the completed transmission line and Ewa Nui Substation consist of visual impacts and health concerns related to electric and magnetic fields; these impacts and concerns are also addressed later in this chapter.

In the vicinity of Barbers Point Naval Air Station, the proposed transmission lines (which would be makai of the OR&L ROW) will be at least 220 feet from planned urban uses mauka of the OR&L ROW. The transmission lines would not have an adverse land use impact on the planned uses.

In the vicinity of Kaloi Gulch, the proposed lines would pass through the center of the 1,100 acres to be acquired by the state. Because of this plan, the proposed lines would have an impact on the state's ability to maximize use of the land for urban development. The 75-foot-wide easement requested by HECO along the east edge of Kaloi Gulch would encumber the lands subject to the easement, thereby limiting use of the land to activities compatible with transmission lines (e.g., a golf course, drainage improvements, open space, or roadways). Following Kaloi Gulch minimizes the land use impact of the transmission lines because a portion of the easement area includes the gulch itself, which is likely to continue to be used for drainage. The state's master planning activities would need to consider the transmission lines when determining locations for the potential land uses. High public uses, such as schools, hospitals, and residences, should not be located in proximity to the transmission lines.

The state Department of Transportation Airports Division (which coordinates for the FAA in Hawaii) and Barbers Point Naval Air Station were contacted to determine the potential impacts of the project on air safety at the air station. Any construction within the air interference zone surrounding Barbers Point Naval Air Station would require the issuance of a Notice of Proposed Construction or Alteration by the FAA.

Along the 3.3 miles of the preferred alignment along the OR&L ROW, the relevant imaginary surface is the 183-foot inner horizontal surface. The ground surface along the 3.3-mile segment ranges in elevation between 40 and 70 feet (and averages 50 to 60 feet) above msl, so transmission poles could be no higher than 113 to 143 feet, depending on the ground elevation at the pole site.

Standard double-circuit 138 kV transmission poles range in height from 80 to 110 feet, depending on the terrain, number of circuits, conductor type, and other criteria. Along the 3.3-mile segment on the Barbers Point Naval Air Station's 183-foot inner horizontal surface, pole heights will be adjusted to ensure that poles do not penetrate the imaginary surface. In addition, FAA regulations require that towers and poles be clearly marked with "hazard to

navigation" markings. Based on preliminary reviews, it appears that the transmission lines' poles will be beneath the construction height limitations (see Department of the Navy letter in Appendix A).

To ensure the safety of aircraft operations at Barbers Point Naval Air Station, HECO will comply with measures required by the FAA when it issues its Notice of Construction or Alteration of Navigable Airspace, including limiting pole heights and marking poles and lines with "hazard to navigation" markings.

Concerning the restrictive use easement between the U.S. Navy and Campbell Estate, the proposed transmission line poles will be below the maximum allowable heights. Ground elevation in the restrictive easement area is about 52 feet above msl where the most restrictive heights of 183 feet above msl are located, thus allowing pole heights of up to 131 feet. In areas farther north of the Barbers Point Naval Air Station, ground elevation rises to 60 to 70 feet above msl where height limits increase to more than 300 feet above msl, thus allowing structure heights of more than 200 feet.

HECO is coordinating with Chevron, The Gas Company, and HIRI to ensure that the underground pipelines are not damaged during installation of the transmission line poles. In its consultation letter (in Appendix A), Chevron provided a copy of its guidelines for work near Chevron pipelines. If these guidelines are followed, there should be no damage to the pipelines. In the unlikely event that an accident occurs during construction and a pipeline is ruptured, potentially hazardous and explosive materials would be released into the surrounding environment. Should such an accident occur, the pipeline's operators and the Fire Department will be notified immediately. The transmission lines will not pose a hazard (electrocution) to employees of the pipeline companies while they are maintaining the pipelines.

The proposed transmission lines may or may not have an impact on the RTS extension in the transit corridor paralleling Renton Road or Farrington Highway because little is known about the RTS extension. The proposed transmission line crosses the proposed future extension of the RTS shown in the city's Development Plan-Public Facilities Map as the proposed transmission lines turn mauka between Renton Road and Farrington Highway. HECO has met with RTS representatives to ensure that there is no conflict between the RTS project and the transmission line project.

Concerning the future widening of Farrington Highway, the city's Department of Transportation Services has agreed to widen the highway on its makai side. HECO is coordinating design of the transmission lines with the city to avoid conflicts with future widening plans. The proposed transmission lines will not affect the future widening of Renton Road (meeting on September 29, 1992, with the city's Department of Transportation Services). The transmission lines will not affect the future alignment of the proposed north-south road (meeting on October 15, 1992, with the state's Department of Transportation).

Concerning the proposed trunk sewer in the existing utility corridor along the mauka edge of Barbers Point Naval Air Station, HECO is coordinating design and construction plans with the private developers of the trunk sewer to avoid conflicts during construction.

Construction of the project will require 30 to 40 workers over a 12- to 15-month period. Operation of the proposed project is not anticipated to require HECO to employ additional staff. The proposed project would not affect demographics in the area. The proposed transmission lines will affect the value of property within the easement and areas immediately next to the easements.

Mitigation

No mitigation is necessary beyond those measures described previously.

Geological and Water Resources

Environmental Setting

A geotechnical investigation was performed to survey the types of geologic and hydrologic features within the project area during the corridor investigation stage of the routing study (CH2M HILL, 1991). The characteristics of each factor were analyzed for their potential to constrain foundation and transmission line siting and design.

Five geologic formations exist in the project region: Koolau Basalt (TKb), coral-algal deposits (OIS), older alluvium (Qa), synthetic fills (Rf), and recent alluvium (Ra) (Figures 5-5, -6 and -7). Koolau Basalt, older alluvium, and coral-algal deposits are the most suitable of five formations for standard drilled pier foundations. The other geologic formations have moderate to fair suitability for foundation support, and pile type foundations may be necessary in some locations on both recent alluvium and synthetic fills.

The entire alignment is underlain by either older alluvium or coral-algal deposits. The CIP Substation and the initial 600 feet (approximately) of the alignment is on older alluvium. Beyond that point, coral-algal deposits underlie the alignment up to the intersection of the old sugar irrigation aqueduct and Renton Road. Older alluvium underlies the remainder of the proposed alignment up to and beyond the Ewa Substation.

Older alluvium material is characterized as having a relatively high bearing capacity and is considered to be sufficiently competent to support relatively large loads with proper design. Because of the granular nature of the majority of the coral-algal deposits and the degree of cementation frequently present, this formation generally has high in situ strength characteristics capable of supporting heavy foundation loads. The project area has no areas of slopes with severe instability problems, slopes greater than 20 percent, or soils with high erosion potential.

A 2-mile portion of the alignment parallels and is located on the east side of Kaloi Gulch, an intermittent stream bed that is the only stream in any proximity to the alignment. The gulch has not been channelized.

In anticipation of future plans to urbanize the Kaloi Gulch drainage basin, landowners and developers have met with the city's Department of Public Works to discuss forming a group to address drainage requirements for specific development and for Kaloi Gulch. One of the group's objectives is to minimize adverse impacts to downstream properties by attenuating stormwater flows through the use of stormwater detention and retention systems. The city and the group do not have any specific plans concerning future improvements to Kaloi Gulch (various telephone conversations in October 1992 with staff at the city's Department of Public Works, the Housing Finance and Development Corporation, and Campbell Estate).

A portion of the alignment between Renton and Waimanalo Roads is an area defined on the Federal Emergency Management Agency (FEMA) flood insurance rate maps as being subject to inundation by 100-year flood events (Figure 5-6).

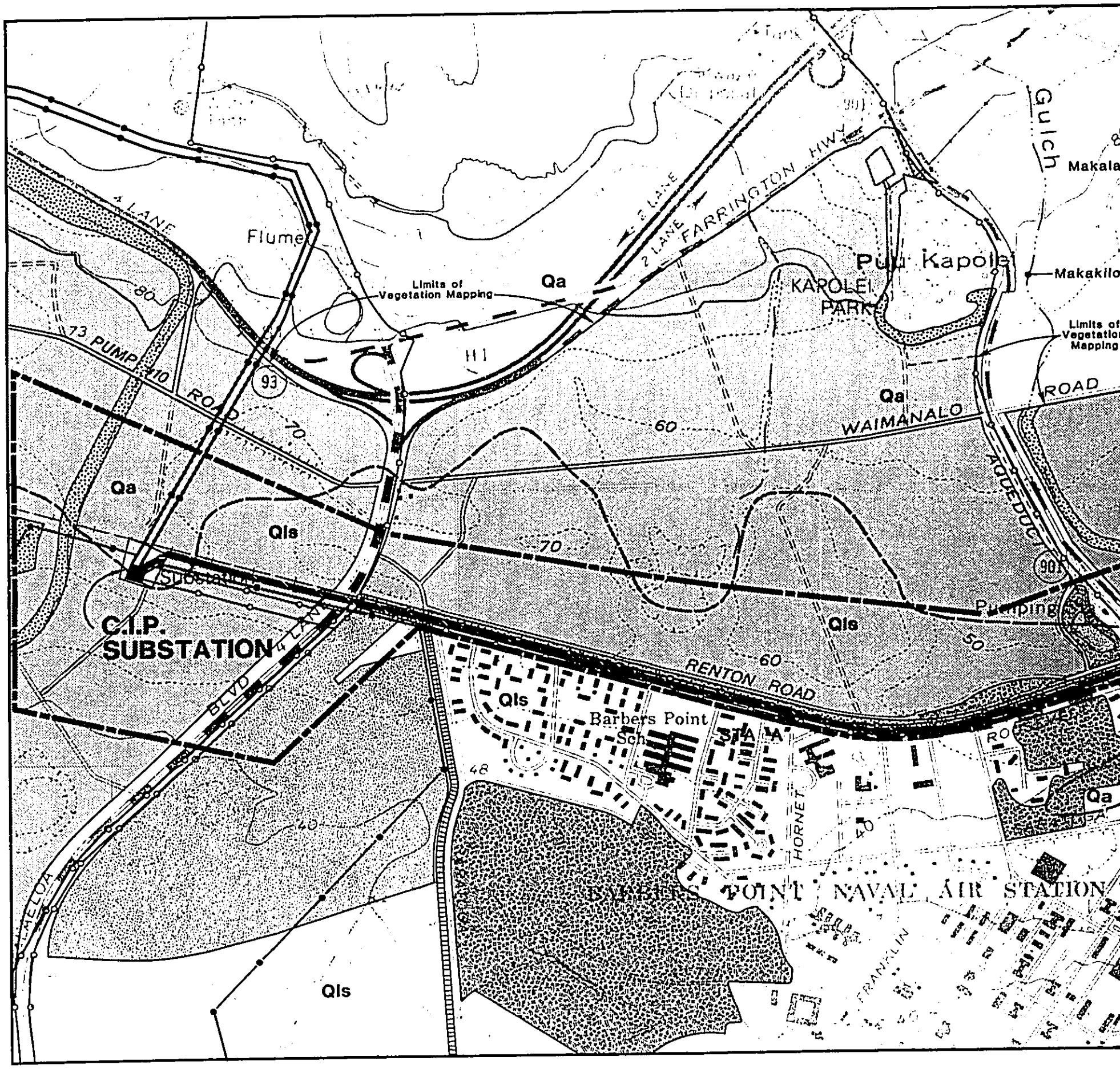
Potential Impacts

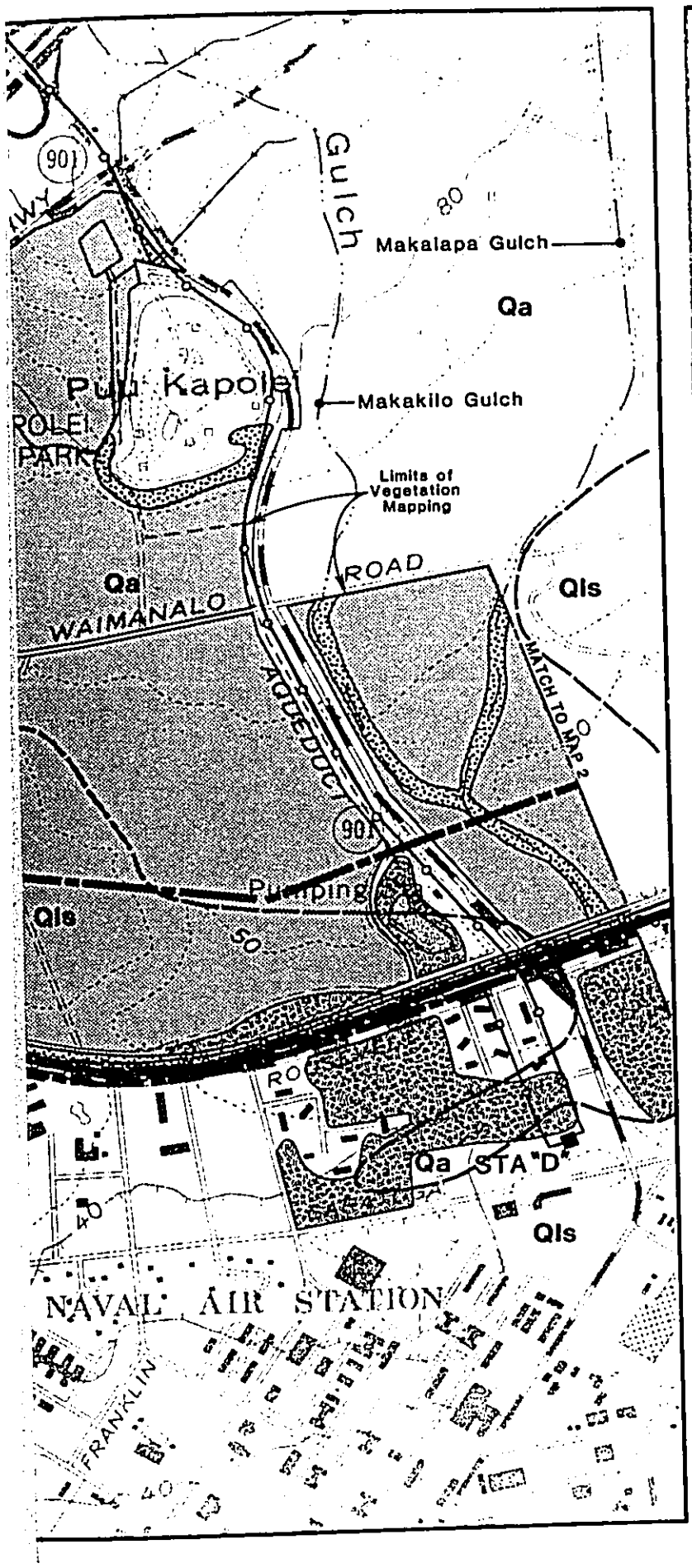
The soil conditions along the transmission line route are such that pile-type foundations are not anticipated and pier-type foundations will be used for pole structures. Drilled piers of 5 to 6 feet in diameter and 20 to 30 feet deep are estimated to be sufficient. Detailed field investigations of the proposed route will be conducted to better define subsoil conditions and the parameters for final design. The older alluvium materials at the Ewa Nui Substation site have sufficient bearing capacity for substation structures.

None of the alignment is currently developed or covered by impervious surfaces; therefore, surface disturbance will not significantly increase soil absorption or decrease the amount of surface runoff. There will be no permanent changes in absorption rates, drainage, or surface runoff from construction and operation of the transmission line. The Ewa Nui Substation will occupy an area of approximately 8.7 acres with the substation proper occupying 6 acres.

Approximately 1.5 acres would be covered with pavement for the entrance and internal roads. Substation facilities would have a total footprint of about 5,000 square feet. The remainder of the substation would be covered with gravel or landscaping. A small increase in surface water runoff would result from the increase in impervious surfaces.

Along Kaloi Gulch, all poles will be sited outside the stream channels and no alteration will be made to the stream channel. No dredging or filling should be required, and there should be no discharges into surface waters and no violations of any federal, state, or county water quality standards. A portion of the proposed route is within FEMA-designated flood-prone areas. Because of the height of the transmission poles and the structural integrity of the supporting poles, no impact is expected to result from being in a 100-year flood area. There should be no impacts on groundwater quantity or quality.


Flume
Limits of Vegetation Mapping
Qa
4 LANE
2 LANE
FARRINGTON HWY
Puu Kapolei
KAPOLEI PARK
Makakilo
Gulch
Limits of Vegetation Mapping
ROAD
WAIMANALO
AQUEDUCT
Pumping
73 PUMP
ROAD
80
70
60
50
40
48
93
901
H1
Qa
Qls
Substation
C.I.P. SUBSTATION
4 LANE
BLVD
RENTON ROAD
Barbers Point
Sch
HORNET
BARBERS POINT NAVAL AIR STATION
FRANKLIN
KAMOKILA



ALIGNMENT DATA MAP

GEOPHYSICAL AND BIOLOGICAL

- Corridor Boundary
- Project Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

GEOPHYSICAL

- Tkb — Koolau Basalt
- Qa — Older Alluvium
- Ra — Recent Alluvium
- Qls — Coral-Algal Deposits
- Stream
- Open-Lined Channel
- Spring
- Flood Prone Area*

BIOLOGICAL

- Cane Fields
- Urban/Developed Lands

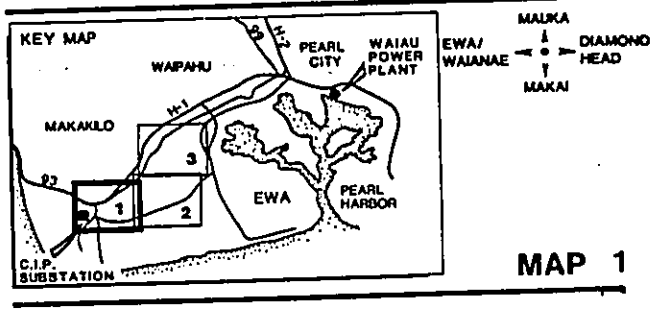
FOREST

- Kiawe Forest
- Koa-Haole Scrub
- Mixed Scrub

WETLANDS

- Mangrove Swamp
- Non-Woody Wetlands
- Cultivated Wetlands

*Subject to inundation by 100-year flood



MAP 1

SCALE 0 500 1000 FEET

0 1/8 1/4 MILE

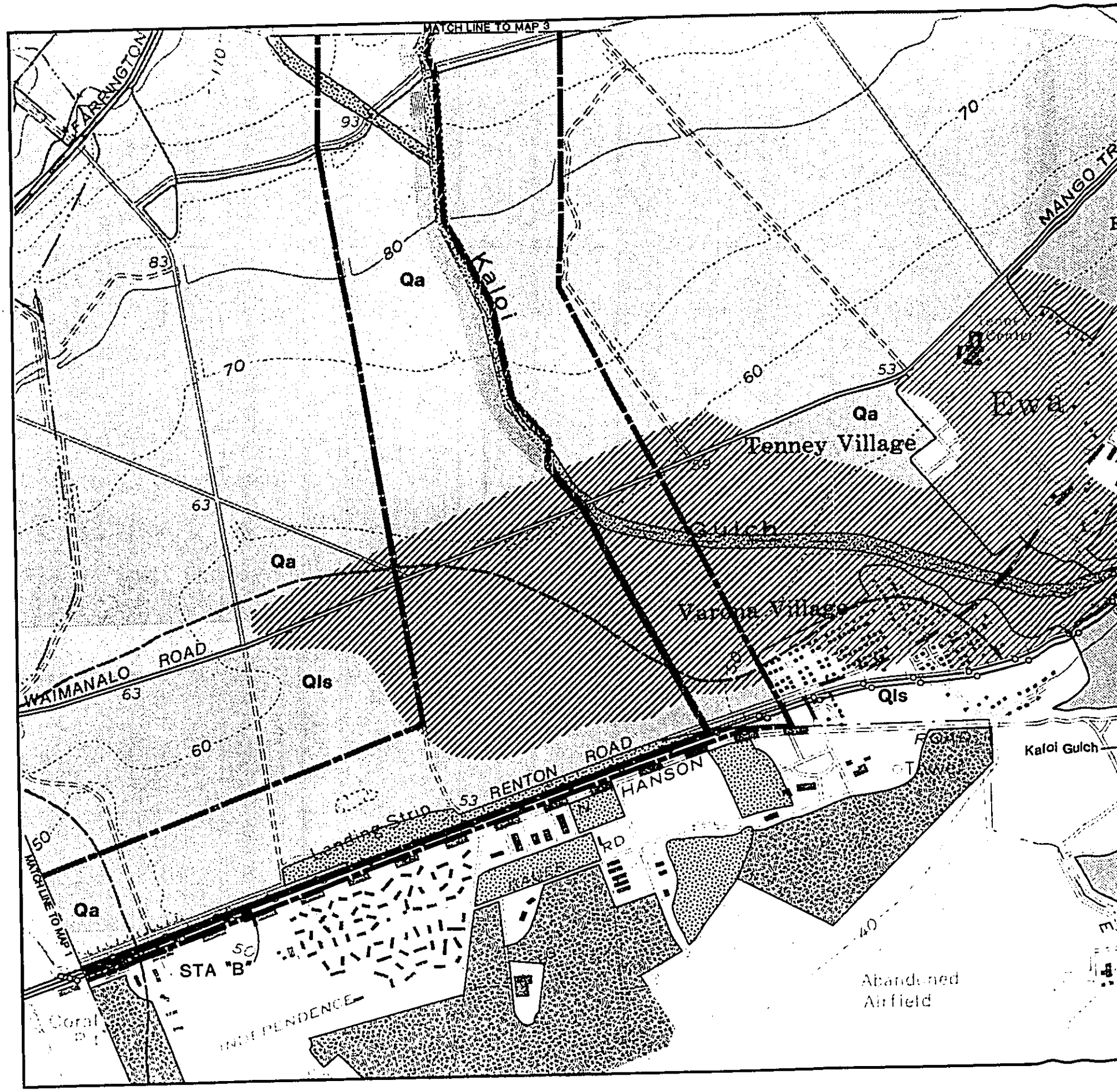
NORTH WEST EAST SOUTH

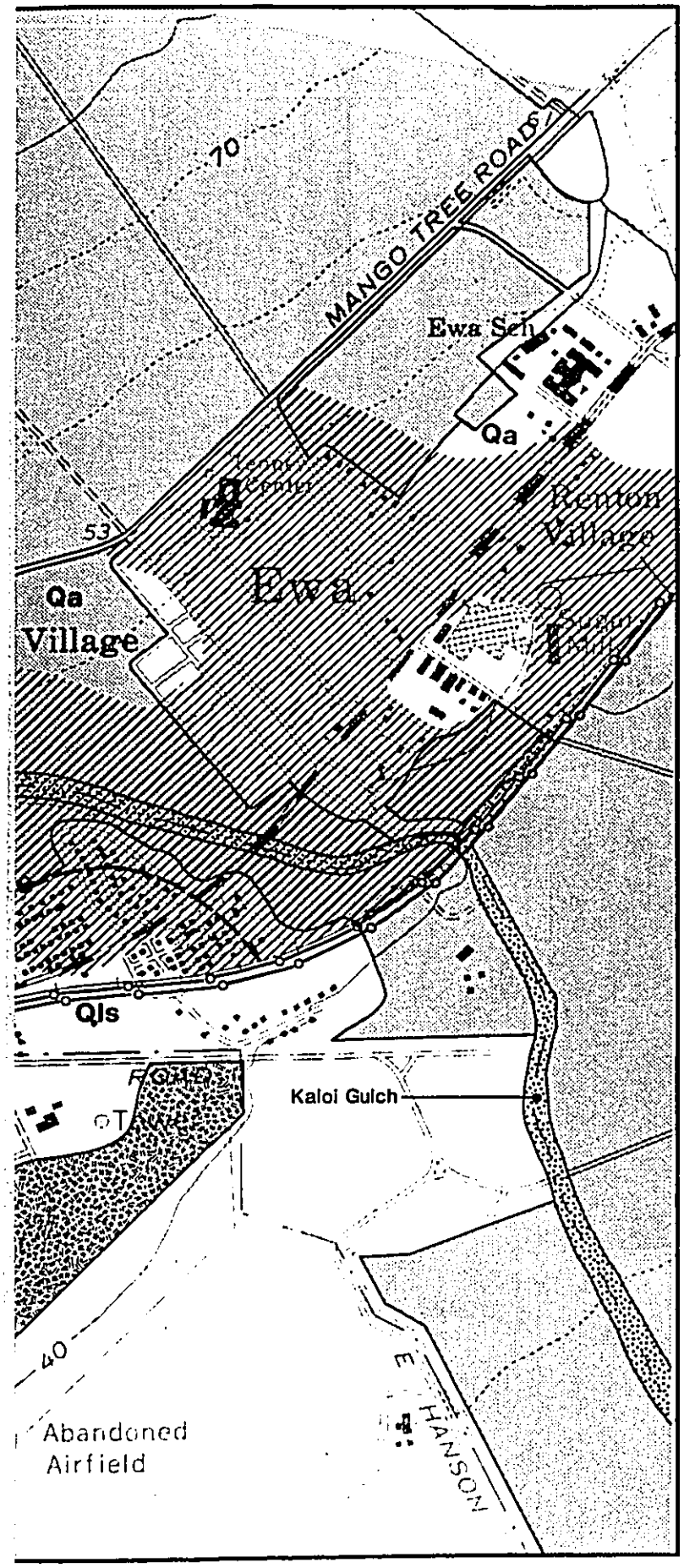
FIGURE 5-5

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL


MATCH LINE TO MAP 3
FARRINGTON
110
93
70
MANGO TR
83
80
Qa
Kaloi
Gulch
60
53
Qa
Tenney Village
59
Ewa
63
Qa
Gulch
Varona Village
WAIMANALO ROAD
63
Qls
Qls
60
RENTON ROAD
HANSON
53
Landing Strip
50
Kaloi Gulch
MATCH LINE TO MAP 1
Qa
STA "B"
50
40
Abandoned
Airfield
INDEPENDENCE



ALIGNMENT DATA MAP

GEOPHYSICAL AND BIOLOGICAL

- Corridor Boundary
- Project Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

GEOPHYSICAL

- Tkb — Koolau Basalt
- Qa — Older Alluvium
- Ra — Recent Alluvium
- Qls — *Coral-Algal Deposits*
- Stream
- Open-Lined Channel
- Spring
- Flood Prone Area*

BIOLOGICAL

- Cane Fields
- Urban/Developed Lands

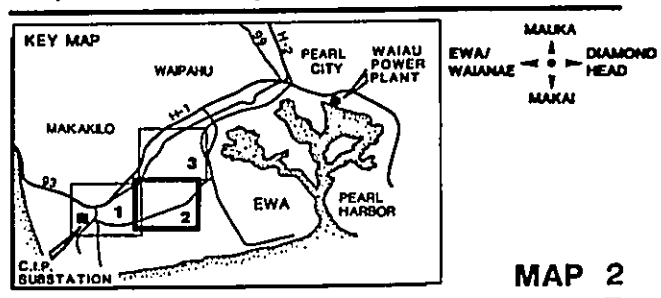
FOREST

- Kiawe Forest
- Koa-Haole Scrub
- Mixed Scrub

WETLANDS

- Mangrove Swamp
- Non-Woody Wetlands
- Cultivated Wetlands

*Subject to inundation by 100-year flood



MAP 2

SCALE
0 500 1000 FEET
0 1/8 1/4 MILE

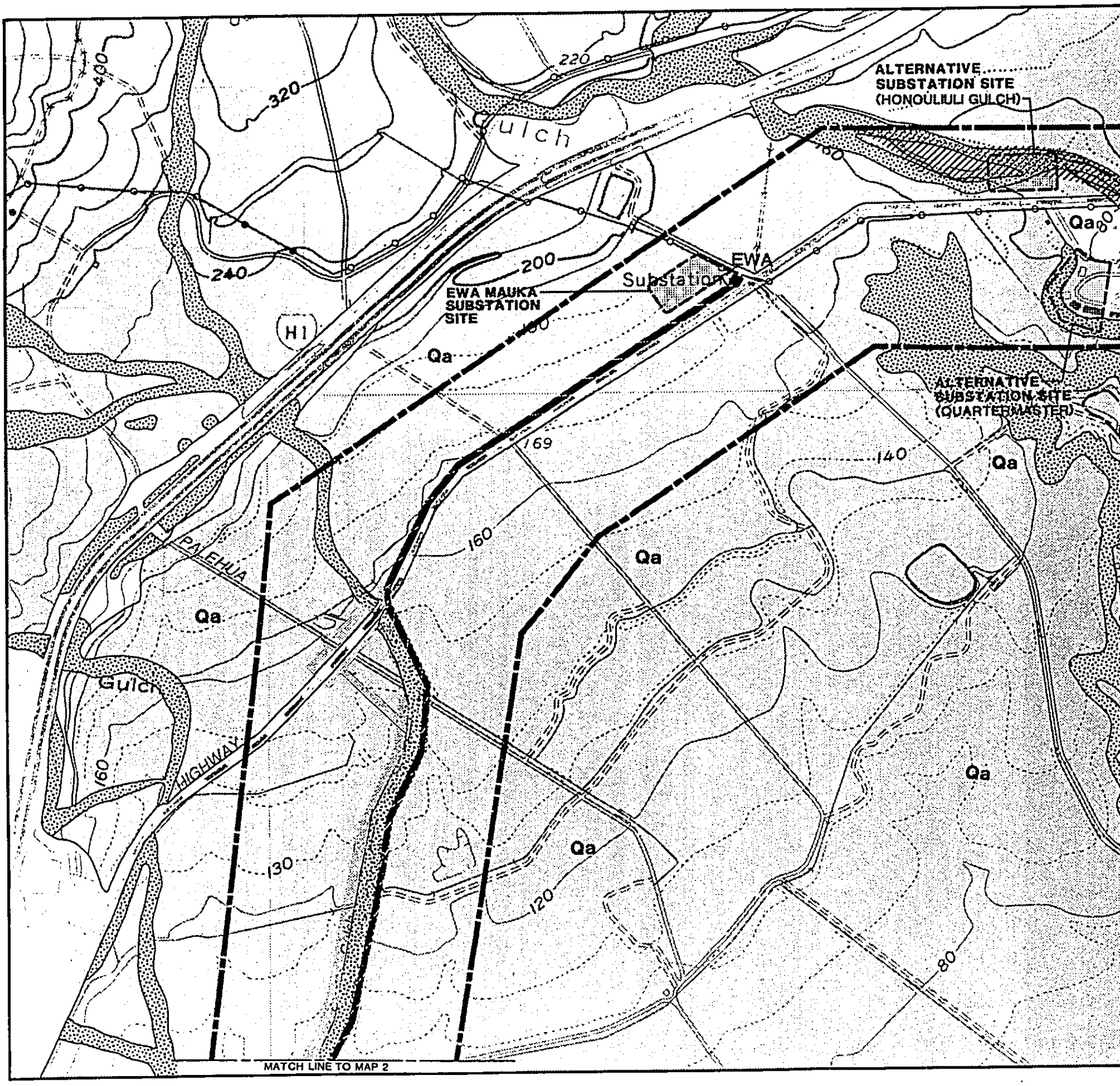
NORTH
WEST EAST
SOUTH

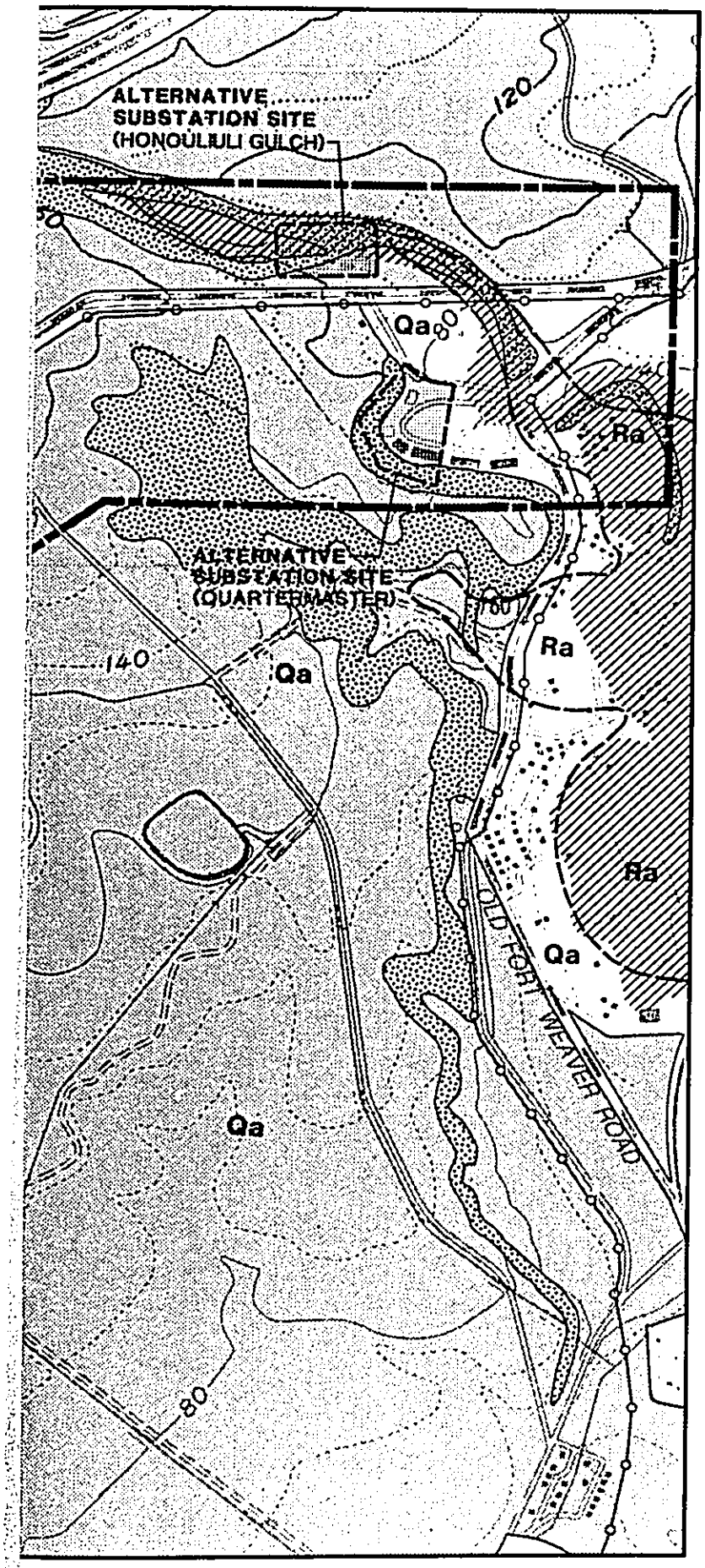
FIGURE 5-6

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL


ALTERNATIVE
SUBSTATION SITE
(HONOULIULI GULCH)
EWA MAUKA
SUBSTATION
SITE
EWA
Substation
ALTERNATIVE
SUBSTATION SITE
(QUARTERMASTER)
HI
PA'EHUA
Gulch
HIGHWAY
Qa
400
320
220
240
200
180
160
140
130
120
80
60
169
MATCH LINE TO MAP 2



ALIGNMENT DATA MAP

GEOPHYSICAL AND BIOLOGICAL

- Corridor Boundary
- Project Alignment
- Existing 46kV Line
- Existing 138kV Line
- Substation

GEOPHYSICAL

- Tkb — Koolau Basalt
- Qa — Older Alluvium
- Ra — Recent Alluvium
- Qls — Coral-Algal Deposits
- Stream
- Open-Lined Channel
- Spring
- Flood Prone Area*

BIOLOGICAL

- Cane Fields
- Urban/Developed Lands

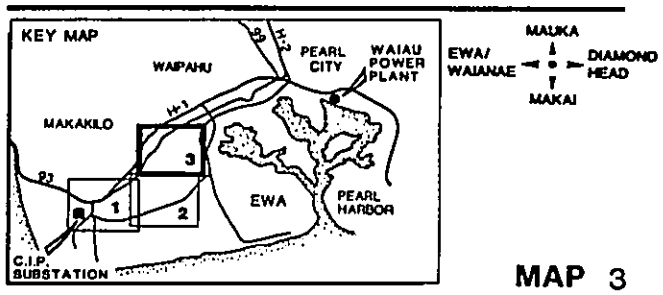
FOREST

- Kiawe Forest
- Koa-Haole Scrub
- Mixed Scrub

WETLANDS

- Mangrove Swamp
- Non-Woody Wetlands
- Cultivated Wetlands

*Subject to inundation by 100-year flood



MAP 3

SCALE
0 500 1000 FEET
0 1/8 1/4 MILE

NORTH
WEST EAST
SOUTH

FIGURE 5-7

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

Mitigation

A full-scale geotechnical exploration, including borings and field and laboratory testing, is being implemented during the final design stage of the project. A geotechnical engineer will closely monitor drilled pier construction to verify that foundation support is achieved. Short-term impacts from soil erosion during construction can be mitigated through the use of siltation fences in the vicinity of Kaloi Gulch. HECO will coordinate the design, construction, and operation of the transmission lines along Kaloi Gulch with the state during its planning for drainage improvements around the gulch.

Biological Resources

Environmental Setting

Generalized vegetation types in the project area (also shown in Figures 5-5, -6, and 7) can be characterized as nonnative, alien, introduced species. Land currently cultivated for sugar cane and linear corridors of koa-haole scrub constitutes most of the transmission line route. Koa-haole scrub is dominated by the koa-haole (*Leucaena leucocephala*), which forms very open to closed canopy scrub in drainageways (i.e., along Kaloi Gulch) and along the OR&L ROW and other transportation corridors. Areas of mixed scrub and Kiawe Forest also exist near the route. Mixed scrub grows in cane fields that have been abandoned. Depending on the length of time the areas have been undisturbed, the plants vary from weedy groundcover to small woody shrubs. Kiawe Forest primarily consists of Kiawe trees (*Prosopis pallida*), generally 33 to 40 feet tall, with a koa-haole understory. This vegetation type usually occurs on the level, most coralline, undeveloped areas.

The U.S. Fish and Wildlife Service has not identified any sites in the project area as primary habitat areas for endangered Hawaiian waterbirds (1978). In addition, the service has not identified any rare, threatened, or endangered species (designated by the federal or the state government) or sensitive plant native plant communities in the project area (August 12, 1992, letter in Appendix A).

Potential Impacts

There should be no significant impacts on biological resources from either the construction or the operation of the proposed transmission lines and Ewa Nui Substation. Few or no undisturbed biological resources exist in the project area. In a few locations, individual trees may need to be trimmed or removed to maintain safe conductor distances. The amount of trimming required is determined by calculating the extreme position of conductors in high winds. Approximately 8 to 9 acres of sugar cane field would be eliminated to allow construction of the Ewa Nui Substation.

Mitigation

Trimming or removal of existing trees would be kept to a minimum. In areas used for sugar cane cultivation, poles would be sited to avoid existing crops. If poles and construction equipment displace crops, replanting should occur.

Cultural and Historic Resources

Environmental Setting

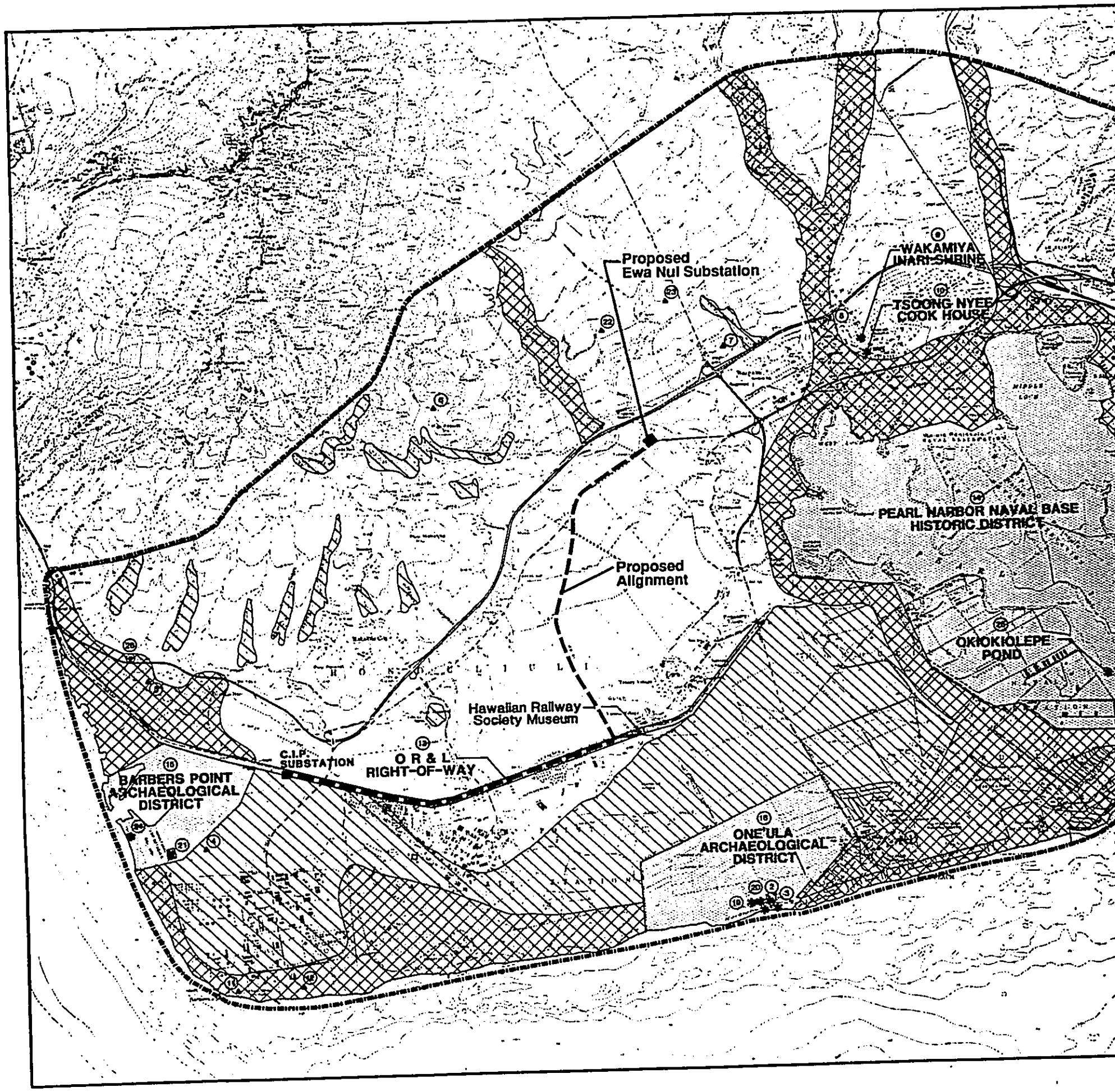
The cultural resources potential of the project area was surveyed early in the siting process for the transmission lines. The survey was completed by an archeologist working in cooperation with the state archeologist and the state historian. In addition, a predictive model was used to identify areas of high, medium, or poor cultural resource recovery potential.

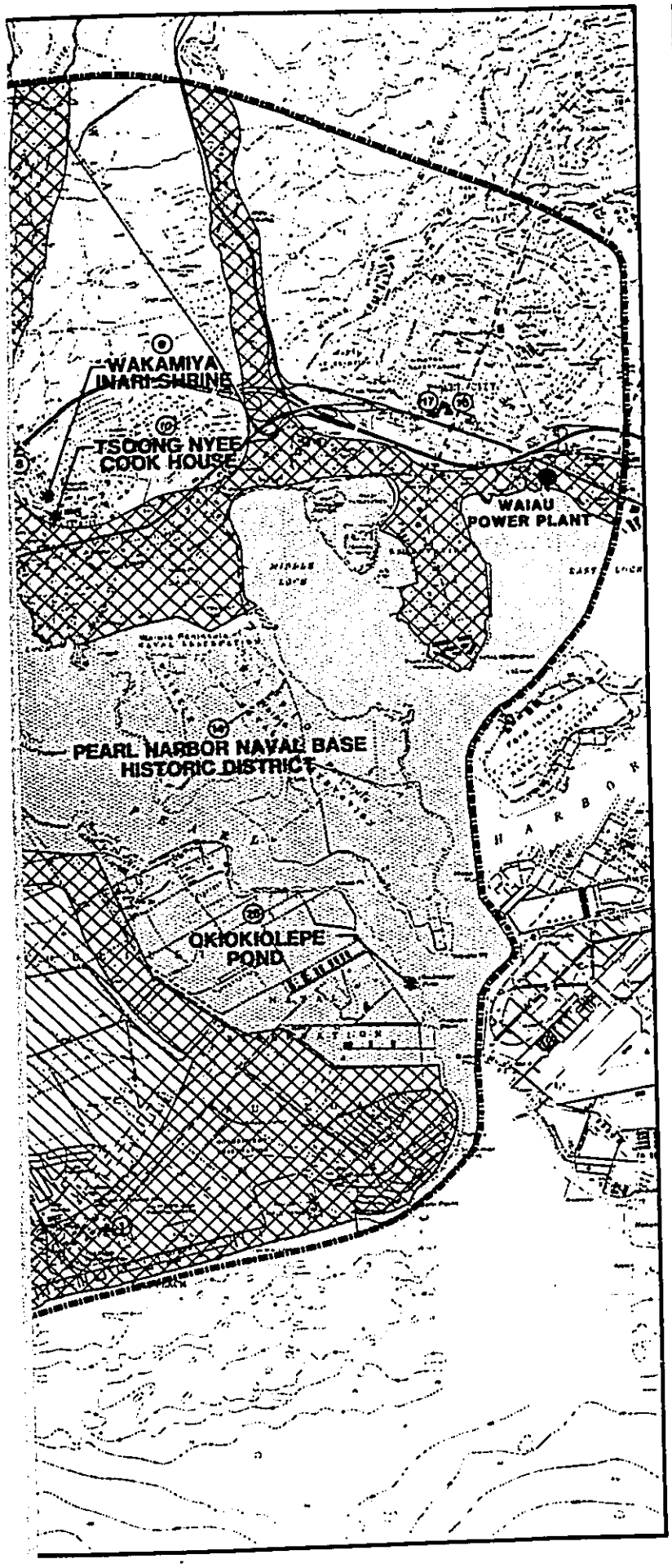
Identified cultural resources in the study area are presented in Figure 5-8. The only known resource near the proposed transmission line route is the OR&L ROW. This national register site preserves 15 miles of the ROW of the narrow gauge railroad constructed by OR&L in the late nineteenth century. The national register site is generally 40 feet wide and most of its land is owned by the state's Department of Transportation. It extends from near Kahe Point to just mauka of Barbers Point Naval Air Station and then follows Renton Road to Honouliuli. Portions of the ROW with intact rails are used by the Hawaii Railway Society for train excursions, and the society hopes to restore more of the roadbed of the line and make the portion of the line from Waipahu Cultural Garden Park to Kahe operational (Hawaii Railway Society, pers. comm., November 1987). There has also been some discussion of using the ROW for a future extension of the proposed RTS (Ellen J. Pellissero, Office of Council Member Leigh-Wai Doo, pers. comm., January 1990).

The transmission line route also passes through unsurveyed areas that were assessed with the predictive model to indicate the potential for the location of archeological sites. Areas were determined to have high, medium, or low potential for containing cultural resources based on a review of the available ethnographic and ethnohistoric data, and on comparisons with environmentally similar areas of Hawaii that had been surveyed for cultural resources.

Potential Impacts

The proposed lines should have no impacts on historic or cultural resources. No historic sites or cultural resources are known to exist within the proposed transmission line alignment or the Ewa Nui Substation site (see September 9, 1992, letter from Department of Land and Natural Resources in Appendix A). The transmission line will be located next to the OR&L ROW but should not affect it. The transmission lines will be built on land that has moderate to poor cultural resource potential. Most of this land has already been disturbed for agricultural uses and roads; therefore, the likelihood of finding subsurface archeological remains is very low.


Proposed
Ewa Nui Substation
WAKAMIYA
INARI SHRINE
TSOONG NYEE
COOK HOUSE
PEARL HARBOR NAVAL BASE
HISTORIC DISTRICT
Proposed
Alignment
OKIOKIOLEPE
POND
Hawaiian Railway
Society Museum
C.I.P.
SUBSTATION
O R & L
RIGHT-OF-WAY
BARBERS POINT
ARCHAEOLOGICAL
DISTRICT
ONE'ULA
ARCHAEOLOGICAL
DISTRICT



CULTURAL RESOURCES

- Study Area Boundary
- National Register Sites
- National Register Districts (Historical & Archaeological)
- Recorded Archaeological or Historic Sites (Report Number on File – DLNR)
- Unsurveyed Areas with Good Cultural Resource Potential
- Unsurveyed Areas with Moderate Cultural Resource Potential
- Unsurveyed Areas with Poor Cultural Resource Potential
- Petroglyphs

NORTH
WEST EAST
SOUTH

MAUKA
EWA/ WAIANAE DIAMOND HEAD
MAKAI

0 1000 2000 5000 10,000 FEET

0 1/4 1/2 1 2 MILES

FIGURE 5-8

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2MHILL

Mitigation

If archeological remains are uncovered during construction, construction activity in the site area will stop and the state's historic preservation officer will be contacted. Consultations with the state of Hawaii will determine what course of action will be taken. Field personnel involved in project construction will be informed about procedures to follow if a previously unidentified site is discovered.

Visual Resources

Environmental Setting

The Department of Land Utilization's *Coastal View Study* (City and County of Honolulu, Department of Land Utilization, 1987) describes the visual resources of the Ewa District. The study states, in part, that:

> Ewa has never been acclaimed for its scenic qualities and not a single scenic lookout or provision for roadside viewing can be found today within the district. . . . Immediately apparent is the flat terrain and absence of predominant land features. As a result, views are decentralized with no particular focus. This is reflected in the Development Plan text regarding public views which do not identify any specific view, dominant feature, or particular characteristic for the area. Instead, it generalizes with the following two statements:
>
> - In order to promote pleasing and attractive living environments in existing new neighborhoods, mauka and makai views, and views of central Honolulu shall be protected whenever possible.
>
> - Views from public streets and thoroughfares to the mountains and sea shall be preserved and enhanced whenever possible.

With respect to the region that the Waiau-CIP Part 1 Transmission Line is located in, the study states the following:

> The Ewa section contains Campbell Industrial Park, Barbers Point Naval Air Station, Ewa Town, the proposed Ewa Marina, and Iroquois Point. The terrain is flat with no significant land forms. While expansive, views from Farrington Highway are very distant and have little visual significance due to an absence of noticeable land forms or other focal points.

A field evaluation of visual resources within the project area was conducted during the corridor evaluation stage of the routing report preparation and was supplemented with a field visit during preparation of this EA.

Views from Makakilo City

From the lower elevations of Makakilo looking southwest, the white structures and stacks of the CIP break the water and horizon line in the background. Between the CIP and Makakilo, the existing substation and canefields dominate the middleground view, and the H-1 Freeway and Farrington Highway in the foreground are accentuated with assorted transmission lines and street lights. Puu Kapolei dominates the middleground to the east and screens most of the makai view. Barbers Point Naval Air Station is evident in the background with facilities generally below the heights of the trees, providing an unobstructed makai view. To the southeast and diamond head of Puu Kapolei, low, open agricultural areas in cane production dominate the middleground, and distant views of Pearl City and Honolulu are evident.

From higher elevations within Makakilo, the view southwest is dominated by the green agricultural fields broken by the white CIP complex, the Ko Olina resort complex, and coral pits and the deep draft harbor in the distance. Looking southeast from Makakilo, the Barbers Point Naval Air Station is in the background; canefields and the Kapolei development dominate the middleground; and the lower-elevation residences and the mauka side of Puu Makakilo are in the foreground. Assorted transmission lines are evident in and along the ridge behind (mauka of) Makakilo, and the slopes of Puu Makakilo also support transmission lines among the broken scrub vegetation. From near the top of the development looking east and toward Diamond Head, the H-1 Freeway and Farrington Highway bisect the view. The makai side is dominated by agricultural fields, across which Pearl City, Pearl Harbor, and downtown views are evident. Mauka of the H-1 Freeway, the agricultural fields and the Kapolei developments slope upward toward Village Park and beyond to the foothills or upland area.

Views from Farrington Highway

Between Makakilo and Kahe Point, Farrington Highway offers some of the more significant shoreline views. The importance of this view is recognized in the *Urban Design Provision for West Beach* (City and County of Honolulu, 1986). The Kapolei developments are creating a new land use pattern between Farrington Highway and the ocean, with foreground views of the golf course and a series of low- and medium-density apartments. Looking mauka from Farrington Highway, the low scrub, grasses, and barren hillside support several transmission lines in the foreground, middleground, and background, originating at Kahe Point.

Potential Impacts

The relatively flat terrain and absence of dominant natural and built features in the Ewa District provides views that are decentralized with no particular focus. These circumstances make overhead transmission lines visible from distant views.

Visual impacts are also determined by the degree to which an area is seen by viewers. Currently, the area that the Waiau-CIP Transmission Line, Part 1, Project passes through

is largely undeveloped. Views of the project area are visible, however, from bordering residential areas (Makakilo City, Villages of Kapolei) and roadways (the H-1 Freeway, Farrington Highway, and Kalaeloa Boulevard).

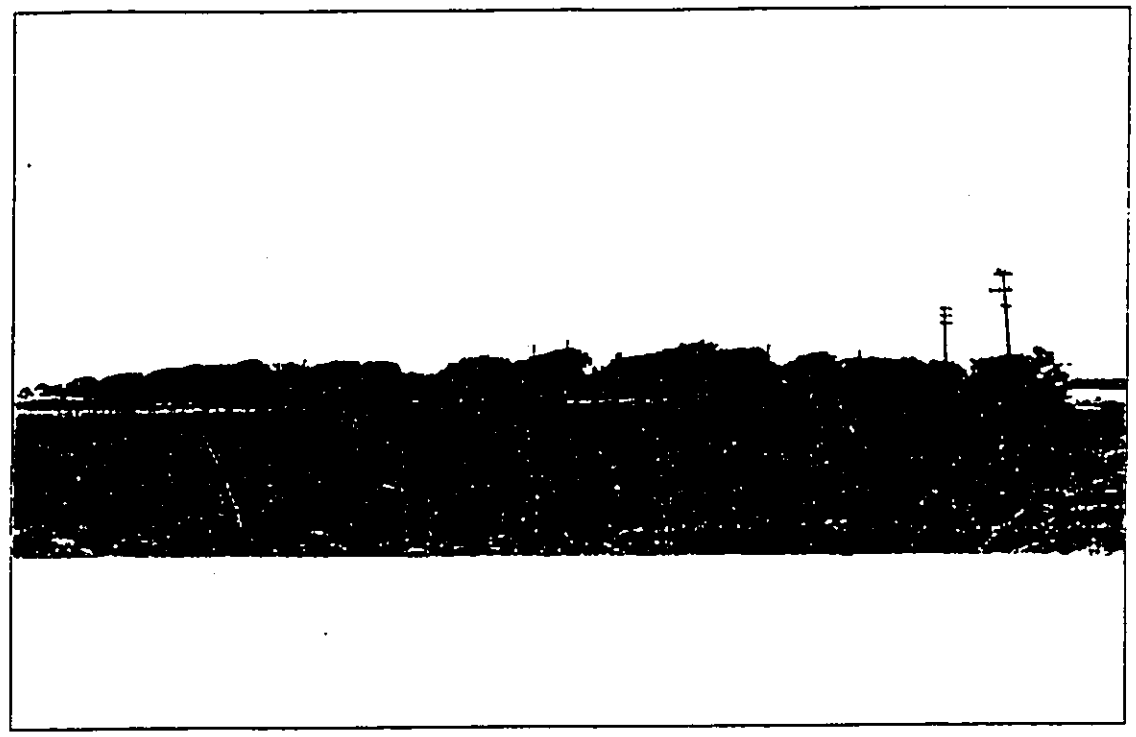
Considerable urban development is planned and proposed for the area in the future. As the area's planned and proposed development occurs, the transmission lines will eventually be located in the context of a developed area and distant views of the lines will be mixed in with views of other urban development. However, closeup views by future residents of the area will be adversely affected by the transmission lines.

For its entire length, the proposed transmission lines will follow an existing linear feature in the landscape. From the CIP Substation and along Renton Road to the canehaul road, the new lines would replace existing poles parallel to the road and the OR&L ROW. The visual impact in this area would not be significant. The greatest potential for visual impact occurs where the line runs mauka along the canehaul road and Kaloi Gulch. The new power poles would extend above the canefields and vegetation along the gulch. The segment of transmission line along Farrington Highway would parallel the road and existing distribution lines, thus diminishing the visual impact. The Ewa Nui Substation would be visible to travellers on Farrington Highway. A 60-foot-wide landscape buffer between the highway and substation would reduce its visibility.

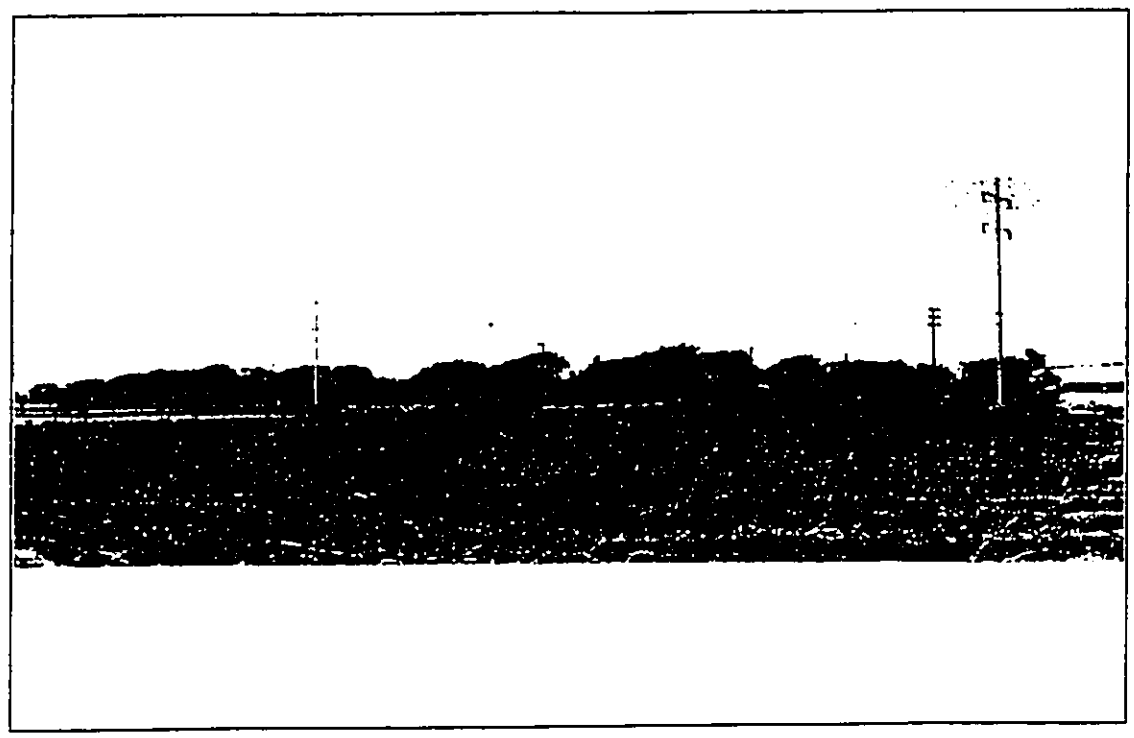
Some viewers in the area will be able to see the transmission lines and the substation from elevated areas. This would be true of viewers passing the area on Farrington Highway and, to an extent, viewers located in the Makakilo area. In the short term, the lines will be visible against the flat terrain but are not expected to encroach into views of the ocean. In the long term, when the area is developed, the transmission lines viewed in the context of constructed improvements would have minimal visual impact.

Views of the transmission lines could have an effect on existing and future residents of the area who live in proximity to the lines because of some people's perception that overhead power lines are unsightly. This potential impact must be weighed against the adverse economic impact of placing the lines underground. Underground transmission lines cost four to five times as much as overhead lines. (For more details, see Chapter 6.) Although some buyers would not purchase a home that has a transmission line nearby or in plain view from the home, other buyers would purchase the home. (This determination is based on a review of several studies and articles.) As a result, a power line in itself does not cause the selling price or marketability of residential property to be lower than it might otherwise be.

Figure 5-9 simulates the visual impact of the project looking from Kalaeloa Boulevard near Renton Road in a makai direction. The figure, a simulation of the visual effect of the proposed project, was developed to help evaluate the project's visual impacts. A computerized process generated digital models of the proposed transmission lines and manipulated them to precisely match the perspective of color photographs of the selected views of existing (preproject) conditions. Working directly on color enlargements, an artist transferred the



Existing Conditions



Simulation of Proposed Project

FIGURE 5-9

VISUAL SIMULATION FROM
KALAELOA BLVD.

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computer images to the photographs and then retouched the photographs to accurately represent the location, scale, extent, and nature of all project features that the computer model identified as being visible in each view. This process provides a realistic image of the proposed project.

Mitigation

The proposed transmission lines will be installed on singular steel poles, which are the least visually obtrusive structures for transmission line poles. Use of steel poles also mean that fewer poles are required to support the lines than if wood poles were used. The lines will also follow existing power lines or other linear features in the landscape. Transmission lines (conductors) will be painted a dark color to avoid reflecting sunlight (and therefore be less visible). Landscaping around the poles and under the lines will be provided as appropriate. The Ewa Nui Substation will have a 30-foot-wide landscaped buffer on all sides with a 60-foot-wide buffer between the substation and Farrington Highway.

Traffic and Transportation

Environmental Setting

A 0.9-mile segment of the preferred transmission alignment lies within the ROW of Farrington Highway. Table 5-1 lists recent peak hour and 24-hour traffic counts at a location on Farrington Highway near Kahi Mohala, which is about ½ mile east of the Ewa Substation. Traffic counts on the section of Farrington Highway where the alignment is proposed were not available. Proposed road improvements (e.g., widening of Farrington Highway, north-south road) are described in the "Proposed Land Use" section.

Table 5-1
Peak and 24-hour Traffic Volume on Farrington Highway near Kahi Mohala (1989)

24-hour volume	5,875
a.m. peak (1 hour) Eastbound Westbound	440 242 198
p.m. peak (1 hour) Eastbound Westbound	558 223 335

Source: State of Hawaii Department of Transportation, Traffic Summary, Island of Oahu, 1989

A short segment of the lines will pass over the main entrance road to the Barbers Point Naval Air Station. The entrance road ROW, which is owned by the U.S. Navy, is 130 feet wide and connects to Fort Barrette Road.

Although the preferred transmission alignment terminates at the CIP Substation, the new transmission lines will tap into existing ones in the vicinity of Kalaeloa Boulevard. This four-lane, divided roadway has an ROW width of 115 feet and provides access to CIP from the H-1 Freeway and Farrington Highway.

Potential Impacts

Because 0.9 mile of the new lines will be installed at the mauka edge of the ROW of Farrington Highway, construction activities may temporarily disrupt traffic. For example, general vehicular traffic and truck traffic related to construction activities at the Villages of Kapolei would experience delays. The first activity that may require coning off a lane of traffic will be the drilling of the pier foundation. Typically, several pier foundations are drilled one at a time, requiring a single lane of traffic to be coned off for 1,000 to 1,500 feet for 2 to 3 weeks during the hours when construction is occurring. The next stage in the construction process, which may occur several weeks later, is pole installation. Approximately three poles per day can be installed, requiring the coning off of a single lane for approximately 700 to 1,300 feet. Conductor installation is done in sections approximately 1/2 to 1 mile long. Installing all conductors requires about 1 month per mile to compete. A single lane of traffic may be coned off for the period when construction is occurring. The entire construction process for the overhead 138 kV lines along Farrington Highway is expected to take 3 to 4 months.

Stringing of the transmission lines over the Barbers Point Naval Air Station's entrance road may require a few hours of interrupted access during an off-peak period (e.g., at night) for safety reasons. The roadway will not be blocked. Construction over Kalaeloa Boulevard will not be necessary; therefore, no impact on the boulevard will occur.

Mitigation

Work on public roads must follow traffic control procedures prescribed by the Federal Highway Administration, the state Department of Transportation Highways Division, or the City and County of Honolulu Department of Transportation Services, depending on which agency has jurisdiction over a specific road. Work performed next to a state road or highway requires a permit to perform work on state highways, which must incorporate a traffic control plan approved by the Highways Division. The City and County of Honolulu requires observation of state and federal traffic control regulations for any work on county roads (e.g., portions of Farrington Highway).

According to state highway regulations, only one lane at a time may be closed on a multilane highway and, on a two-lane highway, wherever possible, lanes of adequate width in both directions must be provided. All lanes must be open to traffic during morning peak hours

(generally 6:00 a.m. to 8:30 a.m.) and afternoon peak hours (generally 3:00 p.m. to 6:00 p.m.). HECO and its construction contractors follow appropriate guidelines for the types of signs, lights, markers, position of traffic cones, areas coned off, and the use of flaggers or police officers.

Construction may be performed in a staggered manner; early stages of construction may continue in some sections of the project even when later stages, such as pole installation, have been completed in other sections of the project. Therefore, areas where coning off lanes of traffic may be required can shift among locations along the alignment.

Installation of transmission lines over the Barbers Point Naval Air Station entrance will be coordinated with Barbers Point personnel to avoid traffic disruption.

Air Quality and Noise

Environmental Setting

Air Quality

Air quality standards that apply to the project area are the national ambient air quality standards (EPA, 40 CFR 50, as amended) and those outlined in the Hawaii Administrative Rules Title 11, Chapter 59. No air quality standards have been adopted for Oahu by the city and county. Air quality is monitored by the Department of Health's Division of Pollution Investigation and Enforcement. In recent years, there have been no exceedances for the regulated pollutants at monitoring stations near the study area.

Noise

Noise can be described as a fluctuating pressure disturbance. The number of fluctuation cycles per second is the frequency of the noise. Loudness of the noise is determined by the magnitude of the fluctuations. The unit commonly used for describing the magnitude of a sound is the decibel. Because the human ear is less sensitive to sounds in the high and low frequency ranges, a weighting scale is sometimes used to approximate the response of the ear. This is called A-weighted decibel (dBA).

Sound levels vary with time, and several methods are used to quantify sound over a given time period. The percentage of time that a sound level is equaled or exceeded is used. For example, an L_{10} of 60 dBA means that the sound level equals or exceeds 60 dBA 10 percent of the time. The equivalent sound level (L_{eq}) is the energy average of the sound pressure level for a stated period of time (usually an hour). The day-night sound level (L_{dn}) is a 24-hour average sound level with an additional 10 dBA added to nighttime sound levels to account for increased human sensitivity to nighttime noise. The maximum noise level recorded during a measurement period is called the L_{max}. The minimum change in sound level

that can be detected by most people is 3 dBA. An increase of 10 dBA is usually perceived as a doubling in loudness.

A number of different noise guidelines and standards are used in assessing noise impacts and the acceptability of various noise environments for different land uses. New land uses on Oahu are assessed with applicable noise standards from the Hawaii Administrative Rules Title 11, Chapter 43, Section 3, Community Noise Control for Oahu.

Construction noise falls under permitted activities that can exceed the levels given in Table 5-2 for a specified period of time. There are, however, permit restrictions for construction activities, as follows:

- No construction activities that produce noise levels in excess of the values in Table 5-2 at or beyond the property line are allowed before 7 a.m. or after 6 p.m.

Table 5-2
Noise Standards for Oahu
(dBA)

Zoning Districts	Allowable Noise Levels	
	Daytime 7 a.m. - 10 p.m.	**Nighttime 10 p.m. - 7 a.m.**
Residential (R-1 through current R-7)	55	45
Preservation (P-1)	55	45
Apartment (A-1 through current A-5)	60	50
Hotel (H-1 and H-2)	60	50
Business (B-1 through current B-5)	60	50
Agricultural (AG-1 and AG-2)	70	70
Industrial (I-1 through current I-3)	70	70

Source: Community Noise Control for Oahu, Title 11, Chapter 43, Section 3, November 6, 1981.

- Construction activities that produce noise levels in excess of 95 dBA at or beyond the property line are allowed only between the hours of 9:00 a.m. and 5:30 p.m.

- No construction activities that exceed the noise levels specified in Table 5-2 are allowed on Sundays, New Year's Day, Presidents' Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Discoverer's Day, Veterans' Day, Thanksgiving Day, or Christmas Day.

- No activities that produce noise levels in excess of 95 dBA at or beyond the property line are allowed on Saturdays.

The principal source of noise along the transmission line route is motor vehicles on adjacent roads and aircraft. The highest noise levels are generally heard next to at-grade sections of high-volume roads, or near high-volume freeway interchanges. These conditions exist along 0.9 mile of the Farrington Highway where the proposed transmission line would be located.

Existing noise-sensitive land uses along the proposed route are the military housing and Barbers Point Elementary School in the Barbers Point Naval Air Station next to the OR&L ROW segment of the route. No other sections of the proposed route are near existing noise-sensitive land uses. The Villages of Kapolei, when fully developed, will have noise-sensitive uses, such as residences, about 200 feet mauka of the OR&L ROW. Future development in the 1,100 acres around Kaloi Gulch will have noise-sensitive uses.

Potential Impacts

Air Quality

Minor amounts of two types of air emissions may result from construction activities: particulates from soil disturbance and emissions from heavy construction equipment. Ambient air quality at and surrounding each excavation site will be affected temporarily during construction activities. Construction will continually move from one section of the line to the next, and particulate levels should not be highly concentrated in any one area. Soil and wind conditions in the project area indicate that airborne particulates could become a problem. The contractor will be required to minimize airborne particulates through wind erosion control measures. Emissions of pollutants from heavy vehicles and equipment used to excavate and to transport equipment and supplies will be controlled with proper maintenance.

Noise

Foundation installation, and to a lesser extent pole erection and insulator and conductor stringing, will temporarily increase noise levels in the immediate vicinity of the activity. Typical sound levels for construction equipment are compared with common noise sources in Table 5-3. Construction of each segment of the line will require the use of most of the construction equipment listed in the table at some point during the construction process. Because of existing geological conditions, standard drilled pier foundations will be used.

Table 5-3
Comparison of Transmission Line Construction Equipment Noise with Other Common Sound Levels (dBA)

Equipment	A-Weighted Sound Level at 50 Feet Unless Specified
Broadcasting studio	20
Human voice--soft whisper (15 feet)	30
Light auto traffic (50 feet)	50
Air conditioning unit (20 feet)	60
Air compressor	67
Freeway traffic	70
*Crawler tractor (20 to 199 horsepower)	72
*Wheeled tractor	72
Freight train	75
*Truck, pickup, and 4-wheel drive	77
*Concrete mixer, truck-mounted	78
*Crawler tractor (200 to 450 horsepower)	78
*Pulling machine	78
*Tensioning machine	78
*Truck, mounted with boring equipment	78
*Truck, flatbed	78
*Truck, rear dump	78
*Dozer	82
*Crane, mobile (15 to 20 tons)	83
*Paving breaker	85
*Pneumatic tools	85
*Crane, mobile (50 tons)	88
Human voice--shout (0.5 foot)	100
Jet takeoff (2,000 feet)	105
*Single-action air compressor for pile driver	105
Auto horn (3 feet)	115
Jet takeoff (200 feet)	120

* Construction equipment.
Adapted from: Shell California Production, Inc. 1982.
Tomlinson, M.J. 1977.

The noise impacts of the construction activities will be short term and intermittent. Noise impacts at any one location will last only a few days at a time as various stages of the construction sequence are completed along each portion of the line. All construction activity will take place during daylight hours.

The military housing and Barbers Point Elementary School are the only existing noise-sensitive land uses close to the transmission line route. The school building is approximately 400 feet from the route and the nearest residences are set back approximately 125 feet. Comparing the construction equipment sound levels in Table 5-3 with the current Oahu noise standards in Table 5-2 indicates that for selected periods, some construction activities are likely to violate the noise standard. If the construction noise level is expected to exceed the standard daylight acceptable level, HECO must apply for a noise permit or noise variance, which may require muffling the sounds of construction equipment or limiting the time of use to a specified period. Construction noise will not affect future noise-sensitive uses in the Villages of Kapolei and in the 1,100 acres around Kaloi Gulch because the line will be constructed before development occurs in these areas.

Transmission lines (mainly 345 kV and above) generate a small amount of sound energy during periods of corona activity. (For a description of corona, see the "Electric and Magnetic Fields" section.) Audible noise can barely be heard in fair-weather conditions on higher-voltage lines and usually not at all on 138 kV lines. During inclement weather, water drops collect on the conductors and increase corona activity so that a crackling or humming sound may be heard near the lines. This noise is caused by small electrical discharges from the water droplets. Audible noise levels for the proposed transmission lines, calculated for the edge of the ROW during inclement weather, are about 10 to 13 dBA. This level would be barely audible to existing and future noise-sensitive land uses in the area, including the Villages of Kapolei and future development in the 1,100 acres around Kaloi Gulch.

Mitigation

Air quality impacts during construction would be mitigated by requiring contractors to minimize dust emissions through wind erosion control measures. This will include keeping watering equipment available and using it whenever necessary. Emissions of pollutants from heavy vehicles and equipment used for construction and transport will be controlled through proper maintenance. Contract provisions will specify the need to comply with this requirement.

Noise during construction will be reduced by the use of drilled pier foundations for installation of most of the poles along the selected alignment. These generate less noise than driven pile foundations. In addition, contract provisions will specify acceptable work hours, and provisions to enforce compliance will be identified.

A noise permit or noise variance will be required if construction activities are likely to violate noise standards. The approval of the permit may require muffling of equipment or further limits on construction hours and activities. All heavy vehicles used during construction will

comply with Hawaii Administrative Rules Title 11, Department of Health, Chapter 42, Vehicular Noise Control for Oahu.

Electric and Magnetic Fields

This section on electric and magnetic fields is an updated version of the *Technical Information Paper on the Transmission Line Electrical Effects* by Enertech Consultants (September 1991). The paper was prepared for the Waiau-CIP Transmission Line, Part 1, Project. It appears as Appendix E in the project's routing report, issued in October 1991.

Environmental Setting

The high-voltage transmission or bulk power lines form the backbone of the electric energy distribution system. A network of about 332,000 circuit miles of transmission lines is in service in the United States. On Oahu, 170 circuit miles of 138 kV lines form the island's transmission system. The proposed Waiau-CIP Part 1 lines also will be operated at 138 kV. This is the highest voltage classification used in Hawaii. The 138 kV voltage, however, is in the lowest voltage classification of transmission lines in operation in the mainland United States, where lines range up to 765 kV.

Electric Fields

Electric fields are a result of the voltage or electric potential on an object. Any object with an electric charge on it has a voltage at its surface caused by the accumulation of more electrons on that surface than on another object or surface. The voltage effect is not limited to the surface but exists in the space surrounding the object. The change in voltage over distance is known as the electric field. The units describing an electric field are volts per meter (V/m) or kV/m. The electric field becomes stronger near a charged object and decreases rapidly with distance from an object.

Electric fields are a very common phenomenon. Static electric fields can result from taking off a sweater or walking across a carpet. Most household appliances and other devices that operate on electricity create electric fields. The electric field is a result of the voltage on the appliance, and the field decreases rapidly with distance. The fields that result from point source household appliances generally decrease more rapidly with distance than fields from line sources such as power lines. Appliances need not be in operation to create an electric field; an electric field occurs whenever an appliance is connected to an electrical outlet. Typical values measured at 12 inches from some common appliances are shown in Table 5-4.

Magnetic Fields

An electric current flowing in any conductor (electric equipment, household appliance, or other) creates a magnetic field. The most commonly used unit for measuring magnetic fields

is the Gauss (mG is equal to one-thousandth of a Gauss), which is a measure of the magnetic flux density (intensity of magnetic field attraction per unit area).

Table 5-4
Typical Electric Field Values for Household Appliances (at 12 inches)

Appliance	Electric Field (kilovolts/meter)
Electric Blanket	0.25*
Broiler	0.13
Stereo	0.09
Refrigerator	0.06
Iron	0.06
Hand Mixer	0.05
Phonograph	0.04
Coffee Pot	0.03

*1 to 10 kV/m next to blanket wires (Enertech Consultants, 1985).

Source: Carstensen, 1985.

The magnetic field under transmission lines is relatively low in comparison with measurements near many household appliances and other equipment. The magnetic field near an appliance decreases rapidly with distance from the appliance. The magnetic field also decreases with distance from line sources, such as power lines, but not as rapidly as from appliances. The magnetic fields of a large number of typical household appliances were measured by the Illinois Institute of Technology Research Institute for the U.S. Navy (Gauger, 1985) and by Enertech Consultants (Silva, 1988) for the Electric Power Research Institute. Typical values of magnetic fields associated with household appliances are shown in Table 5-5.

Magnetic field measurements were made in February 1992 at several public locations in Waipahu and in January 1990 at several public locations on the island of Hawaii to characterize everyday magnetic field levels. These measurements were made with an EMDEX II magnetic field meter. This meter can be worn at the waist; the meter automatically records data every 1.5 seconds and stores the results for readout to a personal computer. The measurement results are summarized in Table 5-6.

Magnetic field measurements were also taken under and near existing 46 kV and 12 kV lines in Ewa, Village Park, Waipahu, and Pearl City. The measurements ranged from 1 to 11 mG. Electrical loads on the lines were low at the time of measurement. If the power lines had been fully loaded at the time of measurement, then the magnetic field levels would have been higher.

Table 5-5 Typical Magnetic Field Values for Household Appliances		
	Magnetic Field in milliGauss	
Appliance	12 Inches Away	Maximum
Electric range	3-30	100-1,200
Electric oven	2-5	10-50
Garbage disposal	10-20	850-1,250
Refrigerator	0.3-3	4-15
Clothes washer	2-30	10-400
Clothes dryer	1-3	3-80
Coffee maker	0.8-1	15-250
Toaster	0.6-8	70-150
Crock pot	0.8-1	15-80
Iron	1-3	90-300
Can opener	35-250	10,000-20,000
Mixer	6-100	500-7,000
Blender, popper, processor	6-20	250-1,050
Vacuum cleaner	20-200	2,000-8,000
Portable heater	1-40	100-1,100
Fans/blowers	0.4-40	20-300
Hair dryer	1-70	60-20,000
Electric shaver	1-100	15-15,000
Color television	9-20	150-500
Fluorescent fixture	2-40	140-2,000
Fluorescent desk lamp	6-20	400-3,500
Circular saws	10-250	2,000-10,000
Electric drill	25-35	4,000-8,000
Source: Gauger, 1985.		

Table 5-6
Summary of Everyday Magnetic Field Levels

Location	Magnetic Field (mG)
Waipahu: Gem's Department Store	0.2-2.5
Gem's Jewelry	10-300
Gem's parking lot	0.5-2.0
Times Supermarket	0.5-14
"Skill Crane" game	12-50
Tokyo Deli	0.5-8
Bakery	2-5
Driving on Farrington Highway	0.5-10
McDonald's restaurant	0.5-15
Waipahu Sporting Goods	1-5
Arakawa's Department Store	0.5-5
Arakawa's Jewelry	4-120
Hilo: McDonalds restaurant	1-32
Post Office	0.5-34
State Building	0.2-12
Sure Save Supermarket	0.2-57
Ben Franklin Department Store	0.5-70
J.C. Penney Department Store	0.2-5
7-11 convenience store	0.5-8
Liberty House Department Store	0.1-3
Tilt-Video Arcade	1-40
Kay Bee Toy Store	0.5-28
Puna: Pahoa Post Office	0.3-10
Dairy Queen restaurant	0.5-12
DA Store—Convenience shop	0.5-5
Walking past stores on Hwy 130	0.2-7

Potential Impacts

A set of load currents, line design details, and phasing were supplied by HECO for the electric and magnetic field calculations (Figure 5-10). The numerical value of these currents and the direction of flow are part of the assumptions supplied by HECO. The currents were assumed to be balanced (numerically equal for both of the double-circuit lines). HECO proposes to use low-reactance phasing to reduce field strengths. Conditions differing from these assumptions would result in less cancellation as a result of phasing and hence, higher fields. HECO will conduct a system load flow study to validate these assumptions and to finalize the optimum phasing for reduced field levels.

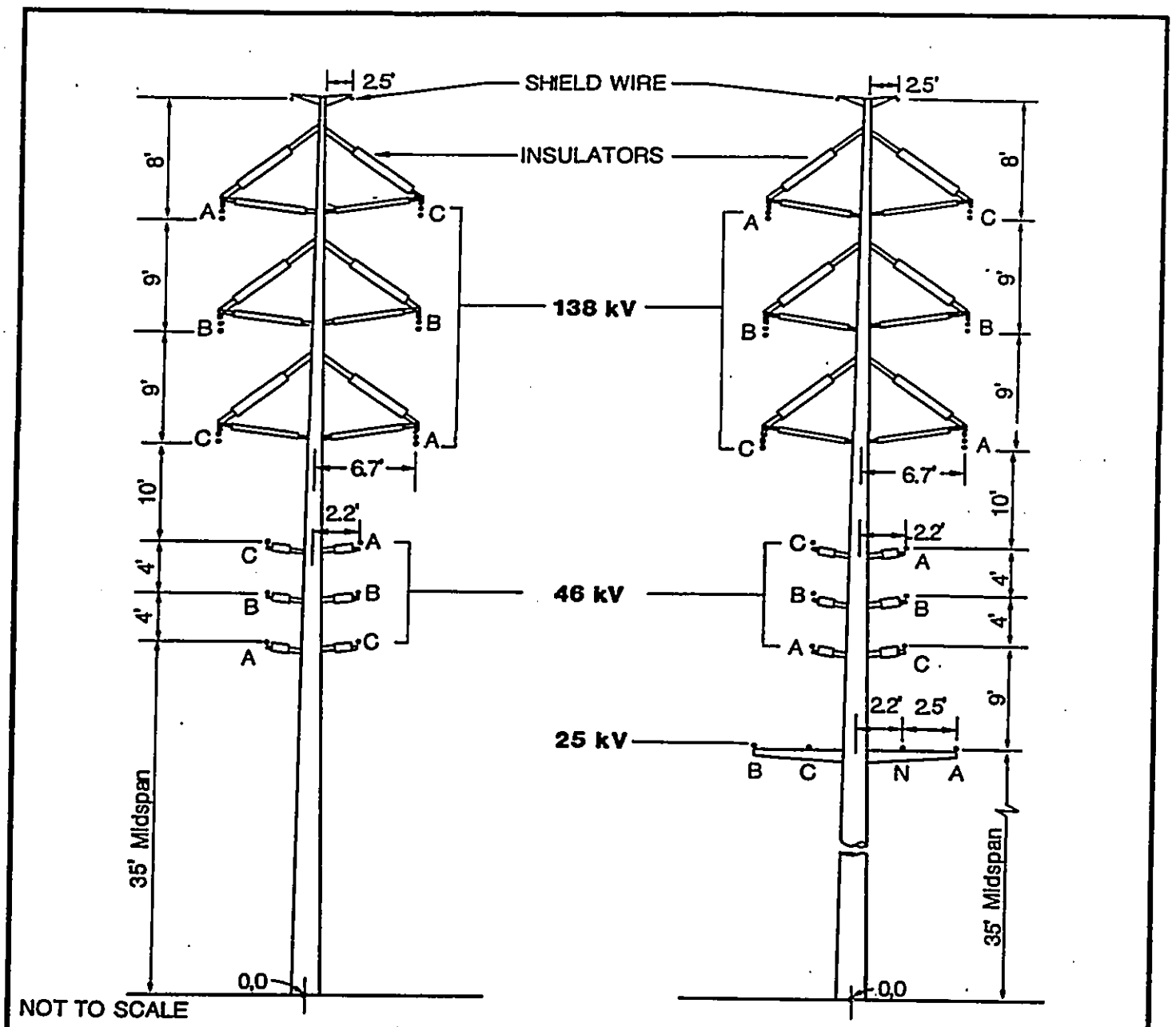
Transmission Lines

Electric Fields

Electric field values were calculated for the proposed lines. Because the configuration of the proposed lines may differ somewhat along the route (as illustrated in diagrams in Figure 5-10), two sets of field values were calculated (Figures 5-11 and 5-12). Between the CIP Substation and the Ewa Nui Substation, there will be a double-circuit vertical array of three 138 kV conductors above a double-circuit vertical array of three 46 kV conductors. Along certain portions of the line, a 25 kV single-circuit underbuild capability may be made available for future use. This configuration would be similar to the 138 kV/46 kV configuration, except that below the 46 kV conductors there will be a horizontal array of 25 kV distribution line conductors. These two different configurations will produce different field strengths. Figures 5-11 and 5-12 show estimated field strengths for the 138 kV/46 kV and the 138 kV/46 kV/25 kV lines. The results are presented as electric field lateral profiles of the field extending away from the lines on both sides at midspan. A lateral profile is a plot of the calculated maximum field as a function of distance away from the ROW center.

Where 138 kV lines are installed on the same pole as lower-voltage lines, some arrangements of conductors (low-reactance phasing) can reduce field strengths because the interaction of the different opposite (or unlike) phases can reduce field strengths. Figures 5-11 and 5-12 illustrate estimated electric field values for the proposed lines using low-reactance phasing. HECO proposes to use low-reactance phasing.

The electric field for the proposed transmission lines will be about 0.10 to 0.15 kV/m at the ROW edge to about 0.2 kV/m (for the assumed phasing) directly under the conductors near midspan. The maximum electric fields reported in the lateral profiles occur in a relatively small area of the ROW (about 5 percent of total area) near midspan, and near the location where the conductors sag closest to the ground.



CONFIGURATION #1

138 kV POLE WITH
46 kV UNDERBUILD

CONFIGURATION #2

138 kV POLE WITH
46 kV AND 25 kV UNDERBUILD

CIRCUITS	CONDUCTOR	ASSUMED LOADING PER PHASE NORMAL	EMERGENCY
138 kV	2x1.026" at 12"	765A	1800A
46 kV	1x0.856"	150A	715A
25 kV	1x0.660"	100A	300A

FIGURE 5-10

TYPICAL 138 kV POLE CONFIGURATIONS AND DETAILS

Waiau–Campbell Industrial Park Transmission Line Project
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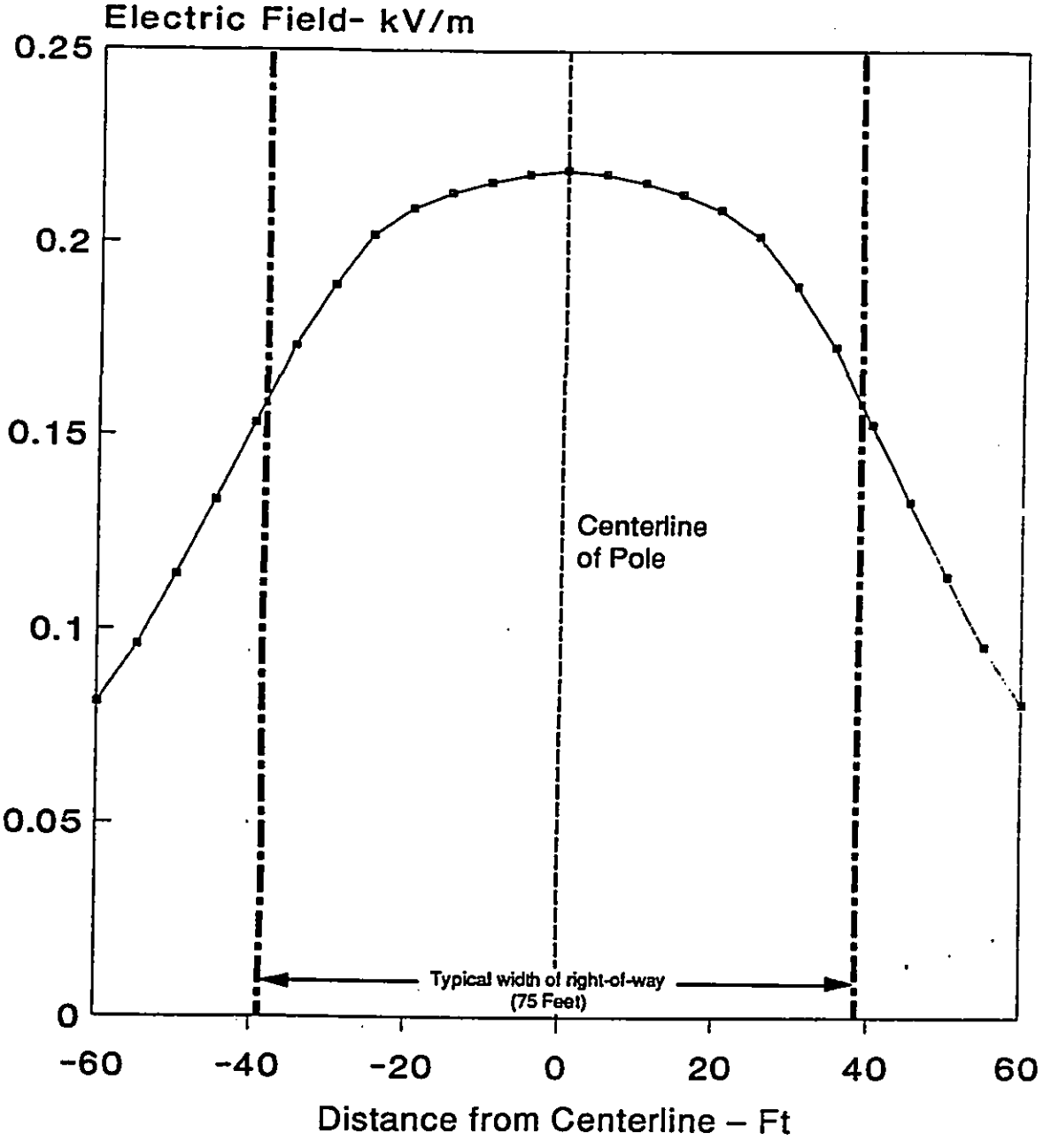

138/46 kV with Unlike (Low-Reactance) Phasing

FIGURE 5-11

LATERAL PLOT OF ELECTRIC FIELD FOR CONFIGURATION 1

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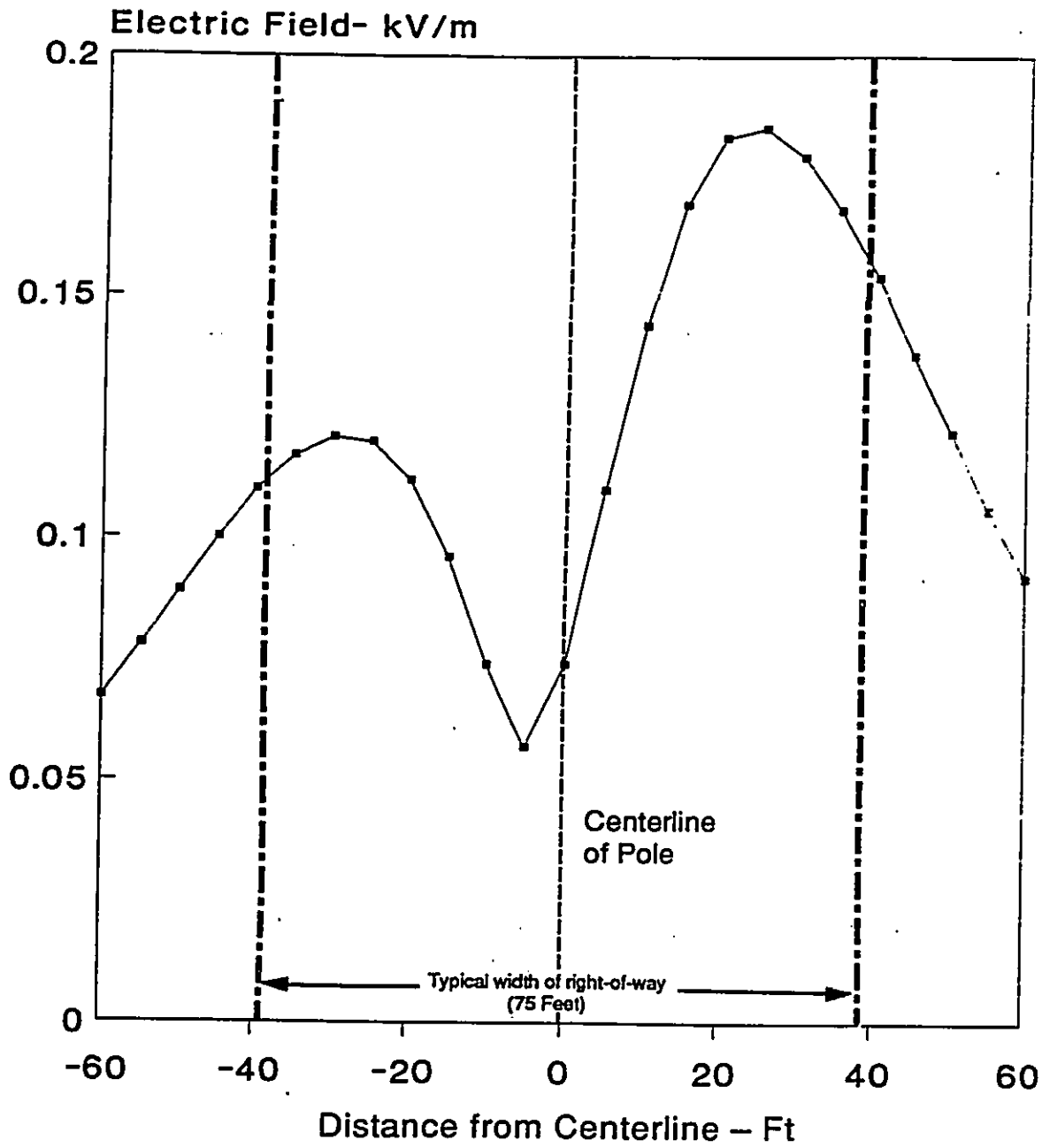


138/46/25 kV with Unlike (Low-Reactance) Phasing

FIGURE 5-12

LATERAL PLOT OF ELECTRIC FIELD FOR CONFIGURATION 2

Waiau–Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL

Magnetic Fields

The magnetic field was calculated for the Waiau-CIP Part 1 transmission lines for the two different configurations (see Figure 5-10). The results are presented as lateral profiles of the magnetic field on both sides of the lines (as a function of distance from the poles center) in Figures 5-13 and 5-14. The lateral profiles show calculated maximum magnetic field levels, assuming low-reactance phasing for normal and emergency loading (see Figure 5-10 for these loads). For normal loading, the calculated magnetic field would be about 6 mG at the ROW edge (for the assumed loads and phasings).

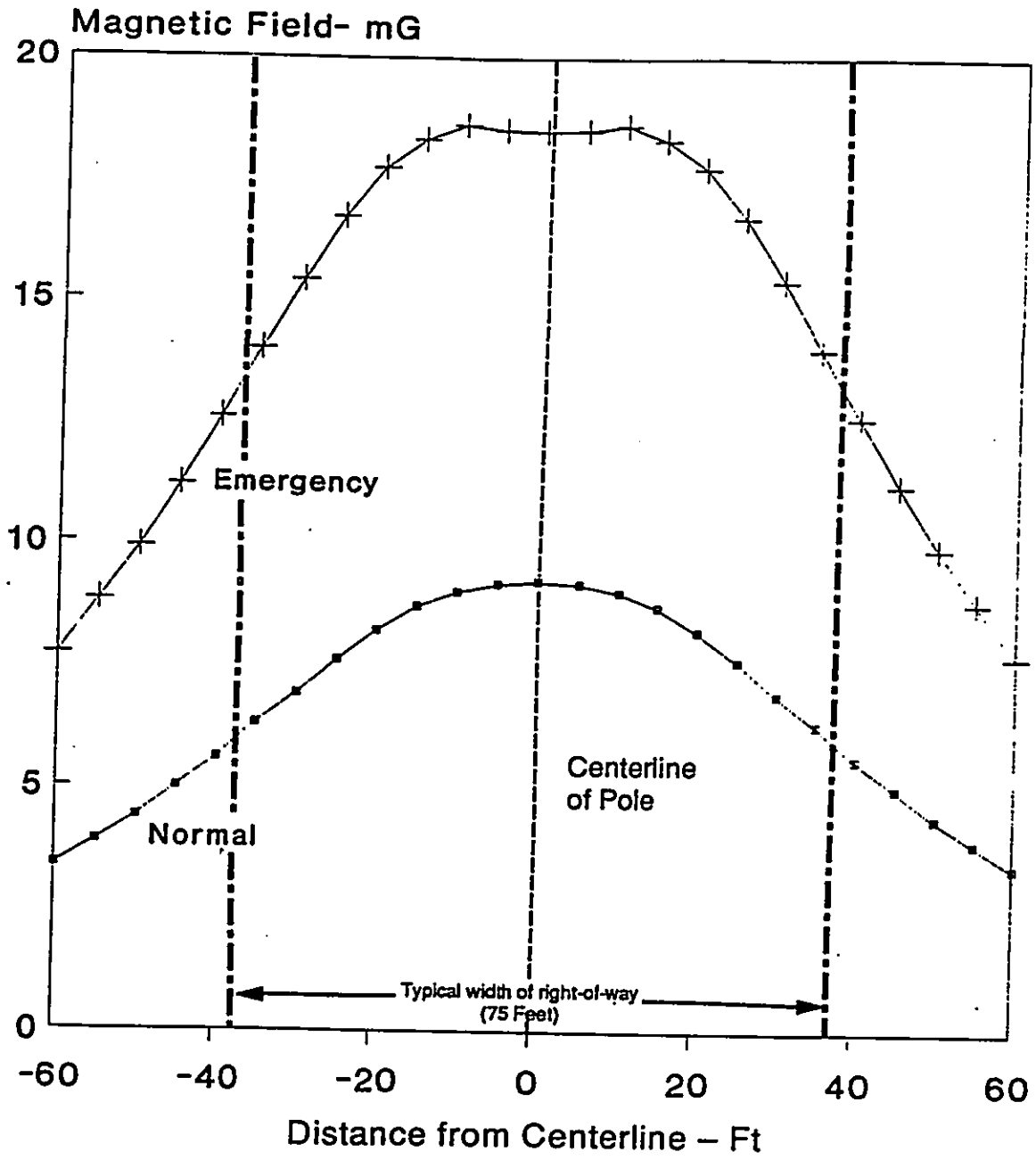
For unusual situations, the proposed 138 kV lines (and 46 kV/25 kV underbuilds) could operate under a maximum heavy or emergency loading situation that would temporarily increase magnetic field values at the ROW edge to the range of about 13 to 15 mG (depending on line configuration) for the assumed loads and phasings. It should be noted that these conditions would be very rare and of short duration (e.g., a few hours).

Substation Fields

Electric power substations also create electric and magnetic fields. However, these fields attenuate more quickly (over a shorter distance) than transmission line fields. The components of a substation act as point sources of field, somewhat similar to appliances. This is in contrast to the line source characteristics of transmission lines. Fields from point sources attenuate more rapidly over distance than fields from line sources. An example of point source attenuation of a field is an appliance. As distance away from a point source becomes greater than the size of the object, the field is greatly reduced; this is also true for substation components. Generally, external substation electric fields are very low because of shielding by metallic substation components themselves and the metal fencing surrounding the substation. Additional shielding may be provided by nearby shrubbery and trees. Representative values for 138 kV substation electric fields at the fence are about 0.10 to 0.20 kV/m without power lines nearby.

Because a substation is a collection of electric components that can each be a magnetic field source, a complex substation is often treated as a big point source for external field measurements. External magnetic fields associated with the substation itself (e.g., the collection of equipment or components) can be considered separately (as point sources) from the magnetic fields associated with the power lines that serve the substation. The manner in which substation magnetic fields attenuate is similar to those from appliances where the distance from the source is larger than the dimensions of the source itself (for example, a transformer). Therefore, at distances on the order of 50 feet or more away from the substation fence, the external field will have decreased to a much lower level than the level inside the substation.

Computer programs that evaluate electric and magnetic fields for electric power substations are being developed, but are not currently available. To evaluate external electric and magnetic fields for proposed (unbuilt) new substations, engineers usually take measurements



138/46 kV @ Normal and Emergency Loads with
Unlike (Low-Reactance) Phasing

FIGURE 5-13

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 1

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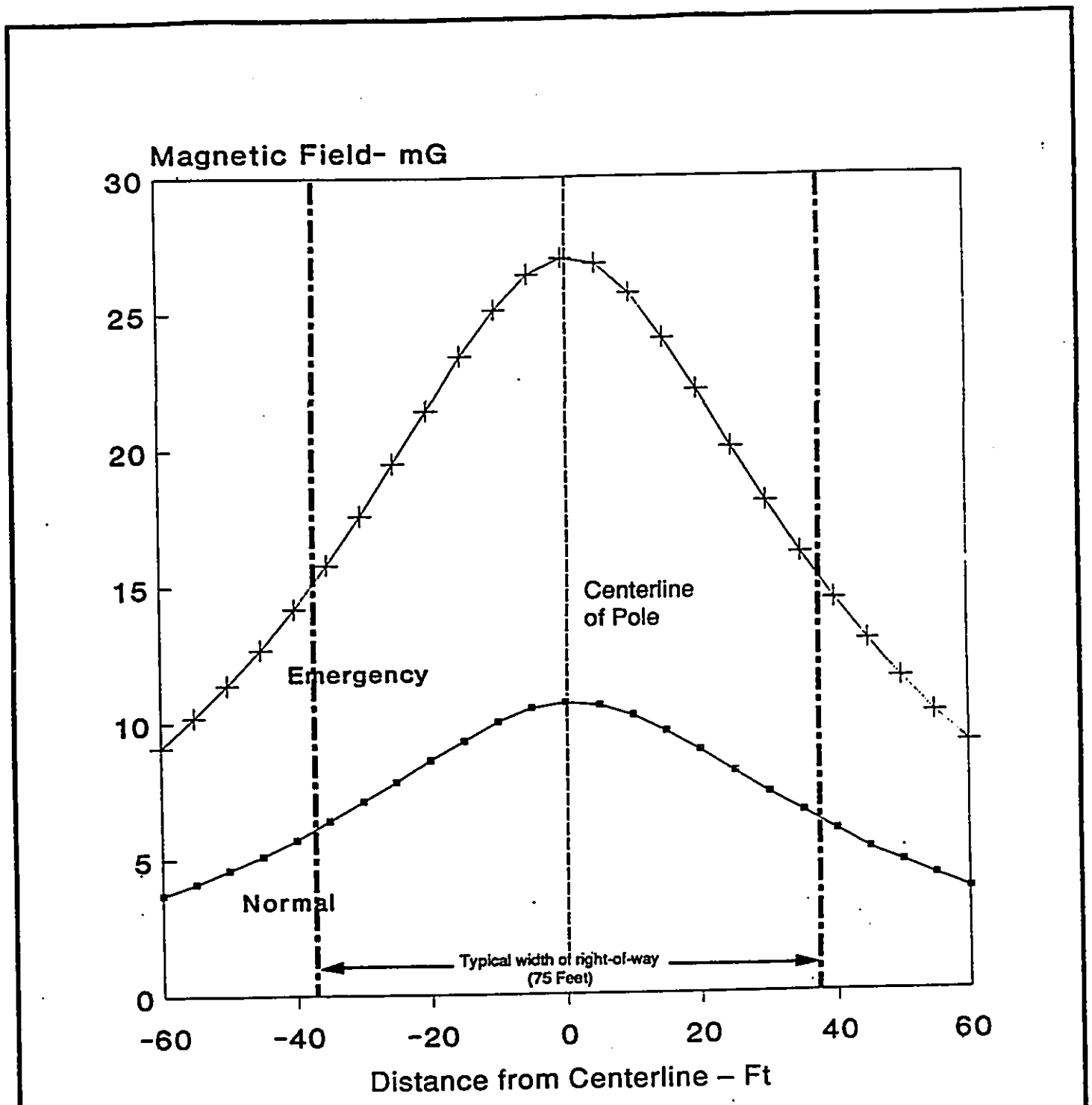

138/46/25 kV @ Normal and Emergency Loads with
Unlike (Low-Reactance) Phasing

FIGURE 5-14

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 2

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near existing substations of a comparable design. Measurement data supplied by HECO for the CIP, AES-BP, and Kalaeloa 138 kV Substations reveal that fields attenuate to low levels within about 20 to 50 feet away from the substation fence (for portions of the substation not near power lines). At 20 to 50 feet away, the electric field was measured to be 0.10 to 0.20 kV/m and the magnetic field was 1 to 2 mG, or less, if no power line was nearby. The most significant source of substation fields is the power lines that supply the substation and distribute the power.

Anticipated electric and magnetic field levels for the substations associated with the Waiau-CIP Part 1 project are estimated to be similar to other existing 138 kV substations in Hawaii.

Health Effects of Electric and Magnetic Fields

Overview

A number of studies in the 1960s and early 1970s found no obvious harmful effects from typical transmission line electric and magnetic fields. Some studies during this period did report the potential for harmful effects. More recent reports (since about 1979) have suggested a possible association between occupational and residential exposure to magnetic fields and adverse health effects, including cancer. The evidence for such an association is still inconclusive, and studies are under way to obtain more definitive information on this subject. Although most of the research has been prompted by concern about the effects of the large (extra high voltage) 765 kV transmission lines, some recent research results are of interest in assessing potential health concerns related to 138 kV lines.

New York State Power Lines Project

One of the most comprehensive recent research programs comprised 16 studies and 2 follow-up projects conducted from 1985 through 1987. These studies, administered by the New York State Power Lines Project, were undertaken "to determine whether there are health hazards associated with electric and magnetic fields produced by 60 Hz power transmission lines (especially 765 kV lines)." The $5 million research effort was funded by electric utilities that serve the state of New York and was supervised by a scientific advisory panel reporting to the New York State Health Department. In general, the field levels used in the laboratory studies were larger than typical fields because of the 765 kV lines.

The studies fall into the broad areas of epidemiology, laboratory animal, and cellular research. None of the studies showed significant adverse effects on reproduction, growth, or development because of the laboratory-created fields. The studies also showed no significant evidence of genetic or chromosomal damage that might lead to inherited effects or that might cause cancer. Two of the project's epidemiological studies, however, also examined the effects of lower-voltage distribution lines. These two studies (of childhood cancer in Denver and adult cancer in Seattle) have generated much public interest.

The Denver Study. The Denver study evaluated the incidence of cancer among children living in homes near different kinds of electric power lines. Measurements were taken inside each home with appliances turned off (low-power condition) and turned on (high-power condition). Distribution wiring configuration codes were used as a surrogate for likely magnetic field exposures over time in the home from external power lines. The wiring code is an index loosely based on the type, number, and diameter of conductors; the distance from house to power line; and the number of nearby service drops.

The New York Scientific Advisory Panel interpreted the Denver study to show an association between the household wiring codes and street addresses of the childhood cancer cases. The panel reported that the study appeared to show an increase in the frequency of childhood cancer in Denver from about 1 in 10,000 children per year to about 1.7 in 10,000. However, the study results were puzzling in several respects. There appeared to be no correlation when high-power condition measurements were used (that is, with many electrical appliances turned on). No clear relationship between the level of exposure and the increased incidence of cancer could be discovered for the low-power conditions (appliances turned off) for which a correlation with childhood cancer was found. The New York Scientific Advisory Panel was also concerned about the study's low interview response rate and possible coincidental factors, such as traffic density, that could also affect the incidence of cancer.

The Seattle Study. The other epidemiological cancer study funded by the New York State Power Lines Project was conducted in the Seattle area. The design of this study shared many features with the Denver study; for example, exposure to magnetic fields was assessed with field measurements and with the same wiring code system. In the Seattle study, the New York Scientific Advisory Panel found that "regardless of how exposure was characterized, no relationship with cancer incidence was disclosed." In other words, the results of this study were negative: no association between cancer and magnetic field exposure (as estimated by the wiring code system) was found.

In evaluating the research results, the New York Scientific Advisory Panel cautioned that research has not found any biological mechanisms that could explain the role of magnetic fields in the development of cancer. The panel also noted that methodological uncertainties exist in quantifying magnetic field exposure levels. The panel concluded that the findings to date could not and should not be translated into specific recommendations for regulating ROW widths, line heights, or the location of lines near homes.

The Los Angeles Study. A new residential epidemiology study funded by the Electric Power Research Institute in an attempt to replicate the Denver study was completed in 1990 in Los Angeles, California. The results generally confirm the results of the Denver study. There was an increased risk of cancer with certain wiring codes, but not for direct field measurements.

Preliminary results of this study of childhood leukemia, conducted by Dr. John Peters in Los Angeles County, were recently published. This study was essentially the same as the Denver study, but in a different location. The researcher concluded that "our data offer no support for a relationship between measured electric field and leukemia risk, little support for the

relationship between measured magnetic field exposure and leukemia risk, some support for a relationship between wiring configuration and leukemia risk, and considerable support for a relationship between children's electrical appliance use and leukemia risk." The reason that wiring configuration correlates with leukemia risk better than measured exposure does is not clear.

It remains unresolved why an indirect magnetic field measurement (such as a wiring code) is associated with a positive finding, and direct field measurements are not. This is even more perplexing because the Los Angeles study had the most sophisticated direct measurements of magnetic fields to date. The following are possible explanations for these apparently contradictory research findings:

- Wiring configuration codes are better predictors of long-term average magnetic field exposure than 24-hour measurements.
- Wiring code categories are markers for some as-yet-unidentified biologically effective characteristics of the magnetic field (e.g., transient pulses or intermittent fields).
- Some wiring code categories are associated with some confounding factor or set of factors in the urban environment that are the true cause of the increased risk but that are unrelated to magnetic fields.
- Relatively subtle biases in subject selection (especially for the controls) have produced a spurious association between wiring codes and leukemia risk in the Denver and Los Angeles studies.

Swedish EMF Studies

Two new epidemiological studies were released in September 1992 in Sweden. The first, "Magnetic Fields and Cancer in People Residing near Swedish High-Voltage Power Lines," was a residential study of children and adults who live within 300 meters of 220 kV and 400 kV transmission lines in Sweden. The authors are Dr. Maria Feychting and Dr. Anders Ahlbom. This residential study evaluated average magnetic field exposure via actual measurements and magnetic field calculations (for both contemporary and historical line loadings). The study also evaluated exposure for various distances from the power lines. The researchers found a statistical association between childhood leukemia and calculated historical fields (the main exposure metric was selected as the annual average of the calculated magnetic field generated by the power line). The study also found an association with distance from the power lines. No association was found with actual magnetic field measurements. For brain tumors and all childhood cancers together, little support for an association was found. The findings of an association with a surrogate, namely calculated historical magnetic fields, but not with actual field measurements, are consistent with earlier studies in Denver and Los Angeles. Similar results are achieved in this study by using

distance from the power line. In this respect, this study is another "wire code" study because a distance criterion is used as the surrogate for magnetic field exposure.

The second study, "Occupational Exposure to Electromagnetic Fields in Relation to Leukemia and Brain Tumors: A Case-Control Study," is an occupational study of adult males. The authors are Dr. Birgitta Floderus, Dr. Thomas Persson, and others. Studying the job held the longest during the 10-year period before diagnosis, the researchers observed a statistical association between a certain subtype of leukemia and estimated magnetic field exposure. (No association was found with the leukemia subtype most often discussed in other occupational EMF studies.) The exposure assessment details were not sufficiently reported to allow a complete evaluation, but in general, some contemporary magnetic field exposure measurements were used as a surrogate to estimate historical exposure for selected job categories. In the occupational study, the exposure metrics included the mean field exposure value, median, standard deviation, and time above 2 mG for exposure categories that included quartiles of exposure intensity and the 90th percentile.

Both studies reported that they have essentially confirmed earlier residential and occupational study findings, with some exceptions (for example, in the residential study there were no positive findings for brain tumors). The most interesting features of these new studies is the exposure assessment, which includes contemporary measurements and historical field calculations for the residential study and job category personal exposure measurements for the occupational study. An important issue for both studies is that if the exposure surrogates prove to be accurate in estimating historical exposure, then this may suggest that future exposure assessment attention is directed to average magnetic field values. In any event, these studies add to our overall scientific knowledge, would seem to confirm portions of earlier work, and will direct future research to understand what aspect of wire codes and other surrogates are related to health risks.

Environmental Protection Agency Preliminary Draft Report

(This report has been under review by the Environmental Protection Agency (EPA) Science Advisory Board. It will be rewritten and submitted for further scientific review before it is published again.) EPA prepared a preliminary draft report in 1990 on electric and magnetic fields based on a review of existing scientific literature. The preliminary draft report evaluated the likelihood that electric and magnetic fields pose a risk for the development of cancer in humans. In this preliminary draft report, EPA concluded that "with our current understanding, we can identify 60 Hz magnetic fields from power lines and perhaps other sources in the home as a possible, but not proven, cause of cancer in people." One problem cited by EPA is a poor understanding of the basic nature of the interaction between magnetic fields and biological processes. The EPA preliminary draft report states, "For example, a real possibility exists that exposure to higher field strengths is actually less hazardous than exposure to low field strengths. Because of this uncertainty, it is inappropriate to make generalizations about the carcinogenicity of electric and magnetic fields."

EPA has also reviewed the research needs for electric and magnetic fields and published a report that identifies the major research topics and their relative priorities. Exposure assessment research and research into possible biophysical mechanisms were listed as two high-priority areas of future study. Definitive exposure data will be necessary to judge the validity of the suggested causal link between magnetic field exposure and cancer. A better understanding of possible biophysical mechanisms is needed to quantify which, if any, aspect of magnetic field exposure might be related to adverse health outcomes.

EPA Science Advisory Board

On January 29, 1992, the Nonionizing Electric and Magnetic Fields Subcommittee of the EPA Science Advisory Board's Radiation Advisory Committee submitted to the EPA administrator its report, *Potential Carcinogenicity of Electromagnetic Fields*, on the EPA's preliminary draft report on electric and magnetic fields. In its report, the Science Advisory Board subcommittee concluded that ". . . there is insufficient information to designate specific values of magnetic-field strength that may be hazardous to human health." The Science Advisory Board subcommittee made two specific policy recommendations:

> **Policy Recommendation No. 1:** The Subcommittee is unanimous in its belief that the question of electric and magnetic field effects on biological systems is important and exceptionally challenging, and that the Subcommittee's advice to the EPA should be that the report should be rewritten by EPA, and then reviewed by the Science Advisory Board.
>
> **Policy Recommendation No. 2:** EPA should complete its efforts with regard to radio frequency (RF) electromagnetic fields (including microwaves) and issue exposure guidelines independent of present issues pertaining to lower frequencies. The current EPA report inadvertently leads even the careful reader to conclude that the potential carcinogenicity of electric and magnetic fields of extremely low frequency (ELF), i.e., power line frequencies is the only—or at least the principal—subject of concern with regard to nonionizing fields. Such a conclusion would reinforce the skewed and somewhat sensationalized picture presented to the public in recent years by the news media and government agencies responding to this publicity. The report should therefore declare explicitly that the attention given to nonionizing electric and magnetic fields derives in the first place from long-standing concern over the hazards of RF (including microwave) radiation. EPA has expended substantial resources on the study of such radiation over a period dating back to the EPA's inception, and EPA should complete its efforts directed toward the issuance of RF exposure guidelines. RF fields present long-known and well-understood hazards such as temperature elevation in tissue and heat stress resulting from acute exposures against which users and the general public must be warned and protected. Any published exposure guideline should specifically identify the hazards from RF exposure.

Office of Technology Assessment—Background Paper

A comprehensive background paper on the biological effects of electric and magnetic fields was prepared for the U.S. Congress Office of Technology Assessment (Carnegie Mellon University, 1989). The paper discusses the present state of knowledge on the health effects of extremely low-frequency (60 Hertz) electric and magnetic fields. A small brochure was also prepared that more concisely summarizes the background paper and various policy options.

The background paper provides a good overview of the sources and nature of electric and magnetic field exposure. It points out that we do not yet know what field attribute or combination of attributes, if any, could produce public health effects. This means that the simple assumption that "more is worse" may not be true. Because of this, simple field strength standards "cannot be adequately supported by the science that is now available."

The background paper also provides a summary of the basic areas for research: cellular experiments, whole animal experiments, exposure assessment, and epidemiological studies. Using the review of the scientific literature, the report states that:

> 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.
>
> If exposure to fields does turn out to pose a health risk, it is unlikely that high voltage transmission lines will be the only sources of concern. Power-frequency fields are also produced by distribution lines, wall wiring, appliances, and lighting fixtures. These nontransmission lines could play a far greater role than transmission lines in any public health problems.

The background paper and brochure also consider the public policy question of what should be done, given our present knowledge. Three basic approaches are suggested:

- **Do nothing.** Conclude that there is not yet enough evidence to warrant any action.
- **Prudent avoidance.** Adopt strategies that can limit field exposures with small investments of money and effort. Do nothing drastic or expensive until research provides a clear picture of whether there is any risk at all.
- **Aggressive regulation.** Conclude that there is a problem and spend some serious time and money on an aggressive program to limit field exposure, yet recognize that we may eventually learn that some or all of this effort and money has been wasted.

Continuing Research

Almost all researchers are careful to point out that it is difficult to identify health hazards that may be subtle to detect or that are evident only after long periods of time. The reverse is also true: no experiment, no matter how well designed, can prove no health hazards at all from any source studied. The studies that do suggest a health effect are usually repeated to verify the results. Because any one study can be fallible, a study needs to be replicated before any conclusions can be reached about health hazards.

Because of the difficulty of reaching any meaningful conclusions about health hazards from the current studies, most researchers (including the New York Scientific Advisory Board and EPA) recommend carrying out additional research. Several areas in particular merit further research:

- So far, research has not been able to discover the biological mechanism by which electric or magnetic fields might cause adverse health effects. Additional basic laboratory research is needed to determine whether physiological changes result from exposure to electric or magnetic fields, and how such changes might affect health.

- Another subject deserving further research is the effect of the fields typically experienced in homes—fields caused by televisions, electric blankets, hair-dryers, other appliances, and electric wiring in house walls. As noted earlier, although field strengths near some of the larger transmission lines may be larger than field strengths at home, most people experience significant exposure to electric and magnetic fields at home. The Denver and Los Angeles studies found evidence of an association between the incidence of childhood cancer and the configuration of electric power line wiring outside the home. Further study will help clarify the relative risk, if any, from fields at home and near transmission or distribution lines.

Electric and Magnetic Field Standards

General transmission line safety standards are imposed by the State of Hawaii PUC GO-6 (Rules for Overhead Electric Line Construction) and the NESC. The Waiau-CIP transmission lines will be designed to comply with these codes and standards. The existing standards do not address concerns about the potential for health effects of electric and magnetic fields.

On April 3, 1991, the Hawaii State Department of Health issued a policy relating to electric and magnetic fields from electric power lines. The policy states:

> A prudent approach is needed at this time to regulate electric and magnetic fields around low-frequency electric power facilities, including high-voltage transmission lines. The existing research data are inconclusive and not sufficient enough for adequate, accurate risk assessment. However, the data

suggest that a "prudent avoidance" approach to siting new facilities is appropriate. Where technically feasible and practical, public exposures should be minimized. Too little is presently known to be able to determine where or what rules would provide useful public-health protection.

Implementing actions:

(a) All newly-installed power lines should be constructed with engineering controls to reduce exposure (for example, the "delta" configuration).

(b) The Department of Health will continue to collect and evaluate research data on electromagnetic fields in order to be aware of significant findings with public-health implications.

There are no national standards in the United States for electric or magnetic field exposure. A few states have some type of electric field guideline and two states have a magnetic field standard. These standards are listed in Table 5-7. The purpose of most of the standards is to make the field levels from new lines similar to the field levels from existing lines. The Waiau-CIP Part 1 transmission lines' field values are far below any of the levels in this table.

The International Nonionizing Radiation Committee of the International Radiation Protection Association has published "Interim Guidelines on Limits of Exposure to 50/60-Hz Electric and Magnetic Fields" in the January 1990 issue of *Health Physics*. The guidelines were approved on May 3, 1989, and those guidelines relating to the general public are summarized below:

General Public Exposure Characteristics	Electric Field Strength (kV/m)	Magnetic Flux Density (mG)
Up to 24 hours a day	5	1,000
Few hours a day	10	10,000

As with the state standards, the Waiau-CIP Part 1 transmission lines' field values are far below the values cited above.

Other Transmission Line Electrical Effects

Corona. One of the more interesting phenomena associated with all energized devices, including high-voltage transmission lines, is corona. Corona is the physical manifestation of energy loss, and can transform energy into very small amounts of light, sound, radio noise, chemical reaction, and heat. Because power loss is not economical, corona has been studied since the early part of this century. Consequently, it is well understood by engineers and steps to reduce it are one of the major factors in line design. The line designer can control corona with good design practices, and it is usually not a problem for lines rated at 230 kV and lower.

Table 5-7
State Regulations that Limit Field Strengths on Transmission Line Rights-of-Way

State	Field Limit
Montana	1 kV/m at edge of ROW in residential areas
Minnesota	8 kV/m maximum in ROW
New Jersey	3 kV/m at edge of ROW
New York	1.6 kV/m at edge of ROW 200 mG at edge of ROW
North Dakota	9 kV/m maximum in ROW
Oregon	9 kV/m maximum in ROW
Florida	10 kV/m maximum for 500 kV lines in ROW 2 kV/m maximum for 500 kV line at edge of ROW 8 kV/m maximum for 230 kV and smaller lines in ROW 3 kV/m maximum for 230 kV and smaller lines at edge of ROW 200 mG for 500 kV lines at edge of ROW 250 mG for double-circuit 500 kV lines at edge of ROW 150 mG for 230 kV and smaller lines at edge of ROW

Source: Carnegie Mellon University (1989).

When significant corona activity occurs on transmission lines it is usually on high-voltage lines of 345 kV and above, and then mostly during inclement weather. The effects are local and should be considered a nuisance rather than a serious problem or hazard. For example, although radio noise in the AM range can be generated by corona discharge, it is usually of such low intensity that it cannot be detected outside the ROW.

The same is true of television interference and audible noise. The engineering design of the proposed Waiau-CIP Part 1 transmission lines will produce very low conductor surface gradients (because of the lower 138 kV line voltage). The corona performance of the proposed 138 kV lines will be as good as or better than other lines in this voltage classification. In summary, the proposed 138 kV lines are expected to have little or no corona activity under most operating conditions.

Audible Noise. During corona activity, transmission lines (mainly 345 kV and above) generate a small amount of sound energy. This audible noise from the line can barely be heard in fair-weather conditions on the higher-voltage lines and usually not at all on 138 kV lines. During inclement weather, water drops collect on the conductor and increase corona activity so that a crackling or humming sound may be heard near the line. This noise is caused by small electrical discharges from the water drops. Audible noise decreases with distance away from the line. Noise levels on typical 138 kV systems are low and have not been a problem; in fact, audible noise is almost never reported on transmission lines below 230 kV. Audible noise levels for the proposed Waiau-CIP Part 1 transmission lines,

calculated for the edge of the ROW during inclement weather, are about 10 to 13 dBA, a very low level.

Radio and Television Interference. As a general rule, overhead transmission lines do not interfere with normal radio or television reception. As described earlier, corona discharges can sometimes generate unwanted electrical signals. The two potential sources of interference are corona and gap discharges. Corona may affect AM radios, and gap discharge can affect television as well as radio reception. Corona activity is reduced through proper line design and is almost never a source of interference, especially on lines smaller than 230 kV. Corona-generated interference decreases rapidly with distance, and beyond the edge of the ROW it decreases to very low values. For the proposed 138 kV line design, the radio noise level, calculated for the edge of the ROW during foul weather, is about 27 dBμv/m (decibels above a 1 *microvolt-per-meter reference value). This level will meet the Federal* Communications Commission level for satisfactory service. The conductor design of the 138 kV lines is such that television interference levels will be extremely low, lower than on many 138 kV lines on the mainland where television interference has not been a problem.

Gap discharges are a very different problem. They are caused by electrical discharges between broken or poorly fitting hardware, such as insulators, clamps, or brackets. Hardware is designed and installed to be problem free, but wind motion, corrosion, gunshot damage, and other factors can sometimes create a gap discharge condition. When this condition develops, intermittent gaps at connection points between hardware items allow small electrical discharges to occur. This phenomenon is not limited to transmission lines and often can be found on distribution lines. The discharges act as small transmitters at frequencies that may be received on some radio and television receivers. Gap discharge sources can be located and repaired by electric utility engineers. The severity of interference depends on the strength and quality of the transmitted radio or television signal, the quality of the radio or television set and antenna system, and the distance between the set and the interference source. It should be obvious that radios and television sets are influenced more by interference sources in the home itself—because of their proximity—than from transmission lines. The large majority of interference complaints are found to be attributable to sources other than transmission lines (e.g., poor signal, poor antenna, heating pad, doorbell, sewing machine, freezer, ignition system, aquarium thermostat, appliances, or fluorescent lights).

Transmission line engineers usually design all transmission lines to be as free as possible from corona and other sources of interference. Radio and television interference complaints are recorded, evaluated, and investigated when necessary; corrective measures are taken as required.

Ozone. Ozone is another possible byproduct of the higher-voltage (345 kV and above) transmission lines that has raised some concern. Ozone is formed when three oxygen molecules combine with each other. This can happen when air molecules are charged. Ambient ozone levels in rural areas are typically around 10 to 30 parts per billion (ppb) at night and may peak during the day at around 100 ppb. In urban areas, concentrations greater than 100 ppb are common. Cities such as Los Angeles may peak at 500 ppb. The national

ambient air quality standard for oxidants (of which ozone is usually 90 to 95 percent) is 120 ppb, not to be exceeded as a peak concentration on more than 1 day per year.

What kind of ozone level increase can be expected in the vicinity of a transmission line? A theoretical worst case would be provided by 10 or more continuous hours of heavy rains and light winds blowing exactly parallel to the lines. Close to the Waiau-CIP Part 1 transmission lines, calculated ozone levels would be about 0.007 ppb. Concentrations below 1.0 ppb are impossible to measure with even the most sensitive instrumentation. Nitrogen oxides can also be generated by transmission lines but on a scale much smaller than ozone, thus presenting a problem even less significant. Neither ozone nor nitrogen oxide is a problem associated with 138 kV transmission lines.

Cardiac Pacemakers. *One area of concern related to the electric fields of the 345 kV and larger lines has been the possibility of interference with cardiac pacemakers. There are two general types of pacemakers: asynchronous and synchronous. The asynchronous pacemaker pulses at a predetermined rate. It is practically immune to interference because it has no sensing circuitry and is not exceptionally complex. The synchronous pacemaker, on the other hand, pulses only when its sensing circuitry determines that pacing is necessary. Interference resulting from the transmission line electric field can cause a spurious signal in the pacemaker's sensing circuitry. When these pacemakers detect a spurious signal, such as a 60 Hertz signal, they are programmed to revert to an asynchronous or fixed pacing mode of operation and return to synchronous operation within a specified time after the signal is no longer detected. Cardiovascular specialists do not consider prolonged asynchronous pacing a problem. As mentioned before, some pacemakers are designed to operate that way. Periods of operation in this mode are often induced by cardiologists to check pacemaker performance. Therefore, although the transmission line electric field may interfere with the normal operation of some pacemakers, the result of the interference is not harmful and is of short duration.*

In any event, the electric fields associated with the Waiau-CIP Part 1 transmission lines (about 0.2 kV/m) are far below levels that are reported as capable of affecting pacemaker operation (about 2 to 9 kV/m) and would, therefore, pose no hazards for pacemaker operation.

Public Perception. The perception by some of the public that EMF exposure could be an adverse health effect may itself be an adverse impact. A variety of common household electrical appliances create exposure levels equal to or significantly higher than levels generated by the proposed transmission lines and substation. Although some of these appliances are mere conveniences and can be avoided (for example, electric can openers), other devices powered by electricity are essential (for example, light bulbs). Placing 138 kV transmission lines underground does not eliminate magnetic fields, as explained in Chapter 3. Because technology cannot currently guarantee elimination of magnetic fields, electricity is an essential utility for the public welfare, and scientific studies on the potential health effects from EMF are inconclusive, the perception by some of the public that EMF may have an adverse health effect is an unavoidable impact.

Property Value. The perception by some of the public that EMF may have an adverse health effect could affect a buyer's perception of value. Although some buyers would not purchase a home that has a transmission line nearby or in plain view from the home, other buyers would purchase the home. (This determination is based on a review of several studies and articles.) As a result, a power line in itself does not cause the selling price or marketability of residential property to be lower than it might otherwise be.

Other Utilities

The proposed transmission lines will be in proximity to telephone facilities, underground fuel oil lines, and gas lines. The transmission lines could affect these other utilities with respect to construction activities, induced electrical currents, disruption to cathodic protection systems (that prevent corrosion to buried pipes), and possible shock hazards.

GTE Hawaiian Tel maintains a facility next to Barbers Point Naval Air Station, as well as telephone lines along Farrington Highway. Chevron U.S.A. Products Company has two 8-inch fuel oil lines and a 4-inch tracer that runs parallel to the OR&L ROW mauka of the proposed transmission lines' alignment. BHP Petroleum (The Gas Company) maintains gas transmission lines in the energy corridor along Farrington Highway and in Kalaeloa Boulevard. The state Department of Civil Defense does not have any equipment in the area (see Department of Civil Defense letter in Appendix A).

The proximity of transmission lines to other utilities is a common occurrence. HECO will coordinate with other utilities in design and operation of the transmission lines to minimize or avoid adverse effects on the other utilities.

Mitigation

Research to date has not demonstrated conclusive evidence of health hazards resulting from 138 kV transmission lines similar to the Waiau-CIP Transmission Line, Part 1, Project. Nevertheless, routing and line design steps that will reduce public exposure to electric and magnetic fields are proposed. The proposed design would comply with the field standards of other states and, in the absence of more concrete scientific information, take prudent steps to minimize exposure that are consistent with the approach suggested by the U.S. Congress Office of Technology Assessment, the state Department of Health, and all of the measures recommended by the project's EMF consultant.

The evaluation of land use along the proposed alignment and different engineering design options (such as unlike or low-reactance phasing) is consistent with the prudent avoidance approach. The following land use considerations were taken into account when selecting the proposed transmission lines route to minimize EMF exposure to the public.

- **Avoidance of populated areas.** The proposed transmission lines' alignment is the one alternative that effectively avoids existing populated areas (the alignment is predominantly in areas currently used for sugar cane cultivation

or as a utility corridor). It also avoids areas where proposed plans for urban development are known (e.g., Kapolei).

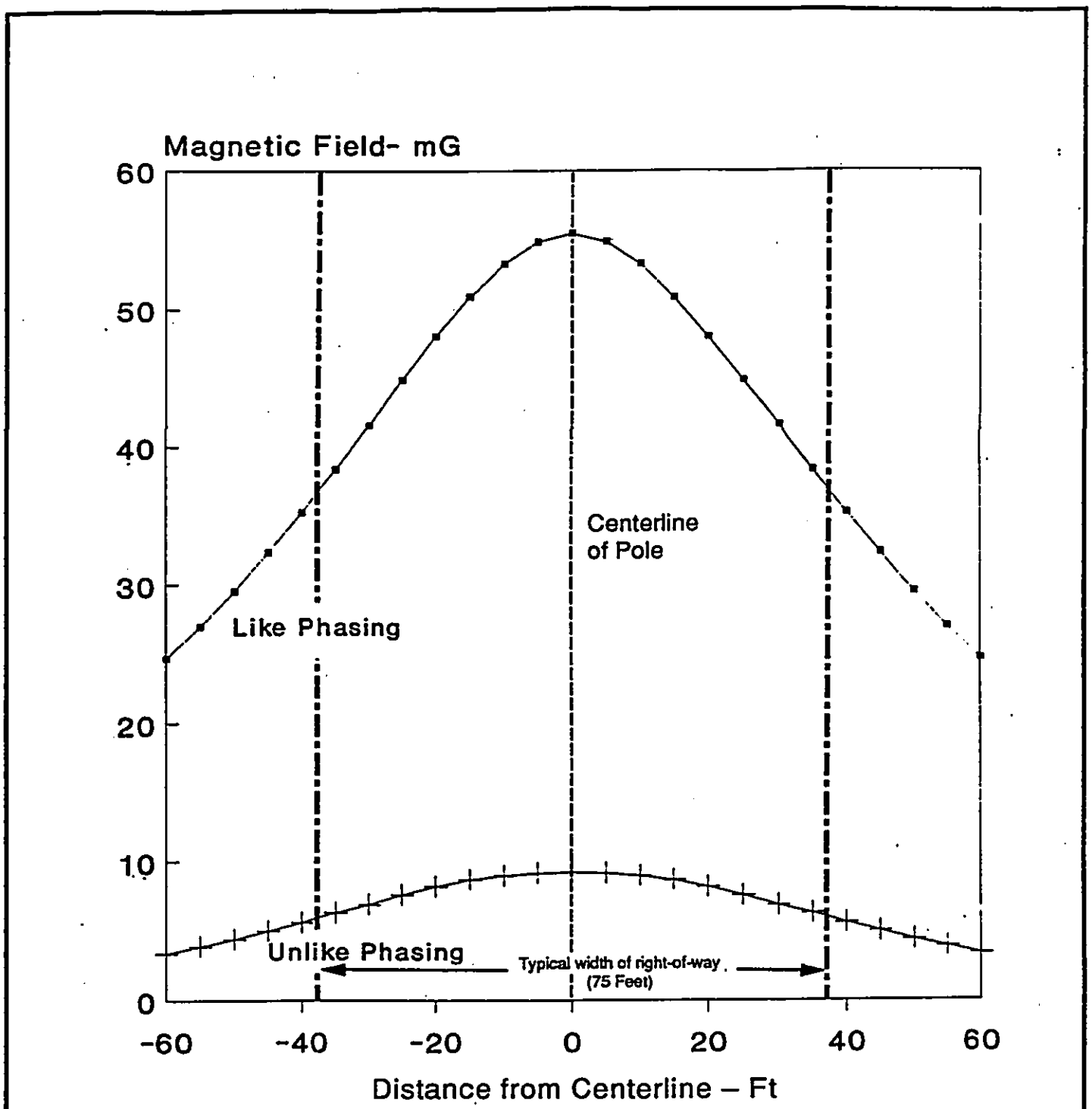
- **Coordination with future master plans.** In the vicinity of the 1,100 acres around Kaloi Gulch where development plans have not been prepared, HECO, in consultation with the affected parties, was directed by the Office of State Planning to follow a natural boundary—Kaloi Gulch. Early recognition of the project's alignment gives the state the opportunity to prepare a master plan that locates residential uses away from the gulch and transmission lines. The combined gulch and transmission line corridor could be used for a number of other necessary land uses such as drainage detention ponds and a greenbelt. Streets for local traffic could be located on either or both sides of the gulch. Such uses are compatible with the existing drainage purpose of Kaloi Gulch and the future transmission lines.

- **Use of existing utility corridors.** The proposed transmission lines' alignment uses existing utility easements and ROWs along the mauka edge of Barbers Point Naval Air Station and Farrington Highway. These corridors have utility poles with 46 kV and 12 kV lines. Use of these corridors provides an opportunity to consolidate the 46 kV lines and 138 kV lines on one set of poles and to reduce EMF exposure levels through low-reactance or unlike phasing.

The use of unlike phasing can reduce field levels for the assumed magnitude and direction of current flow in each circuit. Figure 5-15 illustrates the difference in magnetic fields for like and unlike phasing. HECO proposes to use this approach for the proposed project. HECO will design, construct, and operate its transmission lines in a manner that will minimize electric and magnetic fields where technically feasible and economically reasonable. For example, as a result of detailed design analysis, including electric and magnetic field levels, HECO will use a different type of conductor (i.e., "Lapwing") than initially anticipated (i.e., "ARBUTUS"). This change results in a reduction in magnetic field levels estimated in this document.

Before and after the lines are operational, HECO proposes to measure the actual magnetic field levels at locations along the alignment (selected in consultation with community representatives) to compare these levels with the calculated levels. The information would be made available to the public. HECO will continue to consult with the state Department of Health concerning EMF issues for this and other projects.

HECO will coordinate with other utilities to cause minimal adverse effects on telephone, fuel oil, and gas lines.



138/46 kV @ Normal Loading
Unlike phasing is proposed for the project.

FIGURE 5-15

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 1: USED TO COMPARE FIELD LEVELS OF *LIKE* & *UNLIKE* PHASING

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Chapter 6

Summary of Unresolved Issues

Public Health Impacts from Electric and Magnetic Fields

HECO has adopted strategies consistent with the "prudent avoidance" approach in routing and designing the Waiau-CIP Transmission Line, Part 1, Project. Land uses along the alternatives were evaluated with the prudent avoidance strategy in mind. For example, existing residential areas were avoided. Recognizing that none of the alternative routes could avoid future residential areas, HECO will use unlike phasing of transmission lines (by placing lines with opposite phases next to each other) to significantly reduce field strength levels. This approach is in contrast to the usual like phasing of transmission lines. Placing the 138 kV lines underground would eliminate public exposure to electric fields, but not magnetic fields. Technically, therefore, undergrounding the lines does not resolve the issue of public exposure to magnetic fields.

The issue of public health impacts from the electric and magnetic fields of the proposed project remains an unresolved issue, as does the larger issue of health effects from the electric and magnetic fields produced by existing distribution lines, wall wiring, appliances, and lighting fixtures.

Social Equity

When the needs of the community at large require an imposition on a smaller neighborhood within that community, the question of social equity arises. Existing and future residents of neighborhoods in which facilities must be placed may feel that their neighborhoods are being unfairly burdened with more than their fair share of facilities that may benefit the community at large, but not their own neighborhoods specifically.

The overhead alternatives for the proposed project are seen by landowners and developers as such facilities. Property owners and developers of projects proposed and under construction object to overhead transmission lines because of the visual impact, EMF concerns, and the potential effect on property value and marketability of developments.

Some people in the community may say that the only appropriate mitigation would be to place the lines completely underground. However, the question of social equity exists for underground alternatives as well. In the case of underground lines versus overhead lines, the PUC has approval authority and must decide whether it is appropriate to pass on to all users the significantly higher costs of underground placement, which benefits primarily the land through which the lines pass. This is especially significant if a less expensive overhead line is a viable option.

The construction cost of the proposed overhead transmission lines is $24.9 million. Underground lines would cost four to five times as much as overhead lines.

A decision to have ratepayers bear the cost of placing the project's 138 kV transmission lines underground could set a precedent for placing all electrical lines underground. A 1990 report by the city's Director of Public Works estimated the cost of placing all existing overhead utility lines underground at $14 billion, including $10 billion for electrical facilities. Over time, the cost of electricity to customers to place overhead utilities underground could be four times higher than today's cost.

As a regulated utility, HECO is required to provide reliable electric service at reasonable cost to its customers. In general, HECO's tariff as authorized by the Hawaii PUC is based on an overhead electric system. If a private entity, such as a residential developer, requests underground facilities and is willing to pay for the additional costs to place lines underground, then HECO will place the lines underground. In certain specific locations where lines are required to be underground, such as in the Hawaii Capitol Special District, HECO will install its lines underground and the costs of such undergrounding would be paid for by all customers, subject to PUC approval.

The question of social equity, as it relates to both the neighborhood directly affected by the transmission lines and poles and to the community at large, will continue to be an unresolved issue.

Chapter 7
Bibliography

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List of Preparers

A. Hawaiian Electric Company, Inc., Project Team:

Patrick A. Calizar, senior civil/structural engineer, Structural Section, Transmission Systems Division

Francis K. Hirakami, senior electrical engineer, Transmission Section

Ken Morikami, project manager, Project Management Division, Facilities and Project Management Department

Wendy Oda, land agent, Land and Rights-of-Way Division

B. CH2M HILL Consulting Team:

Preparers of this state environmental assessment:

Marie Gettel, document editor-production manager

James Irish, environmental planner

Paul V. Luersen, project manager, senior reviewer, environmental planner

Preparers of technical studies and the Waiau-CIP 138 kV Transmission Line Part 1 Routing Report:

Paul V. Luersen, CH2M HILL: project manager, principal author

Winona Char, Char and Associates: biological resource assessment

Robert T. Chuck, Manager, Pacific Islands Office, CH2M HILL: water resources

Jim Creighton, Creighton and Creighton: public involvement planning, training, and meeting facilitation

Lillian Dixson, CH2M HILL: word processing

Kristi Dye, CH2M HILL: word processing

John Everingham, former CH2M HILL: former project manager

Dayton Fraim, P.E., Geolabs, Hawaii, Inc.: geotechnical resource analysis

Joan Hughey, CH2M HILL: word processing

Clyde Kanehiro, CH2M HILL: mapping and graphics

Joseph Kennedy, Archaeological Consultants of Hawaii, Inc.: cultural resource assessment

Herbert M. Lee, Lee Communications: community and government relations, public involvement

Andrew O. Linehan, CH2M HILL: environmental impact analysis, land jurisdiction and regulation, and environmental permits and policies

A. Lono Lyman, CH2M HILL: consultant on public affairs, environmental concerns, and permits

Bennett Mark, CH2M HILL: environmental impact analysis, land jurisdiction and regulation, and environmental permits and policies

Peggy A. Montgomery, CH2M HILL: mapping and graphics

Nancy E. Olmsted, former CH2M HILL: land use analysis, impacts on air, noise, water, earth, biological resources, and public involvement

Gordon Ormsby, CH2M HILL: transmission alternatives

Tom Packard, EDAW: visual simulations

Brent Schultz, CH2M HILL: mapping and graphics

Marcy S. Schwartz, CH2M HILL: public involvement program design; newsletter author

Mike Silva, Enertech Consultants: electric and magnetic field measurements and analysis

Tamara West Smith, CH2M HILL: editor and coordinator of report production

Eric Zigas, EDAW: visual resource evaluation and impacts analysis

Acronyms and Abbreviations

ac	alternating current
AES-BP	Applied Energy Services–Barber's Point
Btu	British thermal unit
CIP	Campbell Industrial Park
CZM	Coastal Zone Management
cB	decibel
dBA	decibel A-weighted
DLNR	Department of Land and Natural Resources
EA	environmental assessment
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electric and magnetic fields
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
GO-6	PUC General Order No. 6
H-Power	Honolulu Resource Recovery Venture
HECO	Hawaiian Electric Company, Inc.
HERS	Hawaiian Electric Renewable Systems
HPFF	high-pressure fluid-filled
IITRI	Illinois Institute of Technology Research
kV	kilovolt

Acronyms and Abbreviations
(Continued)

kV/m	kilovolts per meter
LPFF	low-pressure fluid-filled
mG	milliGauss
msl	mean sea level
MW	megawatt
NESC	National Electric Safety Code
OR&L	Oahu Railway and Land Company
ppb	parts per billion
PUC	Public Utilities Commission
RF	radio frequency
ROW	right-of-way
RTS	rapid transit system
v/m	volts per meter

Appendix A

Consultation during Preparation of the Draft Environmental Assessment

List of Agencies and Individuals:
Request Mailed for Environmental Assessment Consultation

Federal

U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 50004
300 Ala Moana Boulevard
Honolulu, Hawaii 96850

U.S. Army Corps of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, Hawaii 96858

U.S. Department of the Interior
Fish and Wildlife Service
P.O. Box 50167
300 Ala Moana Boulevard
Honolulu, Hawaii 96850

U.S. Department of the Interior
National Park Service
P.O. Box 50165
300 Ala Moana Boulevard
Honolulu, Hawaii 96850

U.S. Department of Commerce
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822

U.S. Department of Transportation
Federal Aviation Administration
P.O. Box 50109
300 Ala Moana Boulevard
Honolulu, Hawaii 96825

Directorate of Facilities Engineering
Department of the Army
U.S. Army Support Command Hawaii
Attn: Environmental Management Office
Fort Shafter, Hawaii 96858-5000

Chief, Engineering and
Environmental Planning Division
Directorate of Civil Engineering
Department of the Air Force
Headquarters, 15th Air Base Wing (PACAF)
Hickam Air Force Base, Hawaii 96853-5000

Facilities Engineer
Headquarters Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860-5020

District Chief
U.S. Department of Interior
Geological Survey
Water Resources Division
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawaii 96813-5412

Manager
Environmental Protection Agency
Pacific Islands Contact Office
300 Ala Moana Boulevard, Room 1302
Honolulu, Hawaii 96850

The Honorable Patsy Mink
Prince Kuhio Federal Bldg. Suite 5104
300 Ala Moana Blvd.
Honolulu, HI 96850

Commanding Officer, Code OOH
U. S. Department of the Navy
Naval Air Station
Barbers Point, Hawaii 96862-5050

State

Department of Accounting
and General Services
Division of Public Works
P.O. Box 119
Honolulu, Hawaii 96810

Department of Agriculture
1428 South King Street
Honolulu, Hawaii 96814

Department of Business,
Economic Development and Tourism
220 South King Street, #1100
Honolulu, Hawaii 96813

Department of Business,
Economic Development and Tourism
Energy Division
355 Merchant Street, Room 110
Honolulu, Hawaii 96813

Department of Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawaii 96805

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

State Historic Preservation Division
Department of Land and Natural Resources
33 South King Street, Sixth Floor
Honolulu, Hawaii 96813

Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Department of Health
Environmental Management Division
500 Ala Moana Boulevard
Five Waterfront Plaza, Suite 250
Honolulu, Hawaii 96813

Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Office of State Planning
250 South Hotel Street, 4th Floor
Honolulu, Hawaii 96813

Office of Hawaiian Affairs
711 Kapiolani Boulevard, suite 500
Honolulu, Hawaii 96813

University of Hawaii
Water Resources Research Center
2540 Dole Street, Holmes Hall 283
Honolulu, Hawaii 96822

University of Hawaii
Environmental Center
2550 Campus Road, Crawford 317
Honolulu, Hawaii 96822

Department of Budget and Finance
Housing Finance and Development Corporation
677 Queen Street, Suite 300
Honolulu, Hawaii 96813

The Honorable Annelle Amaral
House of Representatives
Leiopapa A Kamehameha Bldg. #806
Honolulu, Hawaii 96813

The Honorable Michael Crozier
State Senate
Leiopapa A Kamehameha Bldg. #408
Honolulu, Hawaii 96813

City and County of Honolulu

Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Building Department
650 South King Street
Honolulu, Hawaii 96813

Department of Housing
and Community Development
650 South King Street
Honolulu, Hawaii 96813

Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Department of Parks and Recreation
650 South King Street
Honolulu, Hawaii 96813

Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Department of Transportation Services
650 South King Street
Honolulu, Hawaii 96813

Police Department
1455 South Beretania Street
Honolulu, Hawaii 96814

The Honorable John DeSoto
Councilmember
City Council
Honolulu Hale
Honolulu, Hawaii 96813

Other Groups

Hawaii Audubon Society
212 Merchant Street, Suite 320
Honolulu, Hawaii 96813

Historic Hawaii Foundation
Preservation Planning Committee
119 Merchant Street
Honolulu, Hawaii 96813

Jane A. Ross, Chair
Ewa Neighborhood Board No. 23
92-783 Laaloa Place
Ewa Beach, Hawaii 96707

Henry Eng, AICP
Manager, Land Planning
The Estate of James Campbell
828 Fort Street Mall, Suite 500
Honolulu, Hawaii 96813

Hawaiian Independent Refineries, Inc.
91-325 Komohana St.
Ewa Beach, Hawaii 96706

Harold Hashiro, Vice President of
Distribution and Engineering
BHP Petroleum, The Gas Company
515 Kamakee Street
P.O. Box 3379
Honolulu, Hawaii 96842

Operations Superintendent
Chevron U. S. A. Products Company
P.O. Box 29789
Honolulu, Hawaii 96820-2189

Warren Haruki, President
GTE Hawaiian Tel
P.O. Box 2200
Honolulu, Hawaii 96841

Jim Wriston
Oahu Sugar Company
P.O. Box 0
Waipahu, Hawaii 96797

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

August 26, 1992

REPLY TO
ATTENTION OF:

Planning Division

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Thank you for the opportunity to review and comment on the environmental assessment preparation for the proposed Waiau-Campbell Industrial Park 138 KV Transmission Line, Part 1 - CIP Substation to Ewa Nui Substation, Ewa, Oahu. The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. A DA permit is required for utility line crossing of waters of the United States. Formal jurisdictional determination will be made when conceptual plans for stream/gulch crossings are submitted to Operations Division for review.

b. According to the Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM), Panel 150001-0135-C, dated September 28, 1990 (copy enclosed), the project area is located in Zone AH (areas inundated by the 100-year flood, with base flood elevations ranging from 49 to 59 feet above mean sea level) and Zone D (areas in which flood hazards are undetermined).

Sincerely,

for Ray H. Jyo, P.E.
Acting Director of Engineering

Enclosure

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- ZONE A — No base flood elevations determined.
- ZONE AE — Base flood elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- ZONE X — Areas determined to be outside 500-year flood plain.
- ZONE D — Areas in which flood hazards are undetermined.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- 13 — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet where Uniform Within Zone*
- RM7X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY AND COUNTY OF
HONOLULU,
HAWAII

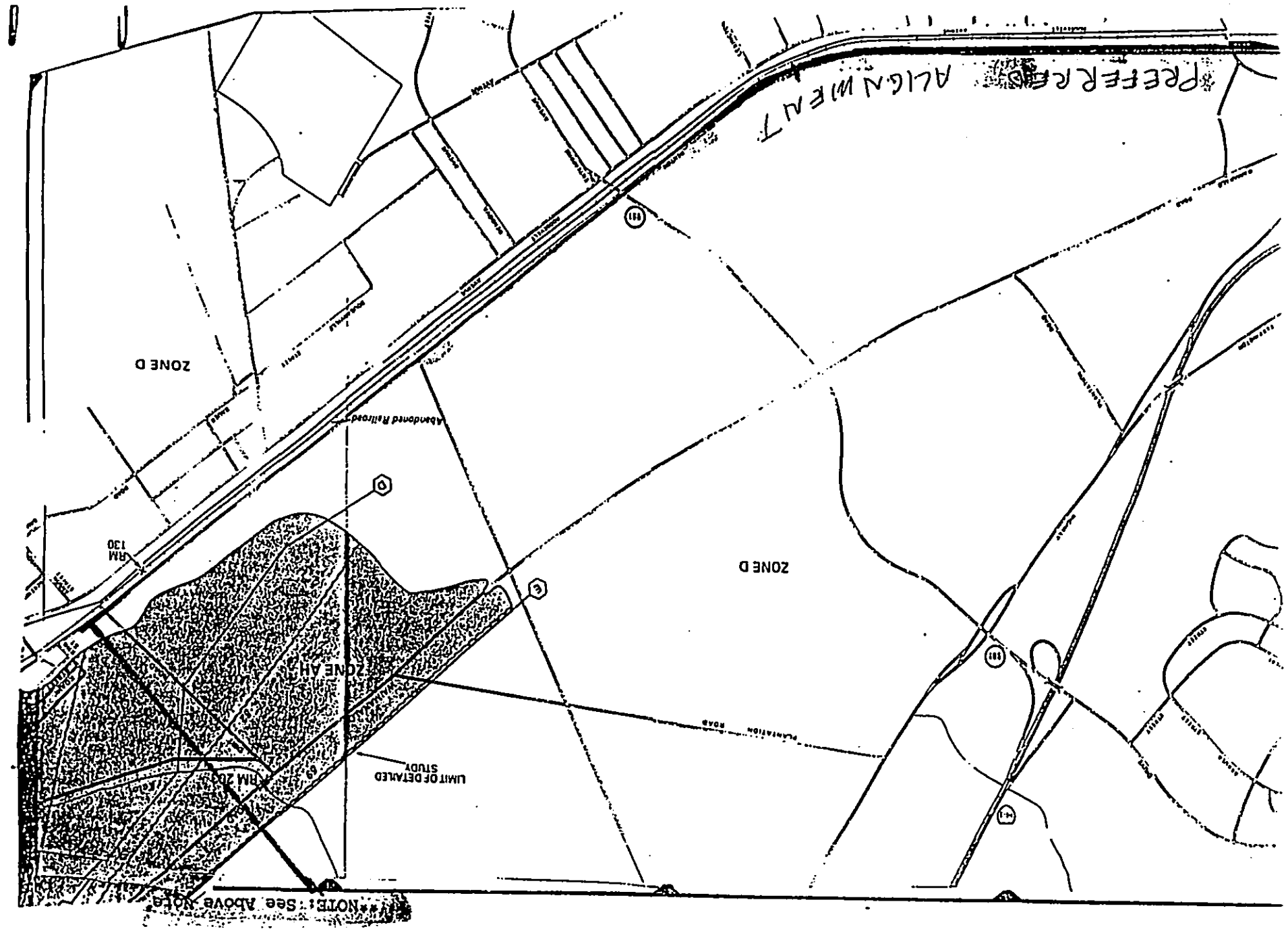
PANEL 135 OF 135
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
150001 0135 C

MAP REVISED:
SEPTEMBER 28, 1990

Federal Emergency Management Agency



Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Ray H. Jyo, P.E.
Acting Director of Engineering
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Ft. Shafter, HI 96858-5440

Dear Mr. Jyo:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

The EA will show the 100-year flood zones noted in your letter. Plans of the project will be sent to the Operations Division for review to determine if a DA permit is required.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Office
P.O. Box 50167
Honolulu, Hawaii 96850

August 12, 1992

Mr. Paul Luersen
Senior Project Manager
CH_2M Hill
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen,

This responds to your August 3, 1992 request for a list of endangered and threatened species of plants and animals that may be found in the vicinity of the proposed Waiau-Campbell Industrial Park; specifically, the area under consideration is the Part 1, CIP Substation to Ewa Nui Substation, section.

We have reviewed the information you provided in addition to species data contained in our files. To the best of our knowledge, there are no listed or proposed endangered or threatened species of plants or animals which would be expected to be found in the vicinity of your project, nor would any such species be affected by your proposed action.

Thank you for your concern for listed species. If we can be of any further assistance, please contact us again.

Sincerely yours,

Brooks Harper

Brooks Harper
Acting Field Supervisor
Pacific Islands Office

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Brooks Harper, Acting Field Supervisor
Pacific Islands Office
U.S. Dept. of the Interior
Fish and Wildlife Service
P.O. Box 50167
Honolulu, HI 96850

Dear Mr. Harper:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15TH AIR BASE WING (PACAF)
HICKAM AIR FORCE BASE, HAWAII 96853-5000

21 AUG 1992

REPLY TO
ATTN OF: 15 CES/DEV

SUBJECT: Request for Comments, Environmental Assessment Preparation for the Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1--CIP Substation to Ewa Nui Substation

TO:
CH2M HILL
1585 Kapiolani Blvd, Suite 1312
Honolulu HI 96814-4530

1. Thank you for the opportunity to review the Hawaiian Electric Company, Inc. proposal to construct two transmission lines from Campbell Industrial Park to the Ewa Nui Substation. The proposed project will not affect US Air Force interests. We, therefore, do not have any comments at this time.

2. If you have any questions, please contact Mr Jack Yamauchi, 449-7518.

RICHARD K. HANAOKA
Chief, Environmental Flight
Directorate of Civil Engineering

CH2M HILL
Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Richard K. Hanaoka, Chief
Environmental Flight
Directorate of Civil Engineering
Dept. of the Air Force
Headquarters 15th Air Base Wing (PACAF)
Hickam Air Force Base, HI 96853-5000

Dear Mr. Kanaoka:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO:
11011
Ser N4(232)/3082
14 SEP 1992

Mr. Paul Luersen
Senior Project Manager
CH2M HILL
1585 Kapiolani Boulevard
Suite 1312
Honolulu, HI 96814-4530

Dear Mr. Luersen:

WAIAU-CAMPBELL INDUSTRIAL PARK 138 KV TRANSMISSION LINES
PART 1-CIP SUBSTATION TO EWA NUI SUBSTATION

We have reviewed the project background forwarded by your letter of August 3, 1992 and transmit our comments for consideration in preparing the environmental assessment (EA) for the subject project (enclosures (1) and (2)).

It is our understanding that the EA is being prepared for the State of Hawaii to grant easements to HECO for portions of the transmission line crossing State land.

This EA could also provide sufficient information for the Navy to grant an aerial easement over the affected Navy parcel at the main gate to Naval Air Station, Barbers Point. As stated in enclosure (1), the Navy could utilize a categorical exclusion for the grant of easement and neither an EA or environmental impact statement (EIS) would be required for the Navy's action. However, as there are exceptions to the use of categorical exclusions, the EA should address the following which would preclude use of a categorical exclusion if the proposed action:

a. Would affect public health or safety;

b. Involves an action that may affect wetlands, endangered or threatened species, historical or archeological resources, or hazardous waste sites;

c. Involves effects on the human environment that are highly uncertain, involve unique or unknown risks, or which are scientifically controversial;

d. Establishes precedents or makes decisions in principle for future actions with significant effect; or

e. Threatens a violation of Federal, state, or local law or requirements imposed for protection of the environment.

Our point of contact on these comments is Mr. Bill Liu, Facilities Engineer, who may be reached at 471-3324.

Sincerely,

W. K. LIU
Assistant Base Civil Engineer
By direction of
the Commander

Encl:
(1) PACNAVFACENGCOM (Code 24)
memo 2411/2120J of 21 Aug 92
(2) NAS Barbers Point ltr
Ser 00H/2492 of 14 Aug 92

11011
2411/2120J
21 Aug 92

MEMORANDUM

From: 24
To: 23 JHC 8/25 232

Subj: COMMENTS ON SCOPE OF ANALYSIS FOR EA FOR HAWAIIAN ELECTRIC COMPANY (HECO) WAIAU-CAMPBELL INDUSTRIAL PARK 138KV PART 1 PROJECT

Ref: (a) NAVBASE PEARL Memo of 10 Aug 92
(b) NAS BARPT ltr 11011 Ser 00H/1667 of 21 May 92
(c) PHONCON HECO Ms. Wendy Oda/PACNAVFACENGCOM Mr. E. Chock of 13 May 92

Encl: (1) TMK 9-1-16
(2) Sketch, Lot 350-C

1. Your note on reference (a) requested review comments regarding CH2M Hill request for comments on scoping the analysis needed for an environmental assessment of the subject project.

2. The project affects Navy property at NAS Barbers Point by an overhead crossing of the transmission line in the vicinity of the main gate. HECO has requested an aerial easement over the parcel (Lot 350-C, TMK 9-1-16:26) indicated on enclosures (1) and (2).

3. By reference (b), NAS Barbers Point advised that the activity has no objection to the grant of easement, provided the right of entry and subsequent grant of easement limit HECO access for construction and maintenance affecting the Navy parcel to non-peak traffic hours. Also, by reference (c), HECO was informally advised that we propose to utilize a Navy category exclusion (CATEX 18) for this easement grant, provided HECO obtains from the State Historic Preservation Officer a finding that the grant of easement has no effect on the adjacent historic railway right-of-way.

D. PACHT

ENCL (1)

DEPARTMENT OF THE NAVY
NAVAL AIR STATION
BARBERS POINT, HAWAII 96862-5050

11010
Ser 00H/2492
14 August 1992

From: Commanding Officer, Naval Air Station, Barbers Point
To: Commander, Naval Base, Pearl Harbor (Code 00F2)

Subj: WAIAU-CAMPBELL INDUSTRIAL PARK 138 kV TRANSMISSION LINES, PART 1-CIP SUBSTATION TO EWA NUI SUBSTATION

Ref: (a) CH2M Hill ltr (P. Luersen) of 3 Aug 92
(b) Waiau-Campbell Industrial Park 138 kV Lines, Part 1 and Ewa Nui Substation Background

1. In response to request for comments contained in reference (a), please ensure that the official response notes construction height limitations cited in FAR 77.28. It appears that HECO's proposed 105-foot maximum pole height (AGL) will remain beneath FAR 77.28 limitations since maximum ground elevation is approximately 40-feet over the proposed route.

2. Likewise, while reference (b) para 3.2 addresses construction-free roadways during peak commute/traffic hours, please underscore our need to maintain Ft Barrette Rd/Barbers Point access road at NAS Barbers Point's main gate free from construction obstructions during peak hours. Coordination with NAS Barbers Point Security Manager, Mr. J. Reese at 684-0656 regarding work which may impede traffic flow at the main gate is desirable.

3. Thank you for entertaining these comments.

M. R. IMMINGS
By direction

ENCL (2)

Engineers
Planners
Economists
Scientists

September 17, 1992

PDX22957.A2.SA

W.K. Liu (Code 00F2)
Assistant Base Civil Engineer
Naval Base Pearl Harbor
P.O. Box 110
Pearl Harbor, HI 96860-5020

Dear Mr. Liu:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

The EA will address the concerns mentioned in your letter, including the topics of construction height limits near Barbers Point Naval Air Station; traffic; historic and archaeological resources; biological resources; and public health and safety.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL · Honolulu Office · 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 · 808.943.1133 Fax 808.941.8225

HNL56/025.51

United States Department of the Interior

GEOLOGICAL SURVEY

WATER RESOURCES DIVISION
677 Ala Moana Blvd., Suite 415
Honolulu, Hawaii 96813

August 5, 1992

Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1-CIP Substation to Ewa Nui Substation, Island of Oahu

The staff of the U. S. Geological Survey, Water Resources Division, has reviewed the subject environmental assessment preparation and has no comments to make at this time.

Sincerely,

William Meyer
District Chief

CH2M HILL Engineers Planners Economists Scientists

September 14, 1992

PDX22957.A2.SA

William Meyer, District Chief
U.S. Department of the Interior
Geological Survey
Water Resources Division
677 Ala Moana Blvd., Suite 415
Honolulu, HI 96813

Dear Mr. Meyer:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL HNL56/017.51 Honolulu Office 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 808.943.1133 Fax 808.941.8225

PATSY T. MINK
SECOND DISTRICT, HAWAII

WASHINGTON OFFICE:
2135 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-1102
(202) 225-4906
FAX (202) 225-4987

DISTRICT OFFICE:
5104 PRINCE KUHIO FEDERAL BUILDING
P.O. BOX 50124
HONOLULU, HAWAII 96850-4977
(808) 541-1986
FAX (808) 538-0233

Congress of the United States
House of Representatives
Washington, DC 20515-1102

COMMITTEE ON EDUCATION AND LABOR
SUBCOMMITTEES:
ELEMENTARY, SECONDARY & VOCATIONAL EDUCATION
POSTSECONDARY EDUCATION
LABOR-MANAGEMENT RELATIONS

COMMITTEE ON GOVERNMENT OPERATIONS
SUBCOMMITTEES:
HUMAN RESOURCES AND INTERGOVERNMENTAL RELATIONS
GOVERNMENT INFORMATION, JUSTICE AND AGRICULTURE

September 1, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M HILL - Honolulu Office
1585 Kapiolani Boulevard
Suite 1312
Honolulu, HI 96814

Dear Mr. Luersen:

Thank you for affording me an opportunity to comment on the scope of analysis for the Environmental Assessment (EA) to be prepared in connection with the construction and operation of two 138 kV transmission lines to interconnect the Campbell Industrial Park Substation and the planned Ewa Nui Substation in the Ewa District, Oahu.

I suggest that it would be very much in the public interest for the EA to include the following matters:

(1) An explanation as to how a reliable EA can be made with reference to the 1,100 acres of State-owned land before the master plan for that tract has been completed by the Hawaii Housing Finance and Development Corporation. I suggest that it is imperative that there be accurate knowledge of the infrastructure to be developed, and the locations of the many homes to be constructed on the tract before a realistic EA can be made.

(2) An explanation as to how the April 3, 1991 Hawaii Department of Health policy relating to electromagnetic fields from electric power lines will be implemented. I understand the essence of this policy is that a "prudent approach" should be taken in siting new facilities, meaning that where technically feasible and practical, public exposure should be minimized.

(3) A full and detailed discussion of what were termed "Unresolved Issues" in HECO's Draft Environmental Impact Statement for Part 2 of the Waiau-Campbell Industrial Park 138 kV Transmission Line Project, namely: the issue of public health effects from electric and magnetic fields and the question of social equity as it relates to both the neighborhood directly affected by the transmission lines and poles, and to the community at large. (See Draft EIS, p. 1-6.)

(4) A complete explanation of HECO's established policy and practice governing when power lines will be put underground and the associated costs passed on to the utility's rate payers.

(5) At the public hearing on February 4, 1992 on Part 2 of the Waiau-Campbell Industrial Park 138 kV Transmission Line Project, a spokesman for HECO stated, "... we leave the responsibility of determining health impacts to the State Department of Health as they are better equipped to evaluate this potential." (See HECO's "Notes" of said meeting which were distributed to the public, p. 7.) The EA should contain a full and detailed explanation as to how coordination is effected between HECO and the Department of Health, including a written commitment from the Department of Health as to its role and responsibilities on this problem, in order that an adequate evaluation may be made of the sufficiency of this approach to such a critically important question which so gravely affects the welfare of the public.

(6) A detailed statement of the expected electric and magnetic fields should be provided, together with an explanation as to how the accuracy of such calculations will be determined. This should include a statement as to whether HECO intends to do pre-construction testing and post-construction testing. If such testing is not to be made, a full explanation should be included. If such testing is to be conducted, a full explanation of when, where and how should be given. It should also be established how the public will be able to determine the reliability of such testing and what recourse the public will have if the testing shows that corrective action is necessary.

(7) There should be a full explanation of all recommendations made by consultants relating to reducing the impacts of electric and magnetic fields. This should be accompanied by a statement as to which of the recommendations are being implemented and an explanation as to why the other recommendations are being rejected.

(8) A full explanation as to the cumulative impacts of electric and magnetic fields when referenced future improvements are made to the system. This is especially needed in connection with the new Ewa Nui Substation and the transmission lines after that substation has been improved.

(9) An explanation of the status of the development of super conductor transmission lines for high voltage electrical lines.

Again, thank you for the opportunity to submit these comments. I trust that you will carefully consider them in preparing the EA.

Very truly yours,

Patsy T. Mink

PATSY T. MINK
Member of Congress

CH2M HILL
Engineers
Planners
Economists
Scientists

October 14, 1992

Honorable Patsy T. Mink
Member of Congress
5104 Prince Kuhio Federal Building
P.O. Box 50124
Honolulu, Hawaii 96850-4977

Dear Congresswoman Mink:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1, Project

Thank you for taking time to comment on the scope of analysis for the State Environmental Assessment (EA) being prepared in connection with Hawaiian Electric Company's proposed 138kV transmission lines and substation in the Ewa District of Oahu.

We will address in the EA the concerns raised in your letter dated September 1, 1992. The following are brief responses to the nine points raised in your letter.

(1) During meetings over the past two years with County and State agencies, it was recognized by all involved that the subject transmission lines were required to be in service by June, 1994. Therefore, to select an alignment in time to meet the required service date, it would have been impractical to wait the several years it would take for the State to prepare and approve a master plan for the 1,100 acres it is acquiring from Campbell Estate. Because the intent of the acquisition is to preserve agricultural uses (Oahu Sugar Company still cultivates the area) and reserve land for future urban development (sometime after 1995 and beyond), all parties agreed too little would be known about the area's development soon enough to have a significant influence on selecting an alignment for the transmission lines. (The Hawaii Housing Finance and Development Corporation (HFDC) has a preliminary list of potential land uses for the area, but it has not yet decided on the locations for the uses.)

Consequently, it was agreed that the prudent approach is to locate the transmission lines along an existing natural boundary; such a feature would also be considered a boundary during the master planning and development phases for the area. The only natural boundary in the 1,100 acres is Kaloi Gulch; and this gulch was selected as the corridor within which the transmission lines would be located.

CH2M HILL
cip1ea7
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

Early recognition of the project's alignment gives HFDC the opportunity to prepare a master plan that locates residential uses away from the gulch and transmission lines. The gulch/transmission line corridor could be used for a number of other necessary land uses (as discussed during the meetings) such as a regional drainageway and a greenbelt. Streets for local traffic could be located on either or both sides of the gulch. Such uses are compatible with the existing drainage purpose of Kaloi Gulch and the future transmission lines.

(2) The EA will discuss how HECO is implementing for this project the "prudent avoidance" approach set forth in the April 3, 1991 Hawaii State Department of Health policy on electric and magnetic fields. The steps taken by HECO include:

- **Avoidance of populated areas.** The proposed transmission lines' alignment is the one alternative that effectively avoids existing populated areas (the alignment is predominantly in areas currently used for sugar cane cultivation). It also avoids areas where proposed plans for urban development are known (e.g. Kapolei). In the vicinity of the 1,100 acres around Kaloi Gulch where development plans have not been prepared, HECO, in consultation with the affected parties, elected to follow a natural boundary as discussed above.

- **Use of existing utility corridors.** The proposed transmission lines' alignment uses existing utility easements and rights-of-way along the mauka edge of Barbers Point Naval Air Station and Farrington Highway. These corridors have utility poles with 46kV and 12kV lines. Use of these corridors provides an opportunity to consolidate the 46kV lines and 138kV lines on one set of poles and to reduce EMF exposure levels through low-reactance or unlike phasing.

- **Use of low-reactance or unlike phasing.** As recommended by the project's EMF consultant (Enertech Consultants), HECO will employ this technological procedure to reduce the exposure levels of electric and magnetic fields. HECO has requested its design engineers to design for this technology. The EA will discuss this technology.

- **Refinements to design.** HECO's design engineers are refining the pole configuration and arrangement of lines to further reduce EMF exposure levels.

(3) The EA will contain a discussion of unresolved issues; namely, the public health effects of electric and magnetic fields, and the advantages and disadvantages of placing 138kV transmission lines underground (e.g., cost, rate impact on customers, visual mitigation, effect on EMF exposure levels).

(4) The EA will describe HECO's policy concerning the placement of 138kV transmission lines underground and the associated cost impact on customers. As a regulated utility, HECO is required to provide reliable electric service at reasonable cost to its customers. In general, HECO's tariff as authorized by the Hawaii Public Utilities Commission (PUC) is based on an overhead electric system. If a private entity, such as a residential developer, requests underground facilities and is willing to pay for the additional costs to place lines underground, then HECO will place the lines underground. In certain specific locations where lines are required to be underground, such as in the Hawaii Capitol Special District, HECO will install its lines underground and the costs of such undergrounding would be paid for by all customers, subject to PUC approval.

(5) HECO coordinates with the Hawaii Department of Health on EMF issues by consulting with the DOH on each project. For the subject EA, CH2M HILL sent a letter to the DOH requesting their comments on what to address in the EA. The DOH responded by stating that the Department has no comment at this time. The DOH will be sent a copy of the EA containing the EMF analysis for review and comment. The DOH's policy on EMF describes the Department's role and policy toward EMF issues. (A copy of the policy is attached.) One of the policy's implementing actions states that the DOH will continue to collect and evaluate research data on EMF in order to keep abreast of significant findings with public-health implications. It is also HECO's policy to financially support such research, monitor the research developments, keep people informed about EMF issues and to construct its facilities in a manner that is consistent with the DOH's policy of "prudent avoidance". A copy of HECO's EMF Policy Statement, dated 3/31/92, is attached.

(6) The EA will contain calculations of expected electric and magnetic field exposure levels. HECO will implement a program for pre-construction and post-construction measurements of actual EMF levels. This program will be done in consultation with members of the community to determine the testing protocol and measurement sites. The results of the tests will be made available to the community and the DOH. As for corrective action, The DOH states in its EMF Policy that, "The existing research data are inconclusive and not sufficient enough for adequate, accurate risk assessment." and that, "Too little is presently known to be able to determine where or what rules would provide useful public-health protection." In the absence of a scientific foundation for health-based EMF standards, there is no ability to define appropriate

corrective action. As you are aware, the recent Energy Bill passed by the U.S. Congress calls for the establishment of an Electric and Magnetic Fields Interagency Committee to coordinate the efforts of the Federal Government with respect to research, measurement and management of electric and magnetic fields.

(7) The EA will contain all recommendations by the EMF consultant concerning the reduction of electric and magnetic field exposure levels. HECO has agreed to implement all EMF recommendations.

(8) The EA will describe EMF exposure levels for the transmission lines when fully developed. The EMF exposure levels for the Ewa Nui Substation are based on actual EMF measurements taken at the Campbell Industrial Park Substation and other substations.

(9) Concerning your question on the status of super conductor transmission lines, a recent publication from the Electric Power Research Institute (EPRI) stated, "Even if high-temperature superconductors live up to expectations, in all likelihood the first utility industry applications--probably underground transmission cables--will not see service until well after the year 2000." EPRI this year issued a research contract to Pirelli Cable Corporation to work with the American Superconductor Corporation to develop superconducting conductors for high anperages; but no time table has been established for completion of that research or for the commercial availability of the conductors required for 138kV transmission lines. Therefore, HECO does not expect the technology to be commercially available for at least ten to fifteen years. The proposed Waiau-CIP 138kV Transmission Lines, Part 1, Project has a service date of June, 1994.

Again, thank you for submitting comments on what issues to discuss in the project's EA. When the Draft EA is available for public and agency review, we will send a copy to your office.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cip1ea7

cc: Ken Morikami, HECO Project Manager
Sho Serikaku, DLNR
Michele Otake, HFDC

Enclosures: Hawaii Department of Health EMF Policy and HECO EMF Policy Statement

cip1ea7

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
HEER OFFICE

DOH POLICY RELATING TO ELECTROMAGNETIC FIELDS FROM ELECTRIC POWER LINES

April 3, 1991

A PRUDENT APPROACH IS NEEDED AT THIS TIME TO REGULATE ELECTRIC AND MAGNETIC FIELDS AROUND LOW-FREQUENCY ELECTRIC POWER FACILITIES, INCLUDING HIGH-VOLTAGE TRANSMISSION LINES. THE EXISTING RESEARCH DATA ARE INCONCLUSIVE AND NOT SUFFICIENT ENOUGH FOR ADEQUATE, ACCURATE RISK ASSESSMENT. HOWEVER, THE DATA SUGGEST THAT A "PRUDENT AVOIDANCE" APPROACH TO SITING NEW FACILITIES IS APPROPRIATE. WHERE TECHNICALLY FEASIBLE AND PRACTICAL, PUBLIC EXPOSURES SHOULD BE MINIMIZED. TOO LITTLE IS PRESENTLY KNOWN TO BE ABLE TO DETERMINE WHERE OR WHAT RULES WOULD PROVIDE USEFUL PUBLIC-HEALTH PROTECTION.

Implementing Actions:

(a) All newly-installed power lines should be constructed with engineering controls to reduce exposure (for example, the "delta" configuration).

(b) The Department of Health will continue to collect and evaluate research data on electromagnetic fields in order to be aware of significant findings with public-health implications.

HAWAIIAN ELECTRIC COMPANY

EMF POLICY STATEMENT

Hawaiian Electric Company considers the health and safety of its customers, employees, and the general public its highest priority. The company recognizes its responsibility to deliver electric service in a manner that is safe, reliable, and environmentally sound. In accordance with its Corporate Environmental Principles, HECO is addressing the issue of electric and magnetic fields (EMF), which are found wherever electricity is produced, transmitted or used.

For many years, scientists have investigated whether EMF produce harmul effects. The predominant view of the scientific community is that the evidence gathered thus far does not demonstrate that such fields adversely affect human health. No conclusive, convincing and consistent relationship between exposure to EMF and adverse health effects has been demonstrated. This is reflected in a policy statement by the Hawaii Department of Health noting that "the existing research data are inconclusive and not sufficient for adequate, accurate risk assessment." (April 3, 1991)

Recent epidemiological studies have suggested a need for additional research. That research is underway, with financial support from Hawaiian Electric Company through its membership in the Electric Power Research Institute. HECO will continue to support and monitor these studies as they progress and will design and construct its facilities in a manner that will minimize EMF where technically feasible and economically reasonable.

HECO will keep its customers and employees informed on the EMF issue and assist those who desire more knowledge in contacting appropriate sources of information or professional services.

3/31/92

JOHN WAIHEE
GOVERNOR

RUSSEL S. NAGATA
COMPTROLLER

ROBERT P. TAKUSHI
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
DIVISION OF PUBLIC WORKS
P. O. BOX 119, HONOLULU, HAWAII 96810

LETTER NO. (P)1773.2

SEP 2 1992

CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Attention: Mr. Paul Luersen

Gentlemen:

Subject: Hawaiian Electric Company, Inc. (HECO)
138 kV Transmission Line, Part 1
CIP Substation to Ewa Nui Substation

Thank you for the opportunity to review the subject project's preliminary document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

GORDON MATSUOKA
State Public Works Engineer

RY:jy

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Gordon Matsuoka
State Public Works Engineer
State of Hawaii
Dept. of Accounting and General Services
Division of Public Works
P.O. Box 119
Honolulu, HI 96810

Dear Mr. Matsuoka:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

JOHN WAIHEE
Governor
MUFI HANNEMANN
Director
BARBARA KIM STANTON
Deputy Director
RICK EGGED
Deputy Director
TAKESHI YOSHIHARA
Deputy Director

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 PHONE: (808) 587-3800 FAX: (808) 587-3820

August 17, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Waiau-Campbell Industrial Park 138 kV Transmission Lines,
Part 1--CIP
Substation to Ewa Nui Substation
Island of Oahu

We wish to inform you that we have no comments to offer on the subject Environmental Assessment Preparation. We are returning the EAP with no comments.

Thank you for the opportunity to review the document.

Sincerely,

for Mufi Hannemann

MHK:hkeis49

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Mufi Hannemann
Dept. of Business, Economic
Development & Tourism
Energy Division
335 Merchant St., Room 110
Honolulu, HI 96813

Dear Mr. Hannemann:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR

MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE

ROY C. PRICE, SR.
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

PHONE (808) 734-2161

August 25, 1992

TO: Mr. Paul Luersen, AICP
Senior Project Manager
CH2M HILL

FROM: Roy C. Price, Sr.
Vice Director of Civil Defense

RCP 8/25/92

SUBJECT: WAIAU-CAMPBELL INDUSTRIAL PARK (CIP) 138 kV TRANSMISSION LINES, PART 1--CIP ENVIRONMENTAL ASSESSMENT PREPARATION

We appreciate this opportunity to comment on the Environmental Assessment (EA) Preparation of the Waiau-Campbell Industrial Park (CIP) 138 kV transmission lines, Part 1--CIP Substation to Ewa Nui Substation, in the Ewa District on the island of Oahu.

We do not have any objections to the EA. The Civil Defense Division, Department of Defense, State of Hawaii, does not presently have any installed equipment that may be affected by this installation.

Our State Civil Defense planners and technicians are available to discuss this further if there is a requirement. Please have your staff call Mr. Mel Nishihara of my staff at 734-2161.

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Roy C. Price, Sr.
Vice Director of Civil Defense
State of Hawaii
Department of Defense
Office of the Director of Civil Defense
3949 Diamond Head Road
Honolulu, HI 96816-4495

Dear Mr. Price:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR

CHARLES T. TOGUCHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

August 14, 1992

Mr. Paul Luersen
Senior Project Manager
CH2M Hill
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

SUBJECT: Waiau-Campbell Industrial Park
138 kV Transmission Lines, Part 1
CIP Substation to Ewa Nui Substation

We have reviewed your proposal to construct two 138,000-volt transmission lines to connect the Campbell Industrial Park Substation and the planned Ewa Nui Substation.

We have the following comments to make regarding your proposal:

1. The alignment of the transmission lines appears to pass Barbers Point Elementary and the proposed high school in the Villages of Kapolei. The proposed elementary school site and intermediate school site also may be affected depending on the ultimate location within the development. We request that the lines be relocated away from all school sites. The lines should be aligned at the farthest point available when passing a school site.

2. The Department of Education (DOE), is greatly concerned about the location of high powered electric transmission lines and the electromagnetic radiation fields which are produced by the high voltage.

Since the association between exposure to magnetic fields and adverse health effects are not conclusive, the DOE requests that we take every possible precaution to protect the health of students and the school staff.

Should there be any questions, please call the Facilities Branch at 737-4743.

Sincerely,

Charles T. Toguchi
Superintendent

CTT:hy

cc: A. Suga
L. Chung

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Charles T. Toguchi, Superintendent
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, HI 96804

Dear Mr. Toguchi:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

We will address your concerns about the health effects of EMF in the EA. The measures HECO intends to use to reduce EMF exposure levels will be discussed in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL HNL56/017.51 Honolulu Office 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 808.943.1133 Fax 808.941.8225

JOHN WAIHEE
GOVERNOR
STATE OF HAWAII

HOALIKU L. DRAKE
CHAIRMAN
HAWAIIAN HOMES COMMISSION

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

August 31, 1992

Mr. Paul Luersen, AICP
CH2M Hill
1585 Kapiolani Boulevard
Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

SUBJECT: Waiau-Campbell Industrial Park 138 kV Transmission Lines, Island of Oahu

Thank you for the opportunity to participate in determining the scope of analysis for the environmental assessment which will be prepared for the subject project.

The proposed transmission lines will be routed through the 1,100 acres identified for acquisition by the State. Act 316, SLH 1992, Section 5(c) identifies 200 acres of this Proposed State Land Acquisition area for eventual transfer to the Department of Hawaiian Home Lands. Accordingly, this department has an interest in the site and this project. Please continue communications with us as a consulted party.

Should you have any questions, please contact Mr. Ben Henderson of our Planning Office at 586-3838.

Warmest aloha,

for Hoaliku L. Drake, Chairman
Hawaiian Homes Commission

HLD:BH:JC:asy

/2547L

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Hoaliku L. Drake, Chairman
Hawaiian Homes Commission
State of Hawaii
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Dear Mr. Drake:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

The EA will illustrate the alignment of the transmission lines relative to the State's acquisition area.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR OF HAWAII

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

REF:OCEA:SKK

FILE NO.: 93-084
DOC. ID.: 1384

SEP 9 1992

Mr. Paul Luersen, Senior Project Manager
CH2M Hill
1585 Kapiolani Blvd.
Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

SUBJECT: Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1 - CIP Substation to Ewa Nui Substation

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the materials you submitted and have the following comments.

Historic Preservation Division Comments:

A review of our records shows that the entire 6.8 mile transmission line route is on lands that have either been cultivated to sugar cane for many years or have been altered by road construction. There are no known historic sites along the route. Since it is extremely unlikely that either surface or subsurface sites remain, we believe that this project will have "no effect" on significant historic sites.

Division of Land Management Comments:

The State is still in the process of acquiring from Campbell Estate the 1100 acres of land over which the 138 kV Electrical Transmission line is proposed to be constructed. This acquisition is pending settlement with Oahu Sugar Company as to the continued use of the 1100 acres for sugar cane cultivation purposes.

Any damage to Oahu Sugar Company's facilities including any crop damage resulting from the construction of the transmission lines must be paid to Oahu Sugar.

Thank you for your cooperation in this matter. Please feel free to call Sam Lemmo at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

WILLIAM W. PATY

JOHN WAIHEE
GOVERNOR OF HAWAII

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

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

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

September 18, 1992

LOG NO.: 6000
DOC NO.: 0970t

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

SUBJECT: Environmental Assessment Preparation, Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1--CIP Substation to Ewa Nui Substation
Honouliuli, 'Ewa, O'ahu
TMK: 9-1 various

This responds to your letter of August 3, 1992. We commented to W. Mason Young, Land Management Administrator, Division of Land Management, Department of Land and Natural Resources as follows:

A review of our records shows that the entire 6.8 mile transmission line route is on lands that have either been cultivated to sugar cane for many years or have been altered by road construction. There are no known historic sites along the route. Since it is extremely unlikely that either surface or subsurface sites remain we believe that this project will have "no effect" on significant historic sites.

Please call Tom Dye at 587-0014 if you have any questions.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:amk

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

William W. Paty, Director
State of Hawaii
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Paty:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:

August 31, 1992

92-294/epo

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Environmental Assessment Preparation
Waiau-Campbell Industrial Park
138KV Transmission Lines, Part 1-CIP
Substation to Ewa Nui Substation
Island of Oahu

Thank you for allowing us to review and comment on the subject project. We have no comments to offer at this time.

Very truly yours,

for JOHN C. LEWIN, M.D.
Director of Health

CH2M HILL
Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

John C. Lewin, M.D.
Director of Health
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Dear Dr. Lewin:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:
91:PPE/4355mo

August 26, 1992

Mr. Paul Luersen, AICP
CH2M Hill
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Environmental Assessment Preparation for the Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1-CIP Substation to Ewa Nui Substation

We have reviewed your request and offer no additional comments to the environmental assessment scoping.

Thank you for the opportunity to comment.

Sincerely,

JOSEPH K. CONANT
Executive Director

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Joseph K. Conant, Executive Director
State of Hawaii
Dept. of Budget and Finance
Housing Finance and Development Corp.
677 Queen Street, Suite 300
Honolulu, HI 96813

Dear Mr. Conant:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

August 28, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Your Letter of August 3, 1992 Regarding the Environmental Assessment for the Waiau-Campbell Industrial Park 138 KV Transmission Lines, Part I - CIP Substation to Ewa Nui Substation, TMK: 9-1

Thank you for the opportunity to review and comment on the Waiau-Campbell Industrial Park 138 KV Transmission Lines, Part I project.

We have no objections to the project. The construction plans for the project should be submitted for our review and approval to coordinate the project with our existing water facilities.

If you have any questions, please contact Bert Kuioka at 527-5235.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Pure Water . . . man's greatest need – use it wisely

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Hayashida:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

We will address your concerns in the EA. HECO will submit construction plans for your review and approval.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

BUILDING DEPARTMENT

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

PB 92-769

August 11, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M HILL
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1
CIP Substation to Ewa Nui Substation

This is in response to your August 3, 1992 request regarding scope of analysis for the subject project's environmental assessment.

We have noted in the past, public concern over possible health hazards caused by electromagnetic fields generated by low-frequency high voltage power lines. We recommend that some attention be provided to this area in your environmental assessment for this project.

If there should be any questions regarding our reply, please contact Clifford Morikawa at telephone 527-6350.

Very truly yours,

HERBERT K. MURAOKA
Director and Building Superintendent

cc: J. Harada

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Herbert K. Muraoka
Director and Building Superintendent
Building Department
City and County of Honolulu
Honolulu Municipal Building
650 South King Street
Honolulu, HI 96813

Dear Mr. Muraoka:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

We will address your concerns about EMF in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

BENJAMIN B. LEE
CHIEF PLANNING OFFICER

ROLAND D. LIBBY, JR.
DEPUTY CHIEF PLANNING OFFICER

MH 08/92-2348

September 25, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M HILL
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

Dear Mr. Luersen:

Environmental Assessment (EA) Preparation for the Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1-CIP Substation to Ewa Nui Substation

In response to your request of August 3, 1992, we have reviewed the subject proposal and offer the following comments:

1. According to Section 1.1 General Configuration, page 3, ". . . In the middle segment along Kaloi Gulch from Renton Road to Farrington Highway, the new alignment will follow the eastern side of the gulch in a new easement 75 feet wide. . . ." This also describes the general alignment of the North/South Road as shown on the Ewa Development Plan Public Facilities Map.

   The State Department of Transportation, in fact, is in the process of preparing an Environmental Impact Statement to study the alignment of this roadway. Your EA should address how this closely parallel alignment will be coordinated and the extent of impacts on both projects.

2. The Draft EA should also address any potential flood hazard that may impact the proposed transmission line alignment through the Kaloi Gulch area.

3. The Draft EA should also address the electric and magnetic field (EMF) impacts to any existing or future residential, commercial, etc. land use areas along the proposed alignment. More specifically, what types of mitigative measures, i.e. buffers, setbacks, would be

proposed to mitigate potential EMF health hazards to habitable spaces within close proximity to the transmission lines?

Should there be any questions, please contact Matthew Higashida of our staff at 527-6056.

Sincerely,

BENJAMIN B. LEE
Chief Planning Officer

BBL:js

cc: Managing Director
Department of Housing and Community Development
Department of Transportation Services

CH2M HILL Engineers Planners Economists Scientists

October 2, 1992

PDX22957.A2.SA

Benjamin B. Lee, Chief Planning Office
Department of General Planning
City and County of Honolulu
Honolulu Municipal Building
650 South King Street
Honolulu, HI 96813

Dear Mr. Lee:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

The EA will address the North/South Road, potential flood hazards from Kaloi Gulch, EMF effects, and impacts to existing and future land uses.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

DONALD A. CLEGG
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

92-01769(ASK)

September 8, 1992

Mr. Paul Luersen
Senior Project Manager
CH2M Hill
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Waiau-Campbell Industrial Park
138 kV Transmission Lines, Part 1-CIP
Substation to Ewa Nui Substation

We have reviewed the project description for the proposed Waiau-Campbell Industrial Park 138 kV Transmission Lines and Ewa Nui Substation received in our office on August 4, 1992 and offer the following comments:

1. The Land Use Ordinance (LUO) categorizes 138 kV substations as a Utility installation Type B. These facilities are permitted in all zoning districts subject to approval of a Conditional Use Permit (CUP), Type 1. In addition, a waiver for structures which may exceed LUO height limits is required. A waiver request may be processed in conjunction with the CUP Type 1.

2. Based on Exhibit 2, the preferred alignment map, the project is not within the Special Management Area.

Should you have questions regarding the above, you may contact Ardis Shaw-Kim of our staff at 527-5349.

Very truly yours,

DONALD A. CLEGG
Director of Land Utilization

DAC:ct

g:luersen.ask

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Donald A. Clegg
Director of Land Utilization
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Clegg:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

An application for a Conditional Use Permit, Type 1, for the project was submitted to your department in June, 1992. A height waiver for the substation was also applied for. These applications are under review.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

WALTER M. OZAWA
DIRECTOR

ALVIN K.C. AU
DEPUTY DIRECTOR

August 19, 1992

CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814

Gentlemen:

Subject: Environmental Assessment (EA)
Waiau-Campbell Industrial Park
138 kV Transmission Lines, Part 1
CIP Substation to Ewa Nui Substation
Ewa, Oahu, Hawaii

We have reviewed the EA for the proposed Waiau-Campbell Industrial Park 138 kV Transmission Lines project and have no comment to offer.

Should you have any questions, please feel free to contact Lester Lai of our Advance Planning Branch at 523-4696.

Sincerely,

WALTER M. OZAWA, Director

WMO:js

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Walter M. Ozawa, Director
Dept. of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Ozawa:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

C. MICHAEL STREET
DIRECTOR AND CHIEF ENGINEER

FELIX B. LIMTIACO
DEPUTY DIRECTOR

ENV 92-207

August 27, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH_2M HILL
1585 Kapiolani Boulevard
Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Draft Environmental Assessment (DEA)
Waiau-Campbell Industrial Park 138 kV Transmission
Lines, Part 1-CIP Substation to Ewa Nui Substation

We have reviewed the subject DEA and have the following comments:

1. Paved access road for the proposed substation should be a minimum of 20-ft. wide to accommodate two-way traffic.

2. We suggest that a thorough investigation on future roadway widening and set-back requirements for the entire transmission alignment be conducted.

3. In the middle segment of the preferred alignment along Kaloi Gulch, from Renton Road to Farrington Highway, we suggest you contact Campbell Estate to ensure the proposed alignment will not interfere with the future drainage channel improvements.

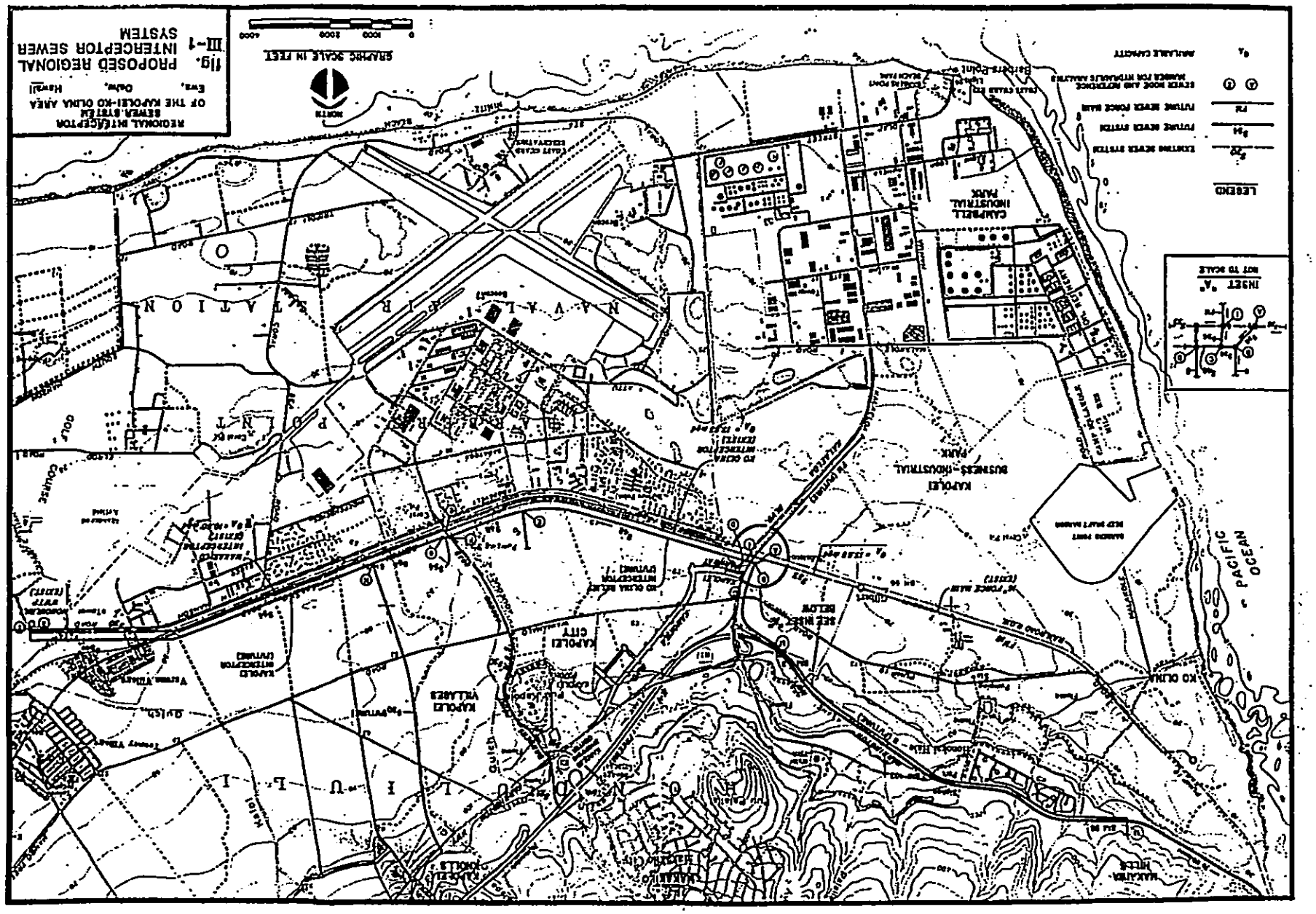
4. The proposed alignment may conflict with existing municipal sewers in the vicinity.

5. For your information, several future sewers are being planned for the same area by private developers with the intent of eventual dedication to the City (see attached map). Therefore, future environmental documents and construction plans for the proposed project should be submitted to the private developers of the Ewa area as well as to the Division of Wastewater Management for review and comment.

Very truly yours,

for C. MICHAEL STREET
Director and Chief Engineer

Attach.



Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

C. Michael Street
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Street:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

Concerning your comment #1, the access road to the proposed Ewa Nui Substation will be 20 feet wide. Concerning your comments #2, #3, #4, and #5, HECO is consulting with appropriate agencies about future road, drainage and utility improvements in the area.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

JOSEPH M. MAGALDI, JR.
DIRECTOR

AMAR SAPPAL
DEPUTY DIRECTOR

August 25, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814

Dear Mr. Luersen:

Subject: **Request for Comments**
Environmental Assessment Preparation
Waiau-Campbell Industrial Park
138 kV Transmission Lines
Part 1-CIP Substation to Ewa Nui Substation
Island of Oahu

This is in response to your August 3, 1992 letter requesting our review and comments on the scope and analysis for the Environmental Assessment Preparation.

We have reviewed the attached project description and the routing report, issued in October 1991. The project's routing report addressed the impacts and concerns expressed during the intensive public hearings on the proposed project are well documented by topic.

Our comments on the EA Preparation for the preferred corridor selected are as follows:

1. There was a general agreement that the transmission line should not be sited in residential areas where practicable.

2. Provide adequate right-of-way for the 138 kV transmission line so as not to impede traffic flow during construction and to perform maintenance operation of the line.

3. Other concerns were the electromagnetic effects of the 138 kV transmission lines on health and on the appliances of residences in nearby homes.

4. During construction, the owner and/or contractor should consider placing notices in the daily newspapers informing the motoring public of any unusual traffic conditions due to the project.

5. The access road to the proposed substation should be wide enough to accommodate two-way traffic.

6. Farrington Highway is a proposed 100-foot roadway with 8 to 10-foot sidewalks. There are road widening setbacks along both sides of the highway. The future right-of-way should be measured as a 50-foot offset in both directions from the existing center line of the roadway.

7. Renton Road is a proposed 80-foot roadway with 8 to 10-foot sidewalks. The current right-of-way is 50 feet with 15-foot road widening set-backs on both sides of the road.

8. The location of the transmission lines should allow for the future widening of Farrington Highway and Renton Road.

9. Construction plans for all work within the proposed City's right-of-way should be submitted to our department for review. A traffic control plan should be included in these plans.

Thank you in affording us the opportunity to review the EA Preparation for the proposed project.

Sincerely,

JOSEPH M. MAGALDI, JR.
Director

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Joseph M. Magaldi, Jr., Director
Department of Transportation Services
City and County of Honolulu
Honolulu Municipal Building
650 South King Street
Honolulu, HI 96813

Dear Mr. Magaldi:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

The EA will address traffic impacts, EMF effects, impacts to existing and future land uses and the project's relationship to the proposed improvements to Farrington Highway and Renton Road. Construction plans will be submitted to your department for review.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 • AREA CODE (808) 943-3111

FRANK F. FASI
MAYOR

MICHAEL S. NAKAMURA
CHIEF

HAROLD M. KAWASAKI
DEPUTY CHIEF

OUR REFERENCE MS-LK

August 20, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Environmental Assessment Preparation for Oahu Waiau-Campbell Industrial Park 138 kV Transmission Lines, Part 1-CIP Substation to Ewa Nui Substation

We have reviewed the information and maps provided regarding the above project. As noted in our response of April 21, 1992, our primary concerns are the minimizing of hazards and traffic disruptions during the construction phase of the project.

Thank you for the opportunity to comment.

Sincerely,

MICHAEL S. NAKAMURA
Chief of Police

By
CHESTER E. HUGHES
Assistant Chief of Police
Support Services Bureau

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Chester E. Hughes
Assistant Chief of Police
Support Services Bureau
Police Department
City and County of Honolulu
1455 South Beretania Street
Honolulu, HI 96814

Dear Mr. Hughes:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

We will address your concerns about traffic safety in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

THE ESTATE OF JAMES CAMPBELL

August 13, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard
Honolulu, HI 96814-4530

Dear Mr. Luersen:

Re: Waiau-Campbell Industrial Park 138 Kv Transmission Lines, Part 1-CIP Substation to Ewa Nui Substation Request for Comments Environmental Assessment Preparation

We have reviewed your project description, dated August 3, 1992, and believe that it is generally an adequate technical basis to formulate the scope of analysis for the EA. We would like to reemphasize the importance of land planning issues related to the lines and the substation, and the importance of analyzing the potential impacts that these facilities may have on present and future uses of land, including any visual impacts. Our focus on these impacts has been consistently expressed throughout discussions on this project. We want to be sure that they are given full and adequate consideration in the scope of analysis. We look forward to receiving and reviewing your draft EA.

Thank you for providing us with the opportunity to comment.

Very truly yours,

Henry

Henry Eng, AICP
Manager, Land Planning

llb:01002900\K10180

Suite 500, 828 Fort Street Mall, Honolulu, Hawaii 96813 (808) 536-1961

Engineers
Planners
Economists
Scientists

September 10, 1992

PDX22957.A2.SA

Henry Eng, AICP
Manager, Land Planning
The Estate of James Campbell
Suite 500
828 Fort Street Mall
Honolulu, HI 96813

Dear Mr. Eng:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

We will address your concerns in the EA.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

Harold M. Hashiro
Vice President, Distribution & Engineering

The Gas Company
515 Kamakee Street
P.O. Box 3379 Honolulu, Hawaii 96842
Telephone (808) 547-3550
Fax (808) 547-3030

BHP Petroleum

August 19, 1992

CH2M Hill Engineers, Planners,
Economists, Scientists
1585 Kapiolani Blvd., Suite 1312
Honolulu, Hawaii 96814-4530

Attention: Mr. Paul Luersen, AICP
Senior Project Manager

Gentlemen:

Subject: Comments for Environmental Assessment Preparations

Project: Waiau-Campbell Industrial Park 138 kV Transmission Lines,
Part 1-CIP Substation to Ewa Nui Substation

We understand and appreciate the need for the installation of the 138 kV transmission lines, however, we are concerned about its effects on our 16-inch transmission line. Specifically at the crossing at Kalaeloa Boulevard, and the proposed alignment on Farrington Highway from Kaloi Gulch to Ewa Nui Substation. We are concerned about the electro magnetic effects on our cathodic protection system, as well as the safety of our personnel performing maintenance on our lines at these locations.

Should there be any questions, or if additional information is desired, please call Roy H. Yoshimoto at 547-3570.

Very truly yours,

Harold M. Hashiro

RHY/HMH:glk
92-123

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Harold M. Hashiro
Vice President, Distribution & Engineering
The Gas Company
515 Kamakee Street
Honolulu, HI 96842

Dear Mr. Hashiro:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

HECO will coordinate design and construction of its project with your staff.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

Chevron

Chevron U.S.A. Products Company
P.O. Box 29789, Honolulu, HI 96820 • Phone (808) 682-5711

K. O. Mohn
Manager
Hawaiian Refinery
Manufacturing Department

August 11, 1992

Paul Luersen, AICP
Senior Project Manager
1585 Kapiolani Blvd, Suite 1312
Honolulu, HI 96814-4530

SUBJECT: COMMENTS, ENVIRONMENTAL ASSESSMENT PREPARATION.

Project: Waiau - Campbell Industrial Park 138 KV transmission lines, Part 1-cip Substation to Ewa Nui Substation.

Dear Mr. Luersen:

Chevron Hawaiian Refinery has two (2) eight inch fuel oil lines and a four inch tracer line that runs parallel with the Hawaii Railway Society tracks from the refinery to Honolulu via the Ewa plains.

The 138,000 volt transmission lines that will have impact on our fuel oil lines are between the Campbell Industrial Park Substation and the Kaloi Gulch where the transmission lines turn Mauka towards the Ewa Nui Substation.

We have expressed our concerns to Hawaiian Electric Company, Inc. (HECO) at previous meetings on the potential problems associated with buried pipelines in the proximity of high voltage transmission lines. A study by A.W. Peabody and A.L. Verhiel on high voltage AC transmission lines' effect on buried pipelines, may cause potential shock hazard, coating damage, and cathodic protection interference. Another concern that Chevron has in conjunction with our buried pipelines are construction activities near or over our pipelines. Enclosed is a copy of "Guidelines For Work Near Chevron U.S.A. Pipelines." We require that these guidelines be included in the construction plans of all projects that impact our pipeline easement.

We would appreciate your consideration and comments on our concerns. If you have any questions, call Mark Hepburn at 682-5711.

Very truly yours,

D W. Koning

Dave W. Koning
Operations Superintendent

HO/ccm

Date: _____

STATEMENT OF CONFORMANCE TO:
GUIDELINES FOR WORK NEAR
CHEVRON U.S.A. PIPELINES

Technical Superintendent
Chevron U.S.A. Inc.
P. O. Box 29789
Honolulu, HI 96820

Gentlemen:

We have reviewed and understand your "Guidelines For Work Near Chevron U.S.A. Pipelines". We, or our authorized Contractor, will conform to your guidelines. We will post a copy of your guidelines at the job site.

The following is provided for your information.

Company: _____

Mailing Address: _____

Project: _____

Company Representative: _____

Telephone Number: _____

Date Work is scheduled to begin: _____

Very truly yours,

_____
Company Representative

CHEVRON U.S.A. INC.

GUIDELINES FOR WORK NEAR CHEVRON U.S.A. PIPELINES

Chevron U.S.A.'s Hawaiian Refinery has one or more petroleum product pipelines in an easement that runs through or immediately adjacent to Contractor's proposed project. These pipelines are used for the transmission of petroleum products at high temperatures and pressures. The pipelines are coated and cathodically protected. They require frequent inspection and maintenance.

It is absolutely necessary that Chevron be provided access to these buried pipelines at all times, 24 hours a day, seven days a week. Therefore, Contractor's proposed project must adhere to the following guidelines:

1. If the easement area is fenced or walled in, Chevron must have a gate key unless the area is attended on a 24-hour basis.

2. Storage of material on the easement shall be avoided. This includes parking lots.

3. A minimum overhead clearance of 15 feet must be maintained within the easement.

4. Heavy landscaping (trees, shrubs, sprinklers, etc.) should be kept off the easement.

5. Heavy obstructions should be kept off the easement (e.g. buildings, walls, equipment pads, etc.).

6. No top-to-bottom obstructions will be permitted in the easement (e.g. power poles, sewer manholes, sewer clean-outs, bridge abutments, etc.).

7. Light obstructions (e.g. grass, paving (asphaltic concrete), curb crossings, etc.) are considered reasonable. Grassed areas must be suitable for all-weather vehicular travel.

8. Chevron's Company Representative will stake the pipelines at Contractor's request. Determination of pipeline elevations shall be Contractor's responsibility and at Contractor's expense.

9. The pipeline easement access road must be kept open at all times. Authorization to block access roads at any time during your construction period must be obtained from Chevron U.S.A. Inc.

10. Avoid running any sewers, fences, sprinkler lines, pipelines, cables, curbs, etc., within the easement in a parallel or near parallel orientation to the easement centerline. Crossings are permitted but must be held to a minimum of 45 degrees to easement centerline.

11. Sewer and electrical conduit crossings should be kept a minimum of four feet clear below Chevron's pipelines for the full easement width. If this condition cannot be met, the crossings should be encased in six inches of concrete, with a minimum two feet clear below Chevron's pipelines.

12. Except for Item 11 above, all crossing facilities should be at least 24 inches clear below Chevron's pipelines for the full easement width. Crossings above Chevron's pipelines are generally not permitted.

13. Removal of fill from the easement should not result in there being less than three feet minimum cover over the lines.

14. Trenches across the pipelines shall be limited to a maximum width of five feet unless the lines are supported in a manner accepted in advance by Chevron U.S.A. Inc.

15. All excavations and backfilling operations in Chevron's easement must be witnessed by a Chevron Company Representative. Contractor shall provide Chevron with 48 hours notice prior to beginning work within Chevron's easement. All backfill material within six inches of our pipelines must be of finely graded dirt or sand. All excavations within two feet of our pipelines must be accomplished by hand digging. Work shall be handled in an expeditious manner in order to keep Chevron's pipelines uncovered for as short a period as possible.

16. Fill on Chevron's easement should be limited to four feet maximum cover over Chevron's pipelines. Chevron will stake the pipelines upon request so that Contractor can excavate to determine the depth of the pipelines.

17. Regrading of adjacent property should not adversely affect drainage of the easement area or pose a hazard to the easement such as land slides or erosion.

18. The slope must be kept reasonably level across the easement. Maximum should be 5:1 to provide for backhoe operation.

19. All costs pertaining to damage of Chevron's pipelines, their coatings, or the cathodic protection devices, or damage of property and injury to persons caused directly or indirectly by this work, will be to Contractor's account. Any repair work on the lines resulting from Contractor's project shall be performed by Chevron U.S.A. Inc. and billed to Contractor.

Engineers
Planners
Economists
Scientists

September 14, 1992

PDX22957.A2.SA

Dave W. Koning
Operations Superintendent
Chevron U.S.A. Products Company
P.O. Box 29789
Honolulu, HI 96820

Dear Mr. Koning:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

HECO will coordinate design and construction of its project with your staff.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

GTE Hawaiian Tel

Beyond the call

GTE Hawaiian Telephone Company Incorporated
P.O. Box 2200 · Honolulu, HI 96841 · (808) 546-2323

Warren H. Haruki
President

August 11, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1212
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Request for Comments
Environmental Assessment Preparation
Waiau-Campbell Industrial Park 138 KV Transmission Lines

Based on our review, we would recommend that the following analysis be included in the environmental assessment:

1. Power line fault current and circuit clearing times to insure adequate grounding and minimized damage to existing telephone facilities.

2. Assessment to insure that no voltages will be induced on our telephone facilities (i.e., overhead cables, messengers, repeater housings, etc.).

Our T&P Administrator, Ronald Matsuwaki, may be contacted at 834-6275 to assist with the assessment.

Sincerely,

Warren H. Haruki

c: Clarke Erskine
Victor Goto
Winslow Tanabe

CH2M HILL Engineers Planners Economists Scientists

September 14, 1992

PDX22957.A2.SA

Mr. Warren H. Haruki
GTE Hawaiian Tel
P.O. Box 2200
Honolulu, HI 96841

Dear Mr. Haruki:

Subject: Waiau-Campbell Industrial Park 138kV Transmission Lines, Part 1, Environmental Assessment

Thank you for responding to our request for consultation comments on preparation of the environmental assessment (EA) on the subject project. A copy of your letter will be included in the EA.

HECO will coordinate design and construction of its project with your staff.

Call me at 943-1133 if you have any questions.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Ken T. Morikami/HECO
Sho Serikaku/DLNR
Michele Otake/HFDC

CH2M HILL
HNL56/017.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

Appendix B

Public and Agency Consultation

Appendix B

Public and Agency Consultation

Public Involvement Plan

Public Involvement Planning Group

A public involvement program outlining the major public participation activities and schedule was prepared by the public involvement planning group for the Waiau-Campbell Industrial Park (CIP) 138 kV Transmission Line Project in June 1987. The Public Involvement Planning Group consisted of Hawaiian Electric Company (HECO) personnel; the environmental consultant, CH2M HILL; and subconsultants who are experts in the field of public involvement. HECO participants represented transmission engineering, land acquisition, corporate communications, governmental affairs, and legal departments.

Public Involvement Plan

As stated in the plan, the purposes of the Waiau-CIP public involvement activities were to:

- Inform the public about the project and their opportunities to participate
- Be certain that specific groups such as affected agencies, interest groups, individuals, and elected officials are well informed about the project
- Ensure that public concerns are reflected in the study approach
- Provide timely information to the project team and to HECO's decision-makers about the public's views on the various corridor and alignment options
- Alert the planning team to potential conflicts and provide mechanisms for resolving them
- Meet implicit and explicit consultation requirements of permitting agencies

Key Public Groups

The public involvement plan was designed to reach a number of different segments of the public. Plan elements were specifically directed toward:

- Elected officials
- Officers and members of neighborhood boards

- Officers of community and service organizations, including:
  - Business organizations
  - Environmental groups
  - Senior citizen groups
  - School organizations
- Community leaders
- Major landowners
- Federal, state, and county agency personnel
- Media
- General public

Public Involvement Activities by Phase

The public involvement activities included information dissemination and opportunities for direct public involvement. The principal activities involved public meetings that coincided with major project study milestones. Other focused public and agency meetings that were held on an ongoing basis throughout the project included project briefings and informational meetings with neighborhood boards. All of the public involvement activities are described below.

Phase I Regional Study and Corridor Identification

The following are the major activities for the initial phases of the work, the regional study, the corridor identification, and the alternative corridor evaluation.

Mailing List (July 1987). At the beginning of project studies, a mailing list was prepared to include the key public groups and individuals in the study area. The project mailing list initially consisted of 275 persons including elected officials; community and service organizations; federal, state, and city and county agencies; major landowners; utilities; and interested persons. During the project, the mailing list was expanded to include those who contacted HECO or its consultants for project-related information, persons who attended meetings, and other organizations and individuals who returned mailing list mailback cards from the newsletter or who requested that their names be added to the list. The final project mailing list included more than 400 people.

Fact Sheet (July 1, 1987). A fact sheet that briefly described the need for the project, the scope and schedule of the route selection study, and the opportunities for public involvement was prepared. The fact sheet included a map of the study area. The fact sheet served as the announcement of the project to the public.

Announcement Letter (July 13, 1987). HECO mailed personal letters to key elected officials, chairpersons of affected neighborhood boards, and to major landowners. These mailings included copies of the fact sheet and formally announced the project.

News Release (July 13, 1987). HECO conducted a media briefing session and issued the fact sheets described above along with a press release.

Announcement to Other Interested Groups and Individuals (July 1987). Following the news release, HECO mailed a letter and fact sheets to neighborhood board members, community leaders, community and service organizations, business organizations, school organizations, senior citizen groups, environmental groups, and major landowners and developers on the project mailing list.

Announcement to Public Agencies (August 1987). A letter was mailed to federal, state, and city and county agencies announcing the project and requesting that they designate a contact person.

Phone Calls and In-person Interviews (July-August, 1987). HECO contacted key elected officials, chairpersons of affected neighborhood boards, and major landowners to ensure that the project information materials were received and to determine whether individual briefings were desired.

Meetings with Community Associations and Neighborhood Boards (August-November 1987). HECO conducted project information meetings for neighborhood boards and community associations to acquaint them with the project, the study process, their opportunities to participate, and to receive their comments and concerns about the transmission line location. Presentations were given to the following organizations:

- Waipahu Neighborhood Board–August 20, 1987
- Pearl City Neighborhood Board–September 17, 1987
- Pearl City Community Association–October 20, 1987
- Ewa Community Association–October 27, 1987
- Ewa Neighborhood Board–November 12, 1987

Individual Meetings with Landowners and the U.S. Navy (September 1987). Key members of the project team met with the Campbell Estate, the Oahu Sugar Company, and the U.S. Navy to discuss the project and to obtain information about locational opportunities and constraints.

Presentation to Councilman Morgado and Other Elected Officials (November 12, 1987). A meeting was requested by Councilman Arnold Morgado to discuss the project with him and other elected officials. The project team gave a presentation of the project's purpose and need and the route selection methodology.

Newsletter No. 1 (November 18, 1987). Newsletters were issued approximately 1 month prior to each series of public meetings. They were mailed to all persons on the project mailing list, made available at HECO offices, and used as handouts at public agency meetings and briefings.

The first project newsletter included a description, a discussion of purpose and need, the route selection methodology of the project, and a study area map showing alternative corridors, and announced the time and place of the community meetings. HECO mailed newsletters to all persons on the project mailing list; interested individuals were asked to respond with their comments on the enclosed card.

News Article for the *Cane Tassel* (November 24, 1987). This local newspaper asked to feature the Waiau-CIP Transmission Line Project in its monthly issue. The article described the project, the purpose and need, and the study schedule.

Initial Contacts with Pipeline Companies (December 3, 1987). Because there are numerous pipelines within the project study area including those owned by HIRI and GASCO, the project team met with representatives from these companies to discuss the project and to determine where potential conflicts with the existing pipelines might occur. A plan for communications throughout the alignment selection process was agreed to by both HECO and the petroleum product companies.

Alternative Corridor Public Workshops (December 8-12, 1987). A series of three meetings were held in Ewa, Waipahu, and Pearl City communities to provide an opportunity for the general public to comment on the alternative corridors and to express their preferences among the corridors.

Consolidated Application Process-Public Agency Meeting No. 1 (February 5, 1988). The assistance of the Office of State Planning and the Coastal Zone Management Office was requested in arranging and coordinating a joint consolidated application process (CAP) meeting of federal, state, and city and county agencies to review and provide comment on the alternative and preferred corridors and potential permit requirements.

Phase II Corridor Evaluation and Alignment Selection

The alternative corridor public workshops and the first joint agency meeting marked the completion of the Phase I regional study and corridor evaluation. Preferred corridors were selected for more detailed study in February 1988.

During the period from February to September 1988, additional information on conditions within the preferred corridor were gathered through detailed field study. The information was mapped and analyzed, and alternative alignments within a preferred corridor were identified. Using input received from neighborhood boards, community groups, and consultation with agencies, a preferred alignment was selected. A brief chronology of the major public involvement during Phase II is presented in the following paragraphs.

Presentation to the Neighborhood Boards (February 11-April 21, 1988). Waipahu and Pearl City Neighborhood Boards were interested in having an update following the corridor workshops. The project team presented the preferred corridor and discussed community concerns regarding the project.

• Pearl City Neighborhood Board Planning and Zoning Committee	February 11, 1988
• Pearl City Neighborhood Board	February 25, 1988
• Waipahu Neighborhood Board	April 21, 1988

Newsletter No. 2 (March 30, 1988). Newsletter No. 2 included a summary of the public comments received during the public corridor workshops, answers to key questions about the project, an updated project schedule, and a map of the preferred corridors.

Meetings with Agencies and Landowners (April-July 1988). The project team conducted several presentations and discussions with interested landowners and agencies who had a specific interest in the project. The input from these meetings was considered in selecting the preferred alignment.

Letters to Community Leaders (July 18, 1988). Each of the community leaders was notified about the progress of the project and invited to attend the public meetings planned for November.

Newsletter No. 3 (October 27, 1988). Newsletter No. 3 contained a description of a preferred alignment and a map insert showing the location of preferred and alternative alignments. It also included diagrams of the pole types, a summary of permitting considerations, and an updated project schedule. An announcement of the times and locations for the public meetings was also included.

Media Release (November 12-16, 1988). A display advertisement announcing the time, location, and purpose of the public meetings was placed in the *Honolulu Advertiser* for 3 consecutive days.

Public Meetings (November 14-17, 1988). A series of three meetings were held in Ewa, Waipahu, and Pearl City to present and discuss the preferred alignments and the reason they were selected and to answer questions and receive comments.

CAP-Public Agency Meeting No. 2 (November 29, 1988). A second joint meeting of federal, state, and city and county agencies was held. The purposes of the meeting were to present the location of a preferred alignment, to identify permits, approvals, and reviews that would be required, and to determine the sequencing of the permits.

Meetings with Landowners (February-March 1989). The project team conducted several meetings with landowners to discuss preferred alignments, the need for easements, and the effects of the project on the landowners' properties.

Newsletter No. 4 (May 11, 1989). Newsletter No. 4 described a selected alignment and announced upcoming community meetings. The newsletter also provided a review of the route selection process, visual simulation photos, typical pole diagrams, a map insert of the alignment, and responses to key concerns raised by the public (e.g., visual effects, underground lines, and the health effects of electric and magnetic fields).

Media Release (May 20, 21, and 22, 1989). A display advertisement that announced the time, location, and purpose of the public meetings was placed in the *Honolulu Advertiser* for 3 consecutive days.

Public Meetings (May 23 and 24, 1989). Two public meetings were held in Waipahu and Pearl City to present and discuss selected alignments, the reasons for their selection, and the environmental effects. Comments were solicited and questions were answered.

Meetings with Elected Officials, Agencies, and Landowners (June 1989-August 1991). As a result of strong opposition to the selected alignment by some agencies, elected officials, and landowners, HECO met regularly with interested parties to build a consensus on an acceptable route that could receive permit approvals and easements without condemnation.

Neighborhood Board and Community Association Meetings

Schedule, Format, and Attendance

After the formal announcement of the project (through letters and fact sheets to elected officials, community leaders, and neighborhood board chairs, and the media release), each organization was invited to have HECO present the Waiau-CIP Transmission Line Project at a monthly meeting. The community associations and neighborhood boards in the study area accepted the invitation. The following presentations with question and answer periods were held:

- Waipahu Neighborhood Board—August 20, 1987
- Pearl City Neighborhood Board—September 17, 1987
- Pearl City Community Association—October 20, 1987
- Ewa Community Association—October 27, 1987
- Ewa Neighborhood Board—November 12, 1987

The format for each of the neighborhood board meetings was similar. HECO's team presented, through a slide presentation, the project description, purpose, and need for the project, the routing methodology, and the goals and objectives for the routing

process. At the close of the project team's presentation, the moderator opened the meeting for questions. The presentation, the public's questions, and responses provided by HECO were recorded and are summarized in the following section.

Additional meetings were held at the request of the neighborhood boards after the selection of a preferred corridor and alternative alignments to discuss specific community concerns:

- Pearl City Neighborhood Board Planning and Zoning Committee—February 11, 1988
- Pearl City Neighborhood Board—February 25, 1988
- Waipahu Neighborhood Board—April 21, 1988

After the series of public meetings in November 1988, requests were made by the following communities to hold additional meetings on the preferred alignments:

• Village Park Community Association	January 11, 1989
• Waipahu Neighborhood Board	May 18, 1989
• Village Park Community Association Board	June 19, 1989

On June 21, 1991, HECO filed an application to the city Department of General Planning to amend the Development Plan—Public Facilities Map to allow construction of the Ewa Nui Substation at a site near the existing Ewa Substation. As a result of the application, HECO was asked to meet with the Ewa Neighborhood Board and one of its committees to discuss the substation and transmission lines. These meetings, held on the following dates, are summarized in the following subsection.

• Ewa Neighborhood Board Committee	August 2, 1991
• Ewa Neighborhood Board	August 8, 1991

Each of the meetings was well attended; the boards all had quorums and a few of the meetings were attended by other interested citizens of the community.

Summary of Comments

Highlights of the principal concerns expressed during the neighborhood board and community association meetings are summarized by topic. The major topics discussed were:

- Transmission alternatives to the proposed overhead lines
- Effect of the project on the ratepayer

- Traffic disruption during construction of the new line
- Socioeconomic effects of the lines such as public health and radio and TV interference
- Environmental assessment (EA) or environmental impact statement (EIS) requirements for the proposed project

Transmission Alternatives to the Proposed Overhead Lines

A common inquiry in all public meetings was the possibility of alternative technologies instead of overhead transmission lines. Participants in the meetings asked HECO to:

- Investigate options of undergrounding the lines or using submarine cables to avoid land use and visual impacts
- Determine whether the new lines could be routed along an existing transmission line corridor or highway

Effect on Ratepayers

Economics of the proposed project and financing for the new lines were concerns of citizens in most meetings. The questions raised were:

- How much will the construction of the new lines cost?
- How does HECO plan to pay for the project?
- Will there be rate reductions for customers who are directly affected by the new lines (i.e., in Pearl City)?
- Will the new lines increase our rates?

Traffic Disruption during Construction

Traffic congestion associated with lane closures during construction was a major concern at most meetings. Traffic management procedures and construction during off-peak traffic hours were suggested as ways of alleviating the potential traffic congestion problems.

Socioeconomic Effects

Other concerns that were voiced during the meetings were related to the socioeconomic welfare of the community residents. Topics included:

- Possible effect of the new lines on TV and radio reception
- Potential adverse health risks from electric and magnetic fields (EMF)
- Safety of the new high-voltage lines
- Visual appearance of the new lines if they had to be sited above ground
- Proximity to residences or schools

EA or EIS Requirements

The public wanted to know how the environmental effects of the proposed project would be assessed. The questions that were asked included:

- Will an EA or an EIS be prepared for this project?
- What permits are required for HECO to build the project?
- What is the schedule for the preparation of the EA?

Ewa Nui Substation

During meetings with the Ewa Neighborhood Board in August 1991, questions were raised concerning the proposed Ewa Nui Substation and the 138 kV transmission lines. In a letter dated August 12, 1991, the Ewa Neighborhood Board concurred with HECO's preference to locate the new substation next to the Ewa Substation and recommended that the city approve HECO's petition to amend the city's Development Plan–Public Facilities Map. Concerns raised by the board included the following:

- Need for the substation
- Health effects from EMF from the substation and lines
- Height and location of the transmission lines

Alternative Corridor Workshop Summary

Schedule, Format, and Attendance

Public workshops were held in Pearl City, Ewa, and Waipahu from December 8 to 10, 1987, to obtain public comment on the alternative corridors, to determine guidelines the public felt were important in evaluating and selecting a preferred corridor, and to identify the public's preferences (if any) for a preferred corridor. The workshop and meeting locations were as follows:

Pearl City	Pearl City Elementary School	December 8
Ewa	Ilima Intermediate School	December 9
Waipahu	August Ahrens Elementary School	December 10

Following a presentation by HECO and CH2M HILL on the purpose and need for the project, the routing methodology, and the status of the project, the workshop attendees

participated in small group discussions on the corridor selection factors and the corridor alternatives. Each individual was asked to identify issues and concerns that would help in the development of corridor selection guidelines. These guidelines were then presented to the group and all participants were asked if they concurred with the choices. After the discussion of the guidelines, each participant was asked to choose their own preferred corridor. A facilitator, recorder, and resource person assisted each small group. The individual rankings were recorded on response forms and questions and comments were recorded on flip charts. Attendance for three meetings totalled only 27 people.

Summary of Comments

The corridor selection guidelines developed by the meeting participants included:

- Avoid locations that would cause traffic problems during maintenance
- Avoid residential areas
- Avoid conflicts with the proposed light-rail system
- Avoid impacts on wetland farming
- If lines must pass through or are close to residential areas, consider undergrounding to avoid visual impact
- Provide maximum separation for low-flying aircraft
- Protect visual resources
- Use government land as much as possible
- Avoid conflicts with future utility of land
- Use the energy corridor where possible
- Avoid major business districts

The avoidance of residential areas came up in all of the meetings as a primary selection criterion. This information was incorporated in the alignment selection criteria.

No clear public preference for a corridor emerged from any of the workshops because of the limited turnout. Most Ewa participants did not express a preference. Waipahu residents who participated in the workshop preferred the Oahu Railway and Land Company (OR&L) right-of-way alternative through the Waipahu section of the study area. Most Pearl City participants also preferred the OR&L right-of-way in their area.

Preferred Alignment–Public Meeting Summary

Schedule, Format, and Attendance

Three public meetings were held in Ewa, Waipahu, and Pearl City on November 14, 15, and 16, 1988, respectively. The meetings provided a forum for public review of the preferred alignment(s), the alignment selection criteria, and the options for undergrounding 12 kV distribution lines as part of the project.

The project team opened the meetings with a slide presentation describing the purpose and need for the project, the routing methodology, and the location of the preferred alignment. A question and answer period followed the presentation. All questions were recorded on flip charts to ensure that the public's concerns were accurately documented.

A total of 32 people attended the three meetings. Most were people from the community with an interest in the project, at least three were owners of businesses along the preferred alignment, three were represented elected officials, and four were from neighborhood boards.

Summary of Comments

Generally, the comments addressed four main issues: location of the preferred alignment, undergrounding (both transmission and distribution lines), electric and magnetic field effects, and project description, cost, and schedule.

Preferred Alignment Location

Several attendees asked why there were two alignments (i.e., two separate routes each with a single circuit) through Waipahu and Pearl City. They wanted to know if just one double-circuit alignment could be sited. Why not site the new alignment along H-1 freeway, thereby avoiding siting a new one along Farrington and Kamehameha Highways?

Undergrounding

In order to improve the visual quality along the alignment, HECO presented a proposal to underground the 12 kV distribution lines along the route in Part 2 as part of the project. The construction and service connection cost were discussed. Most of the questions asked were in reference to this underground option. A few questions arose concerning the possibility of undergrounding the transmission lines (i.e., 138 kV and 46 kV lines), and what the reliability (i.e., repair frequency and maintenance) would be on underground as opposed to overhead lines.

Electromagnetic Field Effects

One participant was interested in the findings of the EMF studies and what the measurements would be along the proposed route. Other participants expressed a general concern regarding EMF and adverse health effects. Another question raised was whether HECO had standards for EMF strengths.

Project Description, Cost, and Schedule

Other questions raised during the three meetings included:

- Why does the alignment split at Kunia Junction?
- How much will the project cost? Who pays?
- When will the new lines be completed?
- Are there other ways that HECO could help improve the Waipahu and Pearl City communities?

Selected Alignment—Public Meeting Summary

Schedule, Format, and Attendance

Two meetings on selected alignment were held in Pearl City and Waipahu on May 23 and 24, 1989, respectively. The meetings were held to present HECO's selection of an alignment and to respond to questions by the public.

The meetings opened with a presentation of the project need, the routing methodology, the alternatives, and the selected alignment. A question and answer period followed the presentation.

A total of 21 people attended the two meetings. About half the attendees were residents of the area. Others were representatives of business associations, neighborhood boards, community associations, and elected officials.

Summary of Comments

Generally, the comments involved five main issues: undergrounding (both transmission and distribution lines), EMF effects, alternative alignments, pole design and effects, and costs to ratepayers.

Undergrounding

As in past public meetings, people asked why the transmission lines and distribution lines could not be placed underground to mitigate visual and EMF impacts. The costs of underground as opposed to overhead lines were discussed. The possibility of having all utility companies cooperate to install all lines underground was mentioned.

Electric and Magnetic Field Effects

People asked questions concerning the potential adverse health effects of EMF and how field strengths could be lowered through undergrounding and reactance phasing. The lack of conclusive evidence that EMF causes adverse health problems was discussed. One participant asked about EMF effects on radio transmissions.

Alternative Alignments

Several participants wanted the alignment to be located elsewhere (e.g., in the OR&L right-of-way or mauka of developed areas in Waipahu). People requested to see the routing report to understand how alternatives were evaluated.

Pole Design and Effects

Questions about pole heights, design, strength, and appearance were raised. One landowner asked if the right-of-way for the project would require use of private property.

Project Costs and Schedule

Other questions concerned costs of the project, who pays for the project, the schedule for construction and operation, and what the next steps are for the process. Questions concerning permit applications and an environmental assessment were asked.

Agency Consultation

CAP Meeting No. 1

On February 5, 1988, the first CAP meeting was held at the state Office of Coastal Zone Management. Eighteen agency personnel participated in the meeting. HECO used a slide presentation to provide an overview of the project, its purpose and need, the routing study methodology, and alternative corridors.

The objectives of the CAP meeting were to:

- Brief the agencies on the purpose and need for the Waiau-CIP 138 kV Transmission Line Project

- Present the corridor alternatives and discuss the constraints and opportunities considered in identifying them
- Identify specific agency issues and concerns:
  - Compatibility or conflict with jurisdiction or statute
  - Information or policies that would influence corridor acceptability
- Identify criteria or guidelines that agencies believe are important to consider in evaluating and selecting preferred corridors
- Discuss agency jurisdiction, possible permits, and the permit process
- Discuss the concept of joint use of existing transportation, utility, and energy corridors as a means of avoiding conflicts with existing and proposed land uses
- Discuss corridor preferences and identify possible means for minimizing and resolving siting conflicts through land use jurisdiction and policy decisions
- Identify contact person(s) for follow-up discussion and additional data collection in later phases of the project

A summary of agency comments is presented in Table B-1.

CAP Meeting No. 2

On November 29, 1988, a second CAP meeting was held at the state Office of Coastal Zone Management. Seventeen agency personnel participated in the meeting. HECO's project team used a slide presentation to describe the preferred alignment.

The objectives of the meeting were to:

- Solicit input from the agencies regarding the location of the preferred alignment
- Identify permits, approvals, and reviews that would be required if the lines were built in the selected alignment
- Determine the sequencing of the permits
- Determine the necessity of a public hearing for any of the approval processes

Table B-1
Summary of Agency Response
CAP Meeting—February 5, 1988

Agency	Principal Concerns and Comments
Public Utilities Commission	Routing of the new 138 kV lines through a residential area would require a public hearing in accordance with HRS 269-27.5.
State Land Use Commission (LUC)	No action or concerns from LUC unless a land use district designation were to be amended.
Department of Land Utilization (City/County)	Conditional use permit (Type 1) would be required for any route selected. Special management area (SMA) use permit would be required if the selected route passed through an SMA. Special use permit (Type B) may also be required depending on the location of the route.
Coastal Zone Management (CZM) (State)	No action or concerns from CZM unless the project were to be constructed in the SMA or coastal zone.
U.S. Fish and Wildlife Service (USFWS)	USFWS is concerned with protection of wildlife resources and the national wildlife refuge units in the project area.
U.S. Army Corps of Engineers (COE)	Actions that could trigger COE's involvement include any dredge or fill actions in wetlands or federal waters or the crossing of any navigable waters by the new line.
State Department of Transportation (DOT) Highways Division	DOT wants the project to avoid crossing or paralleling the H-1 Freeway. The DOT policy states that no work would be permitted within state highway rights-of-way.
Harbors Division	Energy corridor may provide an opportunity for siting the lines. Work within shoreline waters would require a shorewaters and shoreline permit.
Department of Business and Economic Development (DBED)	DBED would only become involved if the federal agencies were involved through the federal consistency review process.
Department of Health (City/County)	Department of Health wants the routing of the new lines to avoid schools, playgrounds, and nursery schools.
Department of General Planning (City/County)	General Planning is concerned with the necessity of including the proposed project on the public facilities map of the development plan.
Department of Land and Natural Resources (DNLR) (State) (no representative present)	Several actions that could trigger DLNR involvement are if the project crossed conservation district lands, historic sites or districts, or any lands owned by the state.

- If more than one hearing is required, investigate the possibility of joint public hearings

Each agency representative was asked to provide their agency's concerns and to identify required permits or approvals.

The major conclusions from the meeting were that a special management area (SMA) use permit would be required by the city and county Department of Land Utilization (DLU) for the Waiau end of the line and, because the application for an SMA permit must precede all other permits for Part 2, the DLU would become the lead agency for environmental review. DLU would also be responsible for processing the conditional use permit. Through its review, DLU would determine if an EIS is required and if so, it would be the lead agency.

Other comments were expressed by the state Department of Transportation—Highways Division and the Department of Transportation Services (DTS) (city/county). These agencies stated that more detailed drawings of the project (i.e., pole locations and design specifications) would be required in order to address their specific concerns. The Highways Division expressed concern about adequate conductor and roadway clearances, safety, and the potential traffic congestion during construction at major roadway crossings in several locations along the alignment. DTS expressed a desire to coordinate with HECO to avoid siting conflicts with the proposed rapid transit system project.

Elected Official, Agency, and Landowner Consultation

Reasons for Additional Consultations

As a result of comments made at the May 1989 public meetings, the project team conducted further studies on the alignments. Strong opposition by landowners caused a reevaluation of segments of the alignment to accommodate the landowner concerns. A series of meetings were held to discuss solutions. In December 1989, HECO filed an application with the city Department of General Planning to amend the Development Plan—Public Facilities Map to allow construction of the Ewa Nui Substation at the then preferred Quartermaster Site. The department deemed the site "inappropriate" in February 1990. The city also found part of the preferred alignment along Old Fort Weaver Road to be "not acceptable." The project team met with city agencies, elected officials, state agencies, and landowners to develop a new consensus on an acceptable corridor and alignment and site for the Ewa Nui Substation. Table B-2 lists these meetings and the agencies, landowners, and elected officials who participated.

Summary of Topics Discussed

Undergrounding

The possible routes, costs, and who should pay for undergrounding the transmission lines were frequently discussed at the meetings. Some strongly favored undergrounding the lines to mitigate visual impacts. It was recognized that the PUC had to approve any proposal to underground the lines. The costs of undergrounding are three to five times the cost of overhead lines.

H-1 Freeway Corridor

At the suggestion of some agencies, HECO reevaluated the H-1 corridor for possible alignments mauka and makai of the freeway in Ewa. Certain constraints to construction and maintenance were identified, although the alignments in Ewa were still feasible. Approval to parallel and cross the H-1 Freeway was necessary from the state Department of Transportation and the Federal Highways Administration. An alignment could run along the H-1 Freeway all the way from the CIP Substation to the Waiau Power Plant. Visual impacts and community concerns were recognized disadvantages.

OR&L Corridor

The feasibility of locating the transmission lines in the OR&L corridor was re-examined. Poor soil conditions, limited access, conflicts with shoreline areas, impacts to the Pearl Harbor Wildlife Refuge, unlimited liability from fuel oil pipeline damage, and difficult permit requirements were recognized as disadvantages. The possibility of shoreline enhancements (e.g., pathway, mangrove trimming, benches, and lights) was proposed by some agencies to gain acceptability for the corridor.

Kaloi Gulch Corridor

A new corridor was identified during the joint planning meetings as a result of the state's action to condemn a large tract of Campbell Estate land near Kaloi Gulch to preserve agricultural uses and for land banking purposes. The use of an existing natural barrier (Kaloi Gulch) as a transmission line alignment was agreed to as acceptable because the pattern of future development would take into account the natural barrier (in any case). The state agreed to allow the alignment through its future property.

Ewa Nui Substation Sites

With each alternative corridor, possible sites for the new Ewa Nui Substation were identified and evaluated. With an underground line, a substation would be needed in the Ewa Plain area. With the H-1 corridor, several sites were evaluated near Palehua Canehaul Road and Kunia Junction. With the Kaloi Gulch corridor, sites discussed were near the existing Ewa Substation, Honouliuli Gulch, and the Quartermaster site.

Table B-2
Agency, Elected Officials and Landowner Meetings
Waiau-CIP Project December 1989-August 1992

Date	Organization or Elected Official
December 11, 1989	Campbell Estate
January 2, 1990	Campbell Estate
January 11, 1990	Campbell Estate
January 11, 1990	City and County Department of Housing and Community Development City and County Managing Director's Office
January 16, 1990	City and County Department of Housing and Community Development
January 16, 1990	Campbell Estate
January 31, 1990	City and County Managing Director's Office City and County Budget Department City and County Finance Department City and County Department of Housing and Community Development
February 15, 1990	Campbell Estate
February 26, 1990	City and County Managing Director's Office City and County Budget Department City and County Finance Department City and County Department of Housing and Community Development
March 2, 1990	City and County Managing Director's Office City and County Department of Housing and Community Development Campbell Estate
April 20, 1990	City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development
April 25, 1990	City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development

Table B-2
Agency, Elected Officials and Landowner Meetings
Waiau-CIP Project December 1989-August 1992

Date	Organization or Elected Official
June 19, 1990	City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development Campbell Estate
June 26, 1990	City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development Campbell Estate
June 29, 1990	Office of State Planning Campbell Estate
July 3, 1990	Office of State Planning State Department of Land and Natural Resources City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development City and County Department of Public Works Campbell Estate
July 10, 1990	State Department of Transportation-Highways Division

Table B-2
Agency, Elected Officials and Landowner Meetings
Waiau-CIP Project December 1989-August 1992

Date	Organization or Elected Official
July 17, 1990	Office of State Planning State Department of Land and Natural Resources City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development City and County Department of Public Works Campbell Estate
July 17, 1990	State Department of Transportation-Highways Division
August 31, 1990	State Department of Transportation-Highways Division
September 10, 1990	Office of State Planning State Department of Land and Natural Resources State Department of Transportation City and County Managing Director's Office City and County Department of General Planning Campbell Estate
October 24, 1990	State Department of Land and Natural Resources State Department of Transportation City and County Managing Director's Office City and County Department of General Planning City and County Department of Housing and Community Development City and County Department of Transportation Services Campbell Estate
January 30, 1991	City and County Managing Director Office
March 20, 1991	Councilmember Rene Mansho
May 7, 1991	State Senator Norman Mizuguchi

Table B-2
Agency, Elected Officials and Landowner Meetings
Waiau-CIP Project December 1989-August 1992

Date	Organization or Elected Official
May 8, 1991	Campbell Estate
May 9, 1991	State Representative Noboru Yonamine
May 13, 1991	City Council Aide
May 14, 1991	State Representative Annelle Amaral
May 16, 1991	State Representative Clarice Hashimoto
May 22, 1991	Office of State Planning
May 23, 1991	State Representative Daniel Kihano
May 30, 1991	City and County Department of General Planning
July 2, 1991	Council Chairman Arnold Morgado
July 10, 1991	Councilmember John DeSoto
July 22, 1991	Councilmember Rene Mansho
August 2, 1991	Ewa Neighborhood Board Committee
August 2, 1991	Campbell Estate
August 8, 1991	Ewa Neighborhood Board
August 14, 1991	City and County Department of General Planning
August 28, 1991	Campbell Estate
September 5, 1991	City and County Department of Transportation Services–Rapid Transit City and County Department of Transportation Services–Planning
October 11, 1991	Campbell Estate
April 13, 1992	Campbell Estate
May 20, 1992	Campbell Estate
May 28, 1992	Campbell Estate
June 10, 1992	State Department of Land and Natural Resources State Housing Finance & Development Corporation
July 1, 1992	Office of State Planning State Department of Land and Natural Resources State Housing Finance & Development Corporation
July 29, 1992	Campbell Estate
August 3, 1992	Campbell Estate

Environmental and Land Use Concerns

Each alternative corridor and substation site was discussed with respect to existing and future land use, EMF health effects, permit requirements, easement requirements, cost and schedule, visual impact, and community concerns.

Appendix C

Sensitivity Analysis of Corridor Alternatives

Appendix C
Sensitivity Analysis of Corridor Alternatives[1]

The sensitivity analysis was developed to assess siting constraints and opportunities in each of the corridor alternatives by means of a semiquantitative process. The sensitivity analysis provided a way to test the sensitivity of each corridor alternative for use as a transmission corridor, using alternative assumptions about the compatibility of a transmission line with land use and environmental factors. The alternative corridors evaluated are shown in Figure 3-4 of the draft environmental assessment.

Methodology

The analysis began with the identification of a hypothetical best alignment within each corridor. This hypothetical alignment, used solely for the purposes of the sensitivity analysis, was developed from maps that show constraint areas and from a common sense assessment of likely alignment locations within each corridor. The hypothetical best alignment was then overlaid onto maps showing all the exclusion, high-, and medium-constraint areas (Figure C-1).

Each time the hypothetical best alignment passed through either a high- or medium-constraint area, the linear distance through the constraint area was measured (in inches) and summed for each corridor alternative. When a hypothetical best alignment passed through any high-constraint area, the measurement for that area was doubled, to reflect the higher constraint in those areas (compared with medium-constraint areas). Because existing 46 kV transmission lines provide siting opportunities, the length of 46 kV lines mapped within each corridor alternative was subtracted from the constraint total for each corridor to yield a net constraint score. Corridor constraint scores were then used to compare and rank corridor alternatives linking the CIP Substation to the proposed Ewa Nui Substation site. In most cases, these corridor alternatives combined portions of several corridor segments into viable corridor alternatives. For example, because the Ewa Nui site is located in the E2 (Farrington Highway) corridor, the sensitivity analysis of the E1 corridor included a short section of the E2 corridor as the E1 hypothetical best alignment backtracked along a portion of the E2 corridor to reach the substation site.

The corridor analysis was completed with two sets of constraint ratings, shown in Tables C-1 and C-2. The first set of constraint ratings reflect the study team's initial analysis of constraint ratings; the rationale for these initial ratings is presented in Chapter 5 of the routing report. In response to input from the community, agencies, and landowners, some of the constraint ratings were revised for a second-stage sensitivity analysis.

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[1]Source: Appendix C, Routing Report: Waiau-Campbell Industrial Park 138 kV Transmission Line, Part 1—CIP to Ewa Nui Substations. CH2M HILL, October 1991.

Initial Sensitivity Analysis

The sensitivity analysis was completed initially with the constraint ratings shown in Table C-1. As shown in Table C-3, when constraint ratings were summed for each corridor alternative with equal weighting for high- and medium-constraint areas (column Q), the E4/EA/ED/E2 corridor receives the lowest score of 8.45 (i.e., is the least constrained), followed by the E4/RM/E3/ED/E2 corridor and the E4/ED/E2 corridor. The corridor with the highest score (i.e., the most constrained) was the E4/EB/E2 corridor, with a score of 27.1.

In the next step of the analysis, the length of parallel 46 kV transmission lines (which provide opportunities for combining the new line with existing lines on a single set of poles) was subtracted from the total constraint rating (Table C-3, columns R and S). In addition, to reflect the fact that a longer corridor necessarily is more visible, has greater potential for environmental impacts, and is more expensive to build, the length of each corridor alternative was added to the constraint total (Table C-3, column T). The resulting ranking showed the E4/ED/E2 corridor to have the lowest score, followed by E4/EA/ED/E2 and KG.

Next, the constraint scores for each corridor alternative were modified by doubling the scores for high-constraint areas (i.e., Table C-3, columns C through H), to reflect the higher constraint of high versus medium areas. The result (columns Table C-3, V and W) indicates very little change for the top-ranked corridors. The E4/ED/E2 corridor continues to be rated the least constrained (score of 10.75), followed again by E4/EA/ED/E2 (14.35) and then by E4/RM/E3/ED/E2 (18.25). The entire ranking of corridors, from least to most constrained, is shown in Table C-4.

Second Stage Sensitivity Analysis

From 1988 through mid-1991, HECO consulted with the community, landowners, and public agencies. A recurring comment from all of these groups was that the transmission line corridors should avoid existing and proposed residential areas and community facilities such as schools. To reflect this concern, the sensitivity analysis was revised to reflect higher constraints related to these factors. Specifically, residential areas, schools, parks, and cemeteries (in the Existing Land Use category); existing and residential areas and proposed projects (in the Visual Resources category); and projects planned, approved, or under construction (in the Proposed Land Use category), which had been rated medium constraint, were revised to high constraint.

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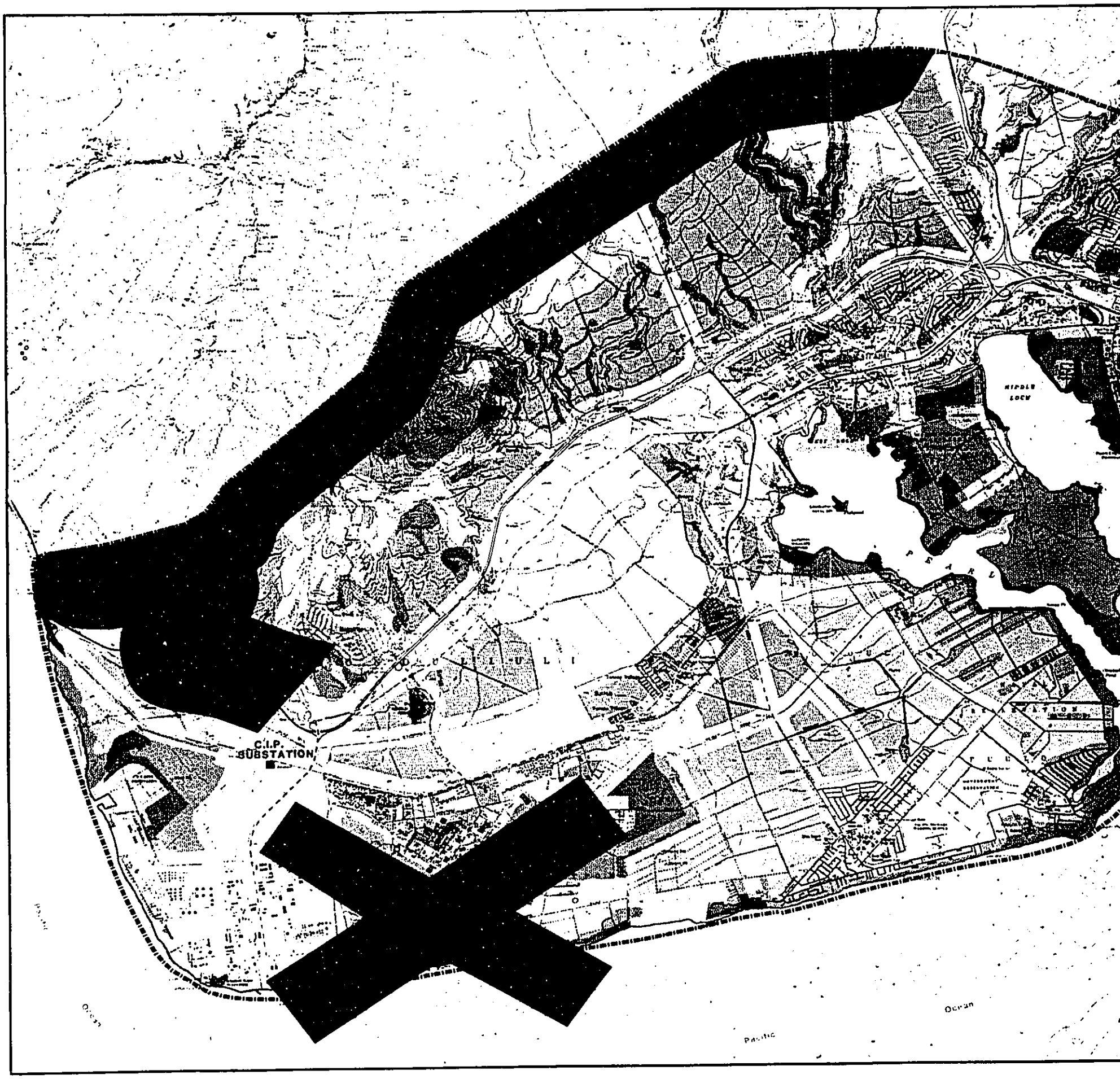

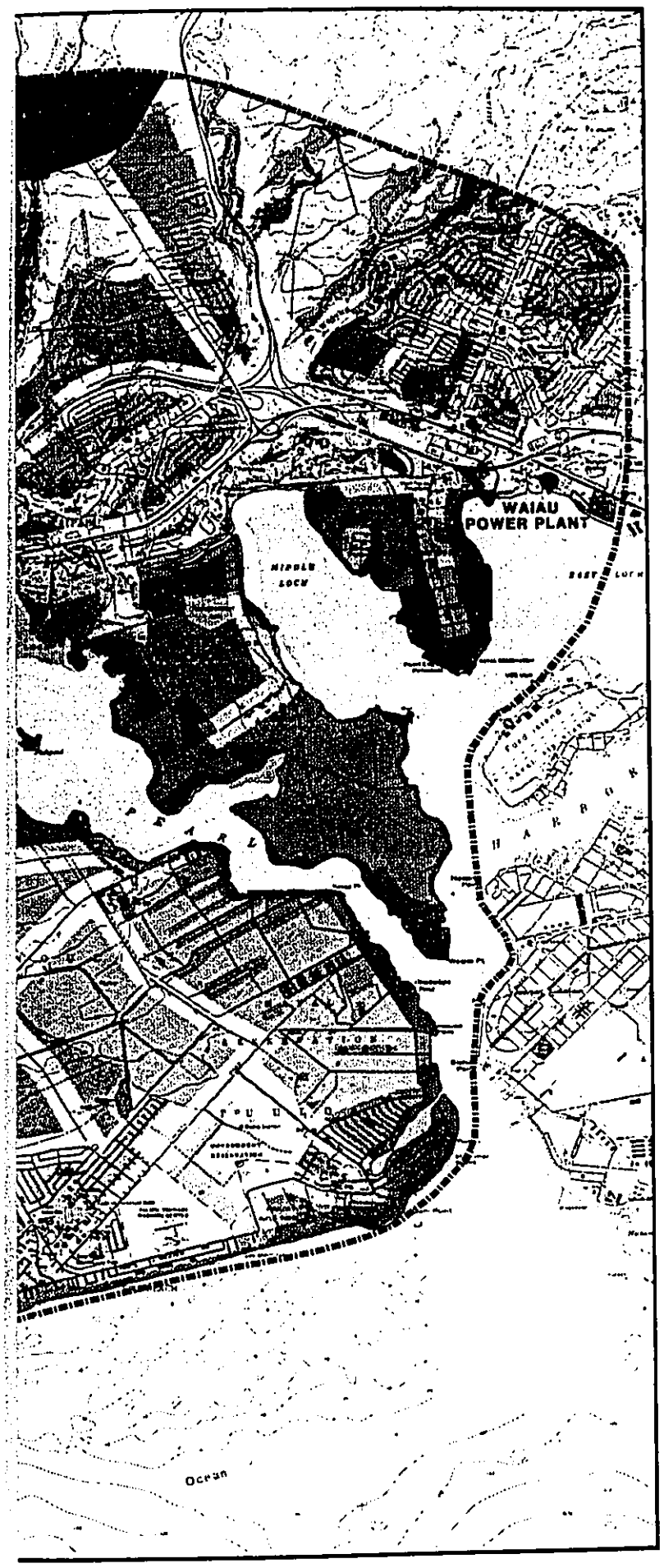

COMPOSITE CONSTRAINTS

Study Area Boundary

CONSTRAINT LEVEL

- Exclusion Area
- High
- Medium–High
- Medium
- Medium–Low
- Low

NORTH
WEST EAST
SOUTH

MAUKA
EWA/ WAIANAE — DIAMOND HEAD
MAKAI

0 1000 2000 5000 10,000 FEET

0 1/4 1/2 1 2 MILES

FIGURE C-1

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2MHILL

Table C-1
Constraint Rating Summary
Stage 1 Sensitivity Analysis

Data Map	Constraint Rating
Exclusion Areas	
Exclusion areas	Air interference zones Transmission corridor separation
High Constraint	
Land jurisdiction	Military lands (Navy, Army, and Air Force)
Land regulation	State Conservation District Lands Protective (P) Subzone
Land use	Communication sites Military ordnance storage, training, and operations and maintenance areas
Utilities and transportation	Areas more than 500 feet from existing 138 kV or 46 kV transmission line, interstate route, state route, major local road, railroad right-of-way, or pipeline
Soils	Wet soils (peat/muck substratum)
Visual	Recognized shoreline views, parks, and beaches
Medium Constraint	
Land regulation	State Conservation District Lands (R) Subzone and Special Management Areas
Proposed land use	Projects under construction
Existing land use	Residential, including military housing Schools Parks, recreation areas, cemeteries, military recreation, and conservation buffer Quarry and coral pits Landfills and refuse areas National wildlife refuges Public and semipublic facilities Commercial Military administration and community facilities

Table C-1
Constraint Rating Summary
Stage 1 Sensitivity Analysis

Data Map	Constraint Rating
Biological	National wildlife refuges Significant areas of density of diversity for special status plants Native waterbird concentration areas Wetlands Habitat for endangered, threatened, or sensitive wildlife
Slope	Slopes greater than 20 percent
Soils	High erosion potential
Visual	Residential (existing) Proposed residential and commercial development Wildlife refuges Existing transportation corridors without parallel lines Agricultural plains Other shoreline views
Cultural	National Register sites Recorded archeological or historical sites

Table C-2
Constraint Rating Summary
Stage 2 Sensitivity Analysis

Data Map	Constraint Rating
Exclusion Areas	
Exclusion areas	Air interference zones *Transmission corridor separation*
High Constraint	
Land jurisdiction	Military lands (Navy, Army, and Air Force)
Land regulation	State Conservation District Lands Protective (P) Subzone
Proposed land use	Planned, approved, and projects under construction*
Land use	Communication sites Military ordnance storage, training, and operations and maintenance areas Residential areas (including military), schools, parks, and cemeteries*
Utilities and transportation	Areas more than 500 feet from existing 138 kV or 46 kV transmission line, interstate route, state route, major local road, railroad right-of-way, or pipeline
Soils	Wet soils (peat/muck substratum)
Visual	Recognized shoreline views, parks, and recreation areas Existing and proposed residential areas*

*Indicates data factors moved from the medium-constraint category (in the Stage 1 analysis) to the high-constraint category (in the Stage 2 analysis).

Table C-2
Constraint Rating Summary
Stage 2 Sensitivity Analysis

Data Map	Constraint Rating
Medium Constraint	
Land regulation	State Conservation District Lands (R) Subzone and Special Management Areas
Existing land use	Military recreation and conservation buffer Quarry and coral pits Landfills and refuse areas National wildlife refuges Public and semipublic facilities Commercial Military administration and community facilities
Biological	Wildlife refuges Endangered plant habitat Wetlands Endangered wildlife habitat
Slope	Slopes greater than 20 percent
Soils	High erosion potential
Visual	Existing transportation corridors without parallel lines Agricultural plains Other shoreline views
Cultural	National Register sites and recorded archeological or historical sites

TABLE C-3
SENSITIVITY ANALYSIS OF WAIAU–CIP PART 1
STAGE 1

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
CORRIDOR	LENGTH	(+) LAND JURIS (HIGH)	(+) LAND REQU (HIGH)	(+) EXISTING LAND USE (HIGH)	(+) UTILITY & TRANSPORT (HIGH)	(+) SOILS (HIGH)	(+) VISUAL (HIGH)	(+) LAND REQU (MED)	(+) PROPOSED LAND USE (MED)	(+) EXISTING LAND USE (MED)	(+) BIOLOG (MED)	(+) SLOPES (MED)	(+) VISUAL (MED)	(+) CULTUR (MED)	(+) SOILS (MED)	SUBTOTAL	(–) PARALLEL TRANSMIS. LINE	MINUS PARALLEL TRANSMIS. LINE	PLUS LENGTH MINUS PARALL LINES	HIGH TIMES TWO TOTAL (1)	HIGH TIMES TWO TOTAL (2)	FINAL RANK	CORRIDOR
Note	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	3	4	5	6		
E1/E2	17.45	0.00	0.00	0.00	1.50	0.35	0.00	0.00	0.00	1.05	0.00	0.00	10.20	0.00	0.75	13.85	2.50	11.35	28.80	13.70	30.85	8	E1/E2
E2	10.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	0.00	0.00	11.00	0.00	11.00	21.85	11.00	21.85	4	E2
E3/ED/E2	17.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	3.00	0.00	0.00	0.00	11.75	0.00	0.90	16.35	4.50	11.85	28.85	17.05	28.55	7	E3/ED/E2
E3/ED/EC/E2	18.80	0.00	0.00	0.00	0.70	1.35	1.25	0.00	9.75	3.20	0.00	0.00	14.15	0.00	0.25	27.10	19.85	7.25	26.05	30.90	32.75	9	E4/EB/E2
E4/EB/E2	21.70	0.00	0.00	0.00	1.35	0.40	2.05	0.00	3.80	6.75	1.00	0.00	11.50	0.00	0.25	27.10	19.85	7.25	26.05	24.00	28.10	6	E4/EC/E2
E4/EC/E2	20.80	0.00	0.00	0.00	0.70	1.35	1.25	0.00	2.75	6.20	0.00	0.00	8.45	0.00	0.00	20.70	16.50	4.20	24.80	10.05	10.75	1	E4/ED/E2
E4/ED/E2	19.40	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	3.25	0.00	0.00	4.50	0.00	0.90	9.35	18.70	–9.35	10.05	10.05	10.75	5	KO(E4/RM/KO/E2)
KO(E4/RM/KO/E2)	15.55	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00	3.25	0.00	0.00	8.25	0.00	0.00	14.25	9.70	4.55	20.10	20.25	28.10	11	E4/RM/E3/EC/E2
E4/RM/E3/EC/E2	20.25	0.00	0.00	0.00	2.00	1.35	1.25	0.00	2.75	3.25	0.00	0.00	8.85	0.00	0.00	19.25	9.70	9.55	29.80	23.85	34.40	3	E4/RM/E3/ED/E2
E4/RM/E3/ED/E2	19.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.35	0.00	0.90	9.25	12.00	–2.75	16.25	11.25	16.25	2	E4/EA/ED/E2
E4/EA/ED/E2	21.75	0.00	0.00	0.00	0.70	0.00	0.00	0.00	4.50	0.00	0.00	0.00	2.35	0.00	0.90	8.45	18.55	–9.10	13.85	9.15	14.35	10	E4/EA/EB/E2
E4/EA/EB/E2	24.00	0.00	0.00	0.00	1.35	0.40	2.05	0.00	7.55	4.20	1.00	0.00	5.75	0.00	1.20	23.50	17.50	6.00	30.00	27.30	33.80		

Notes:

1. Columns B through P and R list scores derived by measurement.
2. Column Q sums across columns C through P.
3. Column S equls column Q minus column R (Parallel Transmission Lines).
4. Column T equals column S plus Column B (Length).
5. Column U doubles the scores for all high constraint areas (columns C through H) and then sums across columns C through P.
6. Column V adds column B (Length) and subtracts column R (Parallel Transmission Lines) from column U.

Table C-4 Stage 1 Sensitivity Analysis Final Corridor Ranking		
Corridor	Constraint Score	Rank
E4/ED/E2	10.75	1
E4/EA/ED/E2	14.35	2
E4/RM/E3/ED/E2	18.25	3
E2	21.85	4
KG	26.10	5
E4/EC/E2	28.10	6
E3/ED/E2	29.55	7
E1/E2	30.65	8
E4/EB/E2	32.75	9
E4/EA/EB/E2	33.80	10
E4/RM/E3/EC/E2	34.40	11
E3/ED/EC/E2	45.80	12

Increasing the residential-related data factors from medium to high constraint increased the constraint ratings for all the corridor segments that included existing or planned residential areas. The result was to change the ranking of the top candidates, as shown in columns V and W of Table C-5 and in Table C-6.

Table C-6 Stage 2 Sensitivity Analysis Final Corridor Ranking		
Corridor	Constraint Score	Rank
E4/EA/ED/E2	28.00	1
KG	28.35	2
E4/ED/E2	32.25	3
E4/RM/E3/ED/E2	35.75	4
E2	36.75	5
E1/E2	49.55	6
E4/EC/E2	54.75	7
E4/EA/EB/E2	57.90	8
E3/ED/E2	58.80	9
E4/RM/E3/EC/E2	59.30	10
E4/EB/E2	60.45	11
E3/ED/EC/E2	78.30	12

As Table C-6 indicates, the two top-ranked corridors, E4/EA/ED/E2 and KG, are very closely ranked (probably within measuring error) and are separated from the third-ranked corridor (E4/ED/E2) by more than four points. Inspection of Table C-5 shows that the high rank (i.e., low constraint scores) of the top two corridors reflects a combination of low scores

for existing and proposed residential areas, plus relatively high scores for parallel transmission lines (which provide opportunities for siting the new line).

TABLE C-5
SENSITIVITY ANALYSIS OF WAIAU–CIP PART 1
STAGE 2

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
CORRIDOR	LENGTH	(+) LAND JURIS (HIGH)	(+) LAND REGU (HIGH)	(+) PROPOSED LAND USE (HIGH)	(+) EXISTING LAND USE (HIGH)	(+) UTILITY & TRANSPORT (HIGH)	(+) SOILS (HIGH)	(+) VISUAL (HIGH)	(+) LAND REGU (MED)	(+) EXISTING LAND USE (MED)	(+) BIOLOG (MED)	(+) SLOPES (MED)	(+) VISUAL (MED)	(+) CULTUR (MED)	(+) SOILS (MED)	SUBTOTAL	(–) PARALLEL TRANSMIS. LINE	MINUS PARALLEL TRANSMIS. LINE	PLUS LENGTH MINUS PARALL LINES	HIGH TIMES TWO TOTAL (1)	HIGH TIMES TWO TOTAL (2)	FINAL RANK	CORRIDOR
Note	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	3	4	5	6		
E1/E2	17.45	0.00	0.00	4.90	0.00	1.50	0.35	8.30	0.00	1.03	0.00	0.00	2.70	0.00	0.75	19.33	2.50	17.05	34.50	34.60	49.55	6	E1/E2
E2	10.85	0.00	0.00	5.00	0.00	0.00	0.00	5.20	0.00	0.00	0.00	0.00	5.50	0.00	0.00	15.70	0.00	15.70	26.55	25.90	36.75	5	E2
E3/ED/E2	17.00	0.00	0.00	10.70	0.00	0.70	0.00	10.60	0.00	0.00	0.00	0.00	1.40	0.00	0.80	24.30	4.50	19.80	36.80	49.30	58.80	9	E3/ED/E2
E3/ED/EC/E2	18.60	0.00	0.00	13.35	2.20	0.70	1.35	12.30	0.00	1.00	0.00	0.00	1.40	0.00	0.00	32.30	2.50	29.80	48.40	62.20	78.30	12	E3/ED/EC/E2
E4/EB/E2	21.70	0.00	0.00	6.80	6.30	1.35	0.40	11.15	0.00	0.45	1.00	0.00	0.90	0.00	0.25	30.80	19.85	10.75	32.45	58.80	60.45	11	E4/EB/E2
E4/EC/E2	20.50	0.00	0.00	9.20	5.20	0.70	1.35	7.70	0.00	1.00	0.00	0.00	1.35	0.00	0.00	26.50	18.50	10.00	30.50	50.85	54.75	7	E4/EC/E2
E4/ED/E2	19.40	0.00	0.00	8.35	3.25	0.70	0.00	4.35	0.00	0.00	0.00	0.00	1.35	0.00	0.90	18.90	18.70	–1.80	17.60	31.55	32.25	3	E4/ED/E2
KQ(E4/RM/KQ/E2)	15.55	0.00	0.00	0.00	0.00	8.00	0.00	1.25	0.00	0.00	0.00	0.00	8.00	0.00	0.00	15.25	9.70	5.55	21.10	22.50	29.35	2	KQ(E4/RM/KQ/E2)
E4/RM/E3/EC/E2	20.25	0.00	0.00	7.15	2.25	2.00	1.35	10.40	0.00	1.00	0.00	0.00	1.45	0.00	0.00	25.60	9.70	15.90	36.15	49.75	59.30	10	E4/RM/E3/EC/E2
E4/RM/E3/ED/E2	19.00	0.00	0.00	4.80	0.00	2.00	0.00	8.40	0.00	0.00	0.00	0.00	1.45	0.00	0.90	16.55	12.00	3.55	22.55	28.75	35.75	4	E4/RM/E3/ED/E2
E4/EA/ED/E2	21.75	0.00	0.00	6.30	0.00	0.70	0.00	3.25	0.00	0.00	0.00	0.00	1.40	0.00	0.90	12.55	16.55	–4.00	17.75	22.80	28.00	1	E4/EA/ED/E2
E4/EA/EB/E2	24.00	0.00	0.00	8.50	3.75	1.35	0.40	10.00	0.00	0.45	1.00	0.00	0.75	0.00	1.20	27.40	17.50	9.90	33.90	51.40	57.90	8	E4/EA/EB/E2

Notes:

1. Columns B through P and R list scores derived by measurement.
2. Column Q sums across columns C through P.
3. Column S equls column Q minus column R (Parallel Transmission Lines).
4. Column T equals column S plus Column B (Length).
5. Column U doubles the scores for all high constraint areas (columns C through H) and then sums across columns C through P.
6. Column V adds column B (Length) and subtracts column R (Parallel Transmission Lines) from column U.

Appendix D

Comment and Response Letters

Appendix D
Comments and Responses on Draft Environmental Assessment

A notice that the draft environmental assessment (DEA) was available for a 30-day public review period and that the approving agency, the Department of Land and Natural Resources, anticipated a negative declaration was published in the December 8, 1992, *OEQC Bulletin*. Four copies were filed with the OEQC. Copies of the DEA were mailed out to reviewers on December 4, 1992. The DEA comment period ended on January 7, 1993. Ten comment letters were received by the approving agency. Responses were mailed to all who commented on the DEA; both comment and response letters are reprinted in this appendix. The final EA includes revisions based on the comments received.

Table D-1 lists all parties who received a copy of the DEA for review and indicates those who responded.

Table D-1
List of Recipients of the Draft Environmental Assessment

	Recipient	Response
Federal		
	Department of the Navy, Naval Base Pearl Harbor	NC
	The Honorable Patsy T. Mink, U.S. House	NR
State		
	Department of Accounting and General Services	NC
	Department of Education	R
	Department of Hawaiian Home Lands	NC
	Department of Land and Natural Resources	R
	State Historic Preservation Division of DLNR	R
	Department of Health	R
	Department of Transportation	R
	Office of State Planning	NR
	University of Hawaii Environmental Center	NR
	Housing Finance and Development Corporation	R
	The Honorable Annelle Amaral, State House	NR
	The Honorable Brian Kanno, State Senate	NR
	The Honorable Michael Crozier, former State Senate	NR
City and County of Honolulu		
	Department of General Planning	R
	Department of Public Works	R
	Department of Transportation Services	NR
	The Honorable John DeSoto, City Council	NR
	Jane Ross, Ewa Neighborhood Board	NR
Nongovernmental		
	The Estate of James B.Campbell	NR
	BHP Petroleum, The Gas Company	R
	Chevron U.S.A.	NR
	GTE Hawaiian Tel	NR
	Oahu Sugar Company	NR
R = Response received on Draft EA		
NC = Response received on Draft EA, but no comment		
NR = No response received		

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO:
11010
Ser N4(235)/0002
04 JAN 1993

Mr. Sojin Serikaku
State Department of Land and Natural Resources
Division of Land Management
1151 Punchbowl Street, Room 220
Honolulu, HI 96813

Dear Mr. Serikaku:

DRAFT ENVIRONMENTAL ASSESSMENT
WAIAU-CAMPBELL INDUSTRIAL PARK 13kV TRANSMISSION LINES PROJECT,
PART 1 - CAMPBELL INDUSTRIAL PARK TO EWA NUI SUBSTATIONS

Thank you for the opportunity to comment on the subject Draft Environmental Assessment (DEA). The Navy has no comments to offer at this time.

Our point of contact is Mr. Bill Liu, Facilities Engineer, at 471-3324.

Sincerely,

[illegible]
[illegible] ENGINEER
[illegible] OF
THE COMMANDER

Copy to:
Mr. Brian J.J. Choy
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, HI 96813

Mr. Ken T. Morikami
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, HI 96840-0001

Mr. Paul Luersen
CH2M HILL, Inc.
1585 Kapiolani Boulevard, Suite 1312
Honolulu, HI 96814

Engineers
Planners
Economists
Scientists

January 20, 1993

Commander
Naval Base Pearl Harbor
P.O. Box 110
Pearl Harbor, Hawaii 96860-5020

ATTENTION: Mr. Bill Liu, Facilities Engineer

SUBJECT: Waiau-CIP 138kV Transmission Lines, Part 1

Dear Mr. Liu:

Thank you for reviewing the Draft Environmental Assessment on the subject project.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL
HNL81/005.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

CHN WAIHEE
GOVERNOR

CHARLES T TOGUCHI
SUPERINTENDENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

December 17, 1992

MEMO TO: Honorable William W. Paty, Chairperson
Department of Land and Natural Resources

F R O M: Charles T. Toguchi, Superintendent
Department of Education

SUBJECT: Draft Environment Assessment
Waiau-Campbell Industrial Park
138 kV Transmission Lines Project

We have reviewed the subject draft EA and have the following comments to make:

1) The Department of Education (DOE) continues to have serious concerns regarding the inconclusive association between exposure to magnetic fields and health effects, including cancer. The results of the Swedish EMF Study (page 5-51) and the EPA preliminary draft (page 5-52) leave cause for caution rather than dismissal of our concerns for the safety of students based on a comparison with household appliances. The fact that most researchers (page 5-54) recommend additional research should not be ignored.

2) On page 5-13 under "Potential Impacts" it is stated: "High public uses such as schools, hospitals, and researchers should not be located in proximity to the transmission lines." Barbers Point Elementary School and three proposed schools in Kapolei Village are sited along the proposed transmission line corridor. The DOE recommends that the line be routed away from these schools to prevent any problems for our future generations of students.

Practicing "prudent avoidance" as stated in the Department of Health policy relating to electromagnetic fields from electric power lines (April 3, 1991) and following the Hawaiian Electric Company EMF Policy Statement that "....considers the health and safety of its customers, employees, and the general public its highest priority" are the DOE recommendations which will protect students and school staff.

Until the issue of the safety of electromagnetic radiation adjacent to high-voltage electric power lines is determined by research the DOE believes in the conservative approach.

Thank you for the opportunity to respond.

CTT:AH:hy

cc: A. Suga, Asst. Supt.
L. Chung, LDO
B. Choy, OEQC
Hawaiian Electric Co., Inc.
CH2M Hill, Inc.

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
DIVISION OF PUBLIC WORKS
P. O. BOX 119
HONOLULU, HAWAII 96810

(P)2027.2

JAN 4 1993

State Department of Land
and Natural Resources
Division of Land Management
1151 Punchbowl Street, Room 220
Honolulu, Hawaii 96813

Attention: Mr. Sojin Serikaku

Gentlemen:

Subject: Waiau-Campbell Industrial Park
138 kV Transmission Line, Part 1
CIP Substation to Ewa Nui Substation

Thank you for the opportunity to review the subject project's preliminary document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

GORDON MATSUOKA
State Public Works Engineer

RY:jk
cc: OEQC
HECO, Inc.
CH2M Hill, Inc.

Engineers
Planners
Economists
Scientists

January 20, 1993

Mr. Gordon Matsuoka
State Public Works Engineer
Division of Public Works
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Matsuoka:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for commenting on the Draft Environmental Assessment on the subject project.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL
HNL81/007.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

CH2M HILL Engineers Planners Economists Scientists

January 20, 1993

Mr. Charles T. Toguchi, *Superintendent*
Department of Education
State of Hawaii
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Mr. Toguchi:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project. Our responses to your comments are as follows:

1. Hawaiian Electric Company (HECO) shares your concern about the potential health effects from EMF and actively supports research efforts on this topic through monetary contributions to the Electric Power Institute (EPRI). EPRI has been HECO's voice in successfully supporting a federal appropriation, in the recently passed National Energy Act, of $65 million over five years for further EMF research.

   In the siting and design of transmission lines, HECO has used the "prudent avoidance" approach set forth in the State Department of Health's EMF Policy (see page 5-5 of the Draft EA). The specific application of the DOH policy is discussed on pages 5-59 to 5-61 of the Draft EA.

2. The Barbers Point Elementary School buildings are located about 400 feet from the proposed transmission lines (see page 5-1, Draft EA). The three proposed schools in Kapolei Village are at least 255 feet from the proposed transmission lines. At these distances, the magnetic field levels would be barely measurable. Transmission lines are intentionally located to minimize EMF levels near schools and other similar facilities.

Thank you for commenting on the Draft EA.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL Honolulu Office 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 808.943.1133 Fax 808.941.8225
HNL81/001.51

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Office of Conservation and Environmental Affairs
Honolulu, Hawaii

JAN 5 1993

FILE NO.: 93-318
DOC. NO.: 1998

MEMORANDUM

TO: Mason Young, Administrator
Division of Land Management

FROM: Roger C. Evans, Administrator
Office of Conservation and Environmental Affairs

SUBJECT: Draft Environmental Assessment (DEA) for the Waiau-Campbell Industrial Park 138kv Transmissions Line Project, Part 1 - Campbell Industrial Park to Ewa Nui Substations.

Thank you for giving our Department the opportunity to review this matter.

Our previous comments (see Appendix A, DEA) on this matter remain applicable.

Please feel free to contact our Office of Conservation and Environmental Affairs at 587-0377, should you have any questions.

cc: OEQC
Hawaiian Electric Company
CH2M Hill, Inc.

Engineers
Planners
Economists
Scientists

January 20, 1993

Mr. Roger C. Evans, Administrator
Office of Conservation and Environmental Affairs
Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Evans:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing the Draft Environmental Assessment on the proposed project.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL
HNL81/006.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:

January 8, 1992

92-294/epo

TO: The Honorable William W. Paty, Chairperson
Department of Land & Natural Resources

FROM: FOR John C. Lewin, M.D.
Director of Health

SUBJECT: Draft Environmental Assessment (EA)
Waiau-Campbell Industrial Park 138KV Transmission Lines Project
Part I - Campbell Industrial Park to Ewa Nui Substations

Thank you for allowing us to review and comment on the subject request. We have the following comments to offer:

The health effects information contained in the Draft EA has been reviewed and is essentially correct.

The Draft EA mentions a recently-released epidemiologic study on human populations in Sweden which reported a significant relationship between leukemia in children and living near the magnetic fields from 220- and 400-kilovolt power lines, which are stronger than the proposed 138-kilovolt power line. Another new Swedish study, not mentioned in the Draft EA, found a strong association between chronic myeloid leukemia in employed men and length of exposure to magnetic fields from power lines while on the job. Consequently, NUTEK, the Swedish State energy regulatory agency, now believes that "there is a connection between power frequency magnetic fields and cancer, above all childhood cancer." NUTEK plans to study this issue more closely.

United States experts will be reviewing the validity of these new Swedish studies and integrating them with past experimental results. The DOH is awaiting these expert opinions with interest.

At this time, therefore, the DOH has no scientific or public-health based objections to the construction of the line. The DOH agrees that routing the line away from schools and residences and using low-reactance phasing wherever possible would be very prudent.

If you should have ay questions, please contact Leslie Au of the Office of Hazard and Evaluation Response at 586-4249.

c: Office of Hazard Evaluation and Evaluation Response
Office of Environmental Quality Control
Hawaiian Electric Company, Inc.
CH2M Hill, Inc.

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
92-294/epo

January 8, 1992

TO: The Honorable William W. Paty, Chairperson
Department of Land & Natural Resources

FROM: FOR John C. Lewin, M.D.
Director of Health

SUBJECT: Draft Environmental Assessment (EA)
Waiau-Campbell Industrial Park 138KV Transmission Lines Project
Part I - Campbell Industrial Park to Ewa Nui Substations

Thank you for allowing us to review and comment on the subject request. We have the following comments to offer:

The health effects information contained in the Draft EA has been reviewed and is essentially correct.

The Draft EA mentions a recently-released epidemiologic study on human populations in Sweden which reported a significant relationship between leukemia in children and living near the magnetic fields from 220- and 400-kilovolt power lines, which are stronger than the proposed 138-kilovolt power line. Another new Swedish study, not mentioned in the Draft EA, found a strong association between chronic myeloid leukemia in employed men and length of exposure to magnetic fields from power lines while on the job. Consequently, NUTEK, the Swedish State energy regulatory agency, now believes that "there is a connection between power frequency magnetic fields and cancer, above all childhood cancer." NUTEK plans to study this issue more closely.

United States experts will be reviewing the validity of these new Swedish studies and integrating them with past experimental results. The DOH is awaiting these expert opinions with interest.

At this time, therefore, the DOH has no scientific or public-health based objections to the construction of the line. The DOH agrees that routing the line away from schools and residences and using low-reactance phasing wherever possible would be very prudent.

If you should have ay questions, please contact Leslie Au of the Office of Hazard and Evaluation Response at 586-4249.

c: Office of Hazard Evaluation and Evaluation Response
Office of Environmental Quality Control
Hawaiian Electric Company, Inc.
CH2M Hill, Inc.

Engineers
Planners
Economists
Scientists

January 20, 1993

John C. Lewin, M.D.
Director of Health
Department of Health
State of Hawaii
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project.

The EA has been revised to include a discussion of the other new Swedish study referenced in your comment letter. This new study is titled, "Occupational Exposure to Electromagnetic Fields in Relation to Leukemia and Brain Tumors: A Case-Control Study", and was prepared by Birgitta Floderus, et.al.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL
HNL81/009.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
JOYCE T. OMINE
AL PANG
JEANNE K. SCHULTZ
CALVIN M. TSUDA

IN REPLY REFER TO:

HWY-PS
2.5175

January 11, 1993

TO: William W. Paty, Chairperson
Board of Land and Natural Resources
Department of Land and Natural Resources

ATTN: Sojin Serikaku, Division of Land Management

FROM: Rex D. Johnson, Director
Department of Transportation

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT, WAIAU-CAMPBELL INDUSTRIAL PARK 138KV TRANSMISSION LINES PROJECT, PART I - CAMPBELL INDUSTRIAL PARK TO EWA NUI SUBSTATION, EWA, OAHU
TMK: 9-1-16: 25, 31; 9-1-17: 04

We have the following comments:

1. The proposed transmission line alignment and substation site should be fully coordinated with all developers in the area. The poles/lines should be placed as far away as possible from the edge of pavement.

2. The City/State should be consulted during the project planning/design phase to ascertain that the transmission line alignment and related improvements will not significantly affect the proposed North-South Road, Renton Road, and Farrington Highway.

3. Plans for construction work within the highway right-of-way must be submitted for our review and approval.

Engineers
Planners
Economists
Scientists

January 20, 1993

Mr. Rex Johnson, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813-6097

Dear Mr. Johnson:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project. Our responses to your comments are as follows:

1. HECO has consulted with landowners and developers with known projects in the area to coordinate planning and design of the transmission lines and substation. The transmission line poles will be located as far away as possible from the edge of roadway pavement. The only existing road along which new poles will be placed is Farrington Highway. In this location, poles will be placed at the mauka edge of the highway right-of-way, away from the pavement, adjacent to the makai boundary of the Energy Corridor.

2. HECO has met with State and City agencies to coordinate the placement and design of the transmission lines. As noted in the Draft EA pages 5-11, 5-12 and 5-14, HECO met with the your staff and the City Department of Transportation Services (DTS) concerning the proposed north-south road, Renton Road and Farrington Highway. See also the December 17, 1992 letter from the City DTS attached to the response letter to the City Department of Public Works in Appendix D of the Final EA.

3. HECO will submit plans to your staff for review and approval of construction work within the highway right-of-way.

For further information, please contact Ken Morikami, HECO project manager, at 543-7819 or Patrick Calizar, HECO engineer, at 543-7731.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL
HNL81/010.51

Honolulu Office

1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530

808.943.1133
Fax 808.941.8225

JOHN WAIHEE
GOVERNOR

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

IN REPLY REFER TO:
92:PPE/6161

December 30, 1992

State of Hawaii
Department of Land and Natural Resources
Division of Land Management
1151 Punchbowl Street, Room 220
Honolulu, Hawaii 96813
Attention: Mr. Sojin Serikaku

Dear Mr. Serikaku:

Subject: Waiau-Campbell Industrial Park 138 kV Transmission Lines Project, Part 1 - Campbell Industrial Park to Ewa Nui Substation, Draft Environmental Assessment

We have reviewed the subject document and have the following comments to offer:

1. The Villages of Kapolei is a development on 890 acres of land. (Page 5-11)

2. The visual impact should not be based solely on distant and closeup views being jeopardized. A consideration should also be given to the perceptual impact on a residential development. If this area were to contain the transmission line, the psychological perception on a perspective home buyer is a negative one. A development with a major transmission line is less marketable to the public. The buyers see the power lines as being dangerous or unsightly because of the potential health hazards of EMF and its inconclusive findings. This perception might greatly impact the HFDC effort in the Ewa region to provide affordable housing to Hawaii.

3. Dealing with the perception impact, studies have shown a property to be devalued if it is adjacent to a transmission line. This depreciation of homes would cause an impact to the development budget.

4. The HFDC policy is to prevent any features which compromise the health and safety of the residents in the State's housing developments. The Swedish Electric and Magnetic Fields (EMF) study indicates a "weak correlation between EMF exposure and childhood leukemia." This demonstrates a potential risk to the families adjacent to the power lines. If at a later date, it is conclusively proven that EMF is hazardous, Hawaiian Electric Company (HECO) should be **solely responsible** for any modifications or measures which must be taken to mitigate the health impacts on the residents at HECO's cost. HECO should indemnify the HFDC from any damages which might be incurred as a result of the EMF on the homeowners in the State-sponsored development.

5. In Appendix C, Sensitivity Analysis of Corridor Alternatives, Figure C-1 is blank.

6. Also in Appendix C, page C-2, Second Stage Sensitivity Analysis is indicated as having occurred due to concerns of avoiding existing and proposed residential areas and community facilities. Do Tables C-5 and C-6 indicate the proposed residential development along the KG corridor? The numbers do not seem to indicate this information. Please provide an updated analysis table and the revised final corridor ranking.

7. HFDC would prefer the power line to be underground along the KG corridor, if selected, because the power poles would have an impact on master planning the landbank area. According to Figure 3-3, the underground circuits suggest less of a risk as compared to the overhead condition and visual and physical obstructions are diminished.

Thank you for the opportunity to comment.

Sincerely,

JOSEPH K. CONANT
Executive Director

c: Mr. Brian J.J. Choy, Director
Office of Environmental Quality Control
Mr. Ken Morikami, Hawaiian Electric Company, Inc.
Mr. Paul Luersen, CH2M Hill, Inc.

Engineers
Planners
Economists
Scientists

January 20, 1993

Mr. Joseph K. Conant
Executive Director
Housing Finance and Development Corporation
State of Hawaii
677 Queen Street, Suite 300
Honolulu, Hawaii 96813

Dear Mr. Conant:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project. Our responses to your comments are as follows:

1. The EA will be corrected on page 5-11 to state that the Villages of Kapolei is a development on 890 acres.

2. It is acknowledged that the perception by some members of the public that EMF exposure could have a potential adverse health effect may itself be an adverse impact. This perception could have a negative effect on a prospective buyer who is considering the purchase of a home that has a transmission line in plain view. As discussed on pages 5-38 to 5-41 of the Draft EA, a variety of common household electrical appliances create exposure levels equal to or significantly higher than levels generated by 138kV transmission lines. While some of these appliances are mere conveniences and so can be avoided (e.g., electric can openers), other devices powered by electricity are essential (e.g., light bulbs). Enclosed is a table of EMF field measurements taken in Pearl City with members of the Pearl City Neighborhood Board and State Senator Eloise Tungpalan on November 14, 1992. After reviewing the results, the Neighborhood Board voted to support the Waiau-CIP 138kV Transmission Lines, Part 2, Project. (See enclosed letter.)

   Placing 138kV transmission lines underground does not eliminate magnetic fields (as explained on pages 3-8 to 3-10, Draft EA). Faced with the situation that technology cannot guarantee elimination of magnetic fields, that electricity is an

CH2M HILL
HNL81/002.51
Honolulu Office
1585 Kapiolani Blvd., Suite 1312
Honolulu, HI 96814-4530
808.943.1133
Fax 808.941.8225

essential utility for the public welfare, and that scientific studies on the potential health effects from EMF are inconclusive, the perception by some members of the public that EMF may have an adverse health effect is an unavoidable impact. The resulting effect on the marketability of residential property is discussed below. The EA has been revised to reflect this discussion in the potential impact sections for visual resources and EMF.

3. The effect on property values and marketability of homes because of views of transmission lines and the inconclusive scientific evidence on potential health effects of EMF will depend on the perception of the buyers. To our knowledge, there are no documented instances where an electric line, in itself, has caused the selling price or marketability of a residential property to be lower than it might otherwise be. While it is true that there are buyers who would not purchase a home that has a nearby transmission line or one in plain view, there are other buyers who would purchase the home. An article provided by your office ("With Controversy" in the November/December 1992 issue of *Real Estate Today*) reviews a variety of cases where potential home buyers have avoided homes near power lines while others do not care about the proximity of lines even when informed of the potential EMF effects. This observation is consistent with the anecdotal information reviewed by HECO. The EA has been revised to reflect this discussion in the potential impacts section for EMF.

4. There are two standard clauses contained in the Department of Land and Natural Resources' "Grant of Non-Exclusive Easement for Public Utilities" that indemnify the State and that require HECO to relocate the lines at its own expense. These clauses are attached.

5. A printing error resulted in the absence of Figure C-1 in some copies of the Draft EA. Copies of this figure have been sent to your staff by CH2M HILL.

6. At the time the sensitivity analysis was conducted, the 1,100 acres were being acquired to bank land for agricultural uses. No data were available on possible urban uses. At the time the Draft EA was published, a master plan had not been developed for the area. During meetings with the Office of State Planning and the Department of Land and Natural Resources in 1991 and 1992, it was proposed that Kaloi Gulch be used for stormwater drainage and open space purposes (see page 5-11, Draft EA). We have recently reviewed the sensitivity analysis with respect to your question and concluded that the relative ranking of alternatives would not change, for two reasons. Firstly, in the analysis documented in Tables C-5 and C-6, a residential, commercial, or community facility had to be within 100 feet on either side of the transmission lines to

receive a penalty score. Such a use has not been proposed. Secondly, the Kaloi Gulch alternative received the highest penalty score in the stage 2 analysis (Table C-5) of all the alternatives because the low profile of the existing agricultural use made the lines more visible to people over a broad area than would occur if the lines were in an urbanized area. Thus, if a penalty score were assigned for proposed urban uses, then the visual penalty score would have to be lowered, to be consistent with the method of analysis.

7. The issue of overhead versus underground lines is discussed in Chapter 6 of the Draft EA. The relative benefits of underground lines must be weighed against the adverse economic impact to HECO's customers and the State's economy. A decision to have ratepayers bear the cost of placing the project's 138kV transmission lines underground could set a precedent for placing all electrical lines underground so that all residents of Oahu could enjoy the relative benefits of underground lines. The cost of placing lines underground, excluding 138kV lines and service connections, is estimated at $10 billion, as discussed in Chapter 6. However, if a property owner requests underground facilities and is willing to pay the additional cost to place lines underground, then HECO will do so.

Thank you for your comments.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company
Office of Environmental Quality Control

Enclosures

HNL81/002.51

Magnetic Field Levels Pacific Palisades and Pearl City		
Time (a.m.)	Location	Magnetic Field (mG)
9:10	Mr. Yamashita's driveway	2.24
9:13	Manana Trail driveway	6.16
9:15	Manana Trail checking station (similar to Senator Tungpalan's view)	5.76
9:17	Under 138 kV Line #1	72.00
9:21	Under 138 kV Line #2	22.40
9:25	Under 138 kV Line #3	108.00
9:37	Pole #71–next to transformer (across from Senator Tungpalan's House)	13.00 to 28.00
9:38	Senator Tungpalan's meter socket	3.70
9:39	Senator Tungpalan's backyard	1.92
9:43	Senator Tungpalan's family room–in front of T.V. (on)	16.40
9:44	Senator Tungpalan's family room–in front of T.V. (off)	1.76
9:45	Senator Tungpalan's family room–on side of T.V. (on)	43.60
9:46	Senator Tungpalan's family room–at couch (T.V. on)	1.48
9:49	Senator Tungpalan's microwave (on)	100.00
9:49	Senator Tungpalan's microwave (off)	3.76
9:50	Senator Tungpalan's range hood (on)	13.60
9:50	Senator Tungpalan's range hood (off)	3.20
9:50	Senator Tungpalan's computer at 2 feet away (on)	3.20
9:51	Senator Tungpalan's computer at screen (on)	22.00
10:06	Senator Tungpalan's cellular telephone recharger (on)	364.00
10:45	Intersection of Kuala and Kamehameha Highway–mauka corner	2.24
10:57	Waiau Power Plant parking lot–mauka/diamond head corner	86.00
11:02	Kamehameha Highway–makai side under 138 kV Line #2	9.80
11:04	Kamehameha Highway–makai side under 138 kV Line #3	22.80
11:10	Kamehameha Highway–makai side Pole 233 next to • 12 kV overhead to underground circuit riser–metal casing • 12 kV overhead to underground circuit riser–PVC casing	 204.00 1,460.00
11:12	Kamehameha Highway–makai side under 138 kV Line #1	16.00
11:25	Noelani Street–under 138 kV lines	46.00
11:23	Intersection of Noelani and Hoomalu	9.68
11:24	Noelani residence on makai/ewa side of 138 kV lines	20.40
11:26	Noelani residence on makai/diamond head side of 138 kV lines	19.60
11:42	Lehua Elementary School–mauka/diamond head corner of property	1.40
11:56	Kamehameha Highway–makai side across from Pearl City Elementary School	5.48
Source: HECO field measurements, Saturday, November 14, 1992		

CH2M HILL Engineers Planners Economists Scientists

January 20, 1993

Mr. Benjamin Lee
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Lee:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project. Our responses to your comments are as follows:

1. Hawaiian Electric Company (HECO) met with representatives of the State Department of Transportation on a variety of occasions to coordinate the transmission line project with the DOT's projects (See Table B-2 in Appendix B, Draft EA). At a meeting on October 15, 1992, DOT staff confirmed that the DOT has the lead in planning for the proposed north-south road and that they do not anticipate any conflicts between the transmission lines and the proposed road (see page 5-12, Draft EA).

2. The specifics to applying the concept of "prudent avoidance" to this project are described in Chapter 6 as well as on pages 5-12 to 5-14 and on pages 5-50 to 5-61 of the Draft EA. These pages describe the measures taken to avoid, insofar as practicable, existing and future residential areas.

Thank you for your comments.

Sincerely,

CH2M HILL

Paul Luersen, AICP
senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company
Office of Environmental Quality Control

CH2M HILL Honolulu Office 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 808.943.1133 Fax 808.941.8225
HNL81/003.51

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

BENJAMIN B. LEE
CHIEF PLANNING OFFICER

ROLAND D. LIBBY, JR.
DEPUTY CHIEF PLANNING OFFICER

MH 12/92-3388

December 31, 1992

Mr. Sojin Serikaku
Division of Land Management
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 220
Honolulu, Hawaii 96813

Dear Mr. Serikaku:

Draft Environmental Assessment (DEA) for the Proposed Waiau-Campbell Industrial Park 138 kV Transmission Lines Project, Part 1-CIP to Ewa Nui Substations

In response to receiving the subject DEA on December 7, 1992, we have reviewed the proposed action and offer the following comments:

1. The preferred alignment of the proposed transmission lines should be closely coordinated with the EIS effort to determine the preferred alignment of the proposed North/South Road. HECO should request concurrence from the State Department of Transportation and City before finalizing an alignment for its transmission line.

2. According to Chapter 6 (Summary of Unresolved Issues), page 6-1, 'HECO has adopted strategies consistent with the "prudent avoidance" approach in routing and designing the Waiau-CIP Transmission Line, Part 1, Project. Land uses along the alternatives were evaluated with the prudent avoidance strategy in mind.'

   We request that the applicant clarify and define the term "prudent avoidance" specifically to identify any buffers or other criteria used to avoid existing and future residential areas.

Should there be any questions, please contact Matthew Higashida of our staff at 527-6056.

Sincerely,

BENJAMIN B. LEE
Chief Planning Officer

BBL:js

cc: Managing Director
Department of Housing and Community Development
Department of Transportation Services
Office of Environmental Quality Control
Hawaiian Electric Company, Inc.
CH2M Hill, Inc.

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

C. MICHAEL STREET
DIRECTOR AND CHIEF ENGINEER

FELIX B. LIMTIACO
DEPUTY DIRECTOR

ENV 93-2

January 4, 1993

Mr. Sojin Serikaku
Division of Land Management
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street, Room 220
Honolulu, Hawaii 96813

Dear Mr. Serikaku:

Subject: Draft Environmental Assessment (DEA)
Waiau-Campbell Industrial Park 138kV Transmission Lines Project, Part 1 - Campbell Industrial Park to Ewa Nui Substations, TMK:9-1-16:25 & 31; 9-1-17:04

In addition to our previous comments made during the pre-assessment consultation period (see attached), we have the following comments:

1. The DEA should address the impact of storm water discharges associated with construction activities on water quality of the receiving waters.

2. The DEA should also state what structural or non-structural best management (BMP) will be provided to control and reduce the discharge of pollutants as outlined in the National Pollutant Discharge Elimination System (NPDES) regulations (40 CFR Part 122, Subpart B for municipal storm sewer system).

Very truly yours,

for C. MICHAEL STREET
Director and Chief Engineer

Attach.

cc: Office of Environmental Quality Control
Hawaiian Electric Company (Ken T. Morikami)
CH2M Hill, Inc. (Paul Luersen)

ENVIRONMENTAL ENGIN

ENV 92-207

August 27, 1992

Mr. Paul Luersen, AICP
Senior Project Manager
CH_2M HILL
1585 Kapiolani Boulevard
Suite 1312
Honolulu, Hawaii 96814-4530

Dear Mr. Luersen:

Subject: Draft Environmental Assessment (DEA)
Waiau-Campbell Industrial Park 138 kV Transmission
Lines, Part 1-CIP Substation to Ewa Nui Substation

We have reviewed the subject DEA and have the following comments:

1. Paved access road for the proposed substation should be a minimum of 20-ft. wide to accommodate two-way traffic.

2. We suggest that a thorough investigation on future roadway widening and set-back requirements for the entire transmission alignment be conducted.

3. In the middle segment of the preferred alignment along Kaloi Gulch, from Renton Road to Farrington Highway, we suggest you contact Campbell Estate to ensure the proposed alignment will not interfere with the future drainage channel improvements.

4. The proposed alignment may conflict with existing municipal sewers in the vicinity.

5. For your information, several future sewers are being planned for the same area by private developers with the intent of eventual dedication to the City (see attached map). Therefore, future environmental documents and construction plans for the proposed project should be submitted to the private developers of the Ewa area as well as to the Division of Wastewater Management for review and comment.

Very truly yours,

C. MICHAEL STREET
Director and Chief Engineer

Attach.

bcc: Division of Engineering
Division of Wastewater Management

Engineers
Planners
Economists
Scientists

January 20, 1993

Mr. C. Michael Street
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Street:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project. Our responses to your comments are as follows:

1. Construction of the proposed transmission lines will not have an adverse impact on storm water discharges nor will it adversely affect water quality because of proposed mitigation measures. This is discussed on page 5-16 of the Draft EA.

2. The proposed project will not discharge pollutants to the storm water system or receiving waters.

Attached to your comment letter on the Draft EA was your consultation letter, dated August 27, 1992, sent in response to our letter requesting comments in preparation of the Draft EA. Each of the items in this letter were addressed in preparation of the Draft EA as follows:

1. The Ewa Nui Substation access road will be 20 feet wide, as noted on page 4-11 of the Draft EA.

2. In preparation of the Draft EA, we met with representatives of the City Department of Transportation Services on September 21, 1992 to discuss the project and future road improvements (see pages 5-11 to 5-14, Draft EA). In this meeting, HECO discussed the proposed widening of Farrington Highway and possible extension of Renton Road. As a follow up to the Farrington Highway project, the Department of Transportation Services in a letter dated

CH2M HILL Honolulu Office 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 808.943.1133 Fax 808.941.8225

December 17, 1992, to HECO stated that the Department has no objections to the project along the highway (see attachment). We also consulted with representatives of the City Department of Public Works on various occasions concerning future subdivisions not already identified during the route selection study. No conflicts were identified.

3. We contacted Campbell Estate and the Housing Finance Development Corporation concerning potential improvements to Kaloi Gulch (see pages 5-15 and 5-16, Draft EA). There are no specific plans for improvements yet. As noted in the draft EA, HECO will coordinate design of its project with the landowners.

4. We consulted with the City Department of Public Works and Campbell Estate concerning existing and proposed sewers in the area (see page 5-12, Draft EA). Coordination of final design and construction of the project with the City and Campbell Estate will avoid conflicts with sewerage facilities.

5. HECO will submit design drawings to the City's Department of Public Works Division of Wastewater Management, Campbell Estate, and appropriate developers for review.

Thank you for your comments.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

HNL81/004.51

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

JOSEPH M. MAGALDI, JR
DIRECTOR

AMAR SAPPAL
DEPUTY DIRECTOR

TE-4595
PL92.1.395

December 17,. 1992

Mr. Ken T. Morikami
Project Manager
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Morikami:

Subject: Waiau-CIP 138 kV Project - Part 1
Farrington Highway Widening
TMK: 9-1-16, 17 and 18

This is in response to your letter dated October 27, 1992 requesting our concurrence to place transmission lines on the mauka side of the existing Farrington Highway right-of-way.

At a prior meeting between members of our respective staffs and from your transmittal, we were made aware of the Energy Corridor and the restrictive nature of this easement adjacent to Farrington Highway. As such, we had agreed to pursue shifting the future roadway alignment and the subsequent widening to the makai portion of Farrington Highway. We have had discussions with Campbell Estate, and they have indicated that they have no objections to the proposed realignment. They have transmitted correspondence to our department in this regard for the Campbell properties which may be affected. We still need to work with the State and other property owners fronting Farrington Highway to confirm their commitment to the revised alignment in this area. When these commitments are secured, we will proceed to amend our planning area maps to reflect the revised alignment.

With regard to the Waiau-CIP 138 kV project, we understand that the transmission line will follow Farrington Highway and proceed in the makai direction along Kaloi Gulch. Being that this portion will be entirely within the Campbell properties, we would have no objections in your placing the line on the mauka side of Farrington Highway provided adequate sidewalk width is available for pedestrian movement.

Should you have any questions, please contact Mel Hirayama of my stff at 523-4119.

Sincerely,

JOSEPH M. MAGALDI, JR.
Director

cc: Campbell Estate

copy to: F. Hirakami / M. Riddle
P. Calizar / C. Char
W. Oda
P. Luersen

PEARL CITY NEIGHBORHOOD BOARD NO. 21
P.O. BOX 1025
PEARL CITY, HAWAII 96782

December 17, 1992

Mr. Donald Clegg
Director, Department of Land Utilization
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Clegg:

RE: HECO Proposed Waiau - Campbell Industrial Park 138 K.V. Transmission Lines, Part 2 (Ewa Nui Substation to Waiau Power Plant)
SMP Application

We have received the SMP application for the above mentioned project and recommend its approval. This position was adopted at our regularly scheduled meeting of November 19, 1992 by a vote of 9-4-1.

It should be noted that the Board is concerned about the possible health effects of electromagnetic fields (EMF). It is our understanding that HECO will utilize unlike phasing along the route to mitigate some of the resulting EMF fields. HECO will also attempt to keep the transmission lines as far from residences or other places where people congregate, such as schools.

Please call me at 455-3321 (residence) or 544-1119 (business) if you have any questions. Thank you for this opportunity to comment on this application.

Sincerely,

Thomas K.Y. Kam o.v.

Thomas K.Y. Kam
Chairman

cc: Senator Eloise Tungpalan
Andy Chang, HEI
Pearl City Neighborhood Board members
Neighborhood Commission Office

Grantee(s) shall maintain its/their appliances and equipment in a good and safe condition and repair, and shall at all times with respect to the easement area(s) use due care for public safety and agree(s) to defend, hold harmless and indemnify the Grantor, its officers, agents and employees or any person acting for and on its behalf, from and against all claims or demands for damage, including claims for property damage, personal injury or death, arising on, about or in connection with the easement area(s), caused directly or proximately by any failure on the part of the Grantee(s) to use the easement area(s) and maintain its/their appliances and equipment in the easement area(s) in accordance with the terms and conditions of this Indenture, or arising out of or caused by any act or omission of the Grantee(s).

Should future development necessitate (a) relocation of the easement(s) granted herein, or any portion thereof, the relocation shall be accomplished at the Grantees(s') own cost and expense; provided, however, that if other lands of the Grantor are available, the Grantor will grant to the Grantee(s) without payment of any money consideration, a substitute easement of similar width within the reasonable vicinity of the original alignment, which substitute easement shall be subject to the same terms and conditions as that herein granted and as required by law.

Harold M. Hashiro
Vice President, Distribution & Engineering

The Gas Company
515 Kamakee Street
PO Box 3379 Honolulu, Hawaii 96842
Telephone (808) 547-3550
Fax (808) 547-3030

BHP Petroleum

December 22, 1992

STATE OF HAWAII
Department of Land and Natural Resources
Division of Land Management
1151 Punchbowl Street, Room 220
Honolulu, Hawaii 96813

Attention: Mr. Sojin Serikaku

Gentlemen:

Subject: Comments for Environmental Assessment

Project: Waiau - Campbell Industrial Park 138KV Transmission Line
Part 1 - CIP to Ewa Hui Substation

We would like to take this opportunity to reiterate all concerns about the adverse effects of the 138KV transmission lines on the operations of our 16-inch transmission line as well as the safety of our personnel. HECO has committed to "coordinate with other utilities" in design and operation of the transmission lines to minimize or avoid adverse effects on the other utilities. As.a base line and for our own assurance, we request that HECO have a third party perform a base line survey of the electromagnetic effects on our 16-inch line, both before and periods after the installation of the 138KV transmission lines. This would establish whether the 138KV lines have affected our 16-inch pipeline.

Should there be any questions, or if additional information is desired, please contact RoyYoshimoto at (808) 547-3570.

Very truly yours,

THE GAS COMPANY

Harold M. Hashiro

Harold M. Hashiro

HMH/RHY:spy
92.311

Engineers
Planners
Economists
Scientists

January 20, 1993

Mr. Harold M. Hashiro
Vice President, Distribution and Engineering
The Gas Company
P.O. Box 3379
Honolulu, Hawaii 96842

Dear Mr. Hashiro:

Subject: Waiau-CIP 138kV Transmission Lines, Part 1

Thank you for reviewing and commenting on the Draft Environmental Assessment on the subject project.

Hawaiian Electric Company has requested a consulting firm to investigate potential effects of EMF from the proposed transmission lines on The Gas Company's 16-inch gas line as well as other utility lines in proximity to the transmission lines.

For further information, please contact Ken Morikami at 543-7819 or Patrick Calizar at 543-7731.

Sincerely,

CH2M HILL

Paul Luersen, AICP
Senior Project Manager

cc: Department of Land and Natural Resources
Hawaiian Electric Company, Inc.
Office of Environmental Quality Control

CH2M HILL Honolulu Office 1585 Kapiolani Blvd., Suite 1312 Honolulu, HI 96814-4530 808.943.1133 Fax 808.941.8225
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