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HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-CM 2.3466

AUG 26 1992

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OFC. OF E... QUAL...

Mr. Brian J. J. Choy, Director
Office of Environmental Quality Control
Central Pacific Plaza
220 S. King Street, Fourth Floor
Honolulu, Hawaii 96813

Dear Mr. Choy:

SUBJECT: Final Environmental Impact Statement (EIS)
Waiau-Campbell Industrial Park, 138kV Transmission Line
Part 2-Ewa Nui Substation To Waiau Power Plant
Hawaiian Electric Company, Inc.

As the Accepting Authority, I am notifying you that the Final EIS document is acceptable, pursuant to Chapter 343, HRS, and Title 11, Hawaii Administrative Rules, Department of Health, Chapter 200, Environmental Impact Statement Rules. A copy of our acceptance report is enclosed.

We also enclose four copies of the Final EIS and a copy of your "OEQC Bulletin Publication Form". We request that notice of acceptance of the Final EIS be published in the OEQC Bulletin under the Register of "Final Environmental Impact Statements".

Should you have any questions, please call Kenneth Umemoto at 587-2187.

Sincerely,

for Rex D. Johnson
Director of Transportation

Enclosures

1992 - Oahu - ~~Waiau~~ FEIS -
Waiau Transmission

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1992

Final Environmental Impact Statement

WAIAU-CAMPBELL INDUSTRIAL PARK
138 kV TRANSMISSION LINE

Part 2–Ewa Nui Substation to Waiau Power Plant

APPLICANT

Hawaiian Electric Company, Inc.
An HEI Company

AUGUST 1992

CH2M HILL

Final Environmental Impact Statement

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CHAPTER 1

Chapter 1
Summary

Background

The Waiau-CIP Transmission Line Part 2 Project is proposed as double-circuit, 138 kilovolt (kV) alternating current (AC) transmission lines between the new Ewa Nui Substation, next to Farrington Highway in the Ewa District, and the Waiau Power Plant in Pearl City. The lines would extend a distance of 7.8 miles and would generally follow the mauka edge of the H-1 freeway in Waipahu and along the makai side of Kamehameha Highway in Pearl City. An application to the Public Utilities Commission (PUC) for approval of the Part 2 route was filed on March 12, 1992.

The proposed transmission lines constitute the eastern portion of a new 138 kV transmission line system that would connect the Campbell Industrial Park (CIP) Substation with the Waiau Power Plant. The western portion of the system is called the Waiau-CIP Transmission Line Part 1. An application to the PUC for approval of the Part 1 route was filed on October 25, 1991.

Proposed Action and Alternatives

Hawaiian Electric Company, Inc. (HECO), has gone through a lengthy process to identify potential alignments for the Part 2 route. The *Waiau-Campbell Industrial Park 138 kV Transmission Line Part 2—Ewa Nui Substation to Waiau Power Plant Routing Report* was published in February 1992. The Routing Report identified five potential alignment alternatives, in addition to No Action, to be carried forward into an Environmental Impact Statement (EIS). Following 4-1/2 years of environmental evaluation, engineering analysis, and consultations with the public, elected officials, agencies, and landowners, HECO selected a preferred alignment for the Part 2 transmission lines. This alignment and the other alignments under consideration in this EIS are shown in Figure 4-3 (see Chapter 4). The alignments considered in this EIS are:

- H-1 Overhead (preferred by HECO)
- H-1 Overhead/Underground
- Farrington Overhead
- Farrington Underground
- OR&L Overhead/Underground
- No Action

Beneficial and Adverse Impacts

Shown in Table 1-1 is a summary of the characteristics and potential environmental effects associated with the two transmission technologies considered in this EIS: conventional overhead and underground. Generally, conventional overhead transmission lines have greater visual and EMF[1] related impacts than underground lines, but have fewer surface and subsurface impacts. In addition, overhead lines are easier to maintain. Two of the alternatives considered in this EIS are entirely overhead: H-1 Overhead and Farrington Overhead. Two lines have both overhead and underground components: H-1 Overhead/ Underground and OR&L[2] Overhead/Underground. Only the Farrington Underground alternative is exclusively underground.

Based on the analysis presented in this EIS, a table summarizing the specific potential impacts associated with each alternative alignment has been prepared (Table 1-2). The OR&L alignment has the most significant adverse impacts associated with it. These impacts include visual impacts associated with placement of overhead lines along the shoreline. Biological impacts would result from placing the line adjacent to existing wetlands and wildlife habitat, and near a wildlife refuge. The OR&L alignment presents significant soil stability problems, in addition to the potential liabilities associated with the existing oil and gas lines beneath the alignment. There is also an old landfill along this alignment that could indicate potential soil contamination. The underground sections of this alignment present maintenance difficulties. The positive aspects of this alignment include a lack of dense urban development along most of its length, fewer traffic impacts during construction and maintenance, and the presence of a corridor dedicated to utilities.

For the Farrington alignments, the impacts of the overhead and underground lines are not vastly different. Neither of these alignments has as many adverse impacts as the OR&L alignment. The Farrington Overhead alternative would have adverse visual impacts, as well as traffic disruption during construction and maintenance, and there is some potential for discovery of cultural resources. In Pearl City, the overhead lines would cross over the city's proposed rapid transit fixed guideway and one of this alternative's single-circuit lines along Kamehameha Highway would pass over a proposed transit station. Except for the visual impacts and transit project crossings, the same adverse impacts would occur with the Farrington Underground alternative. In addition, it is much more difficult to maintain underground lines than overhead lines. Repair of underground lines generally takes longer, is more costly, and results in more traffic and power distribution disruption than repair of overhead lines.

The H-1 alignments have the fewest environmental impacts of all the construction alternatives. The primary potential impacts are disruption to traffic during construction and maintenance, and visual impacts in the overhead sections. The H-1 Overhead alternative

[1]EMF = electric and magnetic fields.

[2]OR&L = Oahu Railway and Land Company's abandoned railroad right-of-way.

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

				Construction and Operation Effects			Maintenance Effects
Transmission Alternative	**Basic System Components**	**Approximate Line Length**	**Construction Cost per Mile**	**Geophysical, Biological, and Cultural Resources**	**EMF and Visual Resources**	**Traffic Considerations**	**Maintenance Considerations**
Conventional Overhead	Augered concrete pier foundations or pile foundations in wet soils (6 to 10 piles each pole) Tubular steel poles 80-120 feet high 3 aluminum conductor bundles and one shield wire per circuit Some sections underbuilt with 46 kV lines	6.4-8.4 miles, depending on alternative	$2.4 to 6.2 million, depending on alternative	Clearing of surface vegetation at pole sites Excavation for pile foundations 13 ft x 18 ft x 4 ft. Trees near right-of-way (ROW) trimmed within 10 ft of conductor position in high wind Subsurface archaeological features may be disturbed in excavations. Requires field archaeologist to survey pole sites.	EMF (Assumes single circuit line with no 46 kV underbuild) Electric field at center of ROW approx. 0.7 kV per meter 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, 1 lane of traffic obstructed for 4-6 weeks each mile during peak traffic periods (2 lanes off-peak) Maintenance Potential traffic disruption or delays depending on type of repair/maintenance practices	Location and access to line repair relatively easy "Live-line" maintenance is possible for routine maintenance Repair time: hours

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

				Construction and Operation Effects			Maintenance Effects
Transmission Alternative	**Basic System Components**	**Approximate Line Length**	**Construction Cost per Mile**	**Geophysical, Biological, and Cultural Resources**	**EMF and Visual Resources**	**Traffic Considerations**	**Maintenance Considerations**
Underground (HPFF)	High-pressure fluid-filled pipe containing cable plus smaller fluid return pipe (3 pipes in a trench) Fluid handling stations at each terminus Splice vaults (manholes) every 2,000-4,000 feet Cooling stations, filtering, and recirculation equipment may be required	2-6.5 miles, depending on alternative	$15.7 to 18.3 million, depending on alternative	Construction Trench excavation 7-10 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 due to cut and fill required for access Potential for disruption of surface cultural resources within ROW. Requires extensive survey and salvage plan. Operation Potential for excavation of pipe for repair of line Potential for fluid leaks due to line rupture	EMF No electric field Magnetic field of 1 to 20 mG 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 manhole 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: hours to weeks

IMPACT AREA	H-I Overhead Alternative	H-I Overhead/ Underground Alternative	Farrington Overhead Alternative	Farrington Underground Alternative	OR&L Overhead/ Underground Alternative	No Action Alternative
Land Use	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Demographics	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Employment	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Visual Resources	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact
Electric and Magnetic Fields	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	No Adverse Impact
Biological Resources	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact
Water Resources	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact
Soil Resources	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact
Transportation/Transit	Minor Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Traffic	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Adverse Impact	Minor Adverse Impact	No Adverse Impact
Utilities	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Pipelines	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact
Hazardous Wastes	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	Adverse Impact	No Adverse Impact
Air Quality	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Noise	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Cultural and Historic Resources	No Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	Minor Adverse Impact	No Adverse Impact
Public Services	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Maintenance	No Adverse Impact	Adverse Impact	No Adverse Impact	Adverse Impact	Adverse Impact	No Adverse Impact
Construction Cost	Minor Adverse Impact	Adverse Impact	Minor Adverse Impact	Adverse Impact	Adverse Impact	No Adverse Impact
Electric Service Reliability	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact	Adverse Impact

LEGEND

- No Adverse Impact
- Minor Adverse Impact (may not be significant)
- Adverse Impact (may be significant)

TABLE 1-2

SUMMARY OF IMPACTS

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

would have the same crossings over the city's proposed transit project as the Farrington Overhead alternative. From an operations standpoint, the underground lines would be much more difficult to repair, and there would be significantly longer periods when the lines would be out of service during repairs.

The No Action alternative would maintain current conditions, so that no new adverse environmental impacts would occur. However, under the No Action alternative, the existing deficiency in transmission capability would not be resolved as recommended by the 1984 Stone & Webster report. As a result, major system outages and other problems with delivery of electricity would continue and likely increase with projected increases in power demand.

Mitigation Measures

Mitigation measures have been identified for the adverse impacts associated with the preferred alternative, H-1 Overhead. Mitigation measures for visual impacts include coloring poles so that they blend with the background. In addition, the proposed design calls for underbuilding where possible, to minimize the number of individual poles required. In some areas, including Kamehameha Highway, existing overhead 12 kV lines will be placed underground, subject to PUC approval. Appropriate measures will be taken to minimize traffic impacts during both construction and maintenance. A staging and construction plan will be prepared with State Department of Transportation approval. HECO will coordinate its design of the transmission lines with the city to mitigate impacts of crossing the proposed rapid transit project. Measures to mitigate EMF impacts include low-reactance phasing of the lines and a program to measure magnetic fields before and after construction for comparison with calculated EMF values.

Unresolved Issues

The issue of public health effects from electric and magnetic fields from the Waiau-CIP Transmission Line Part 2 Project remains unresolved, as does the larger issue of health effects from electric and magnetic fields produced by existing distribution lines, wall wiring, appliances, and lighting fixtures. In addition, 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, continues to be an unresolved issue.

Compatibility with Land Use Plans and Policies

The H-1 Overhead alternative is consistent with local and state land use regulations. It is compatible with the State Land Use Designations, County General Plan, and County zoning designations along the proposed alignment. It conforms to the Hawaii State Plan (HRS Chapter 226), the State Functional Plan, the Coastal Zone Management Law (1975), and the policies of the County General Plan. The H-1 Overhead/Underground and the two Farrington alternatives are also in compliance with these local and state plans and policies. The OR&L alignment presents several inconsistencies. It is adjacent to or in two areas designated Protective (P) Subzone in the State Conservation District. In addition, because of the sensitive nature of the biological resources along the OR&L alignment, there are inconsistencies with the 1975 Coastal Zone Management Law.

In the future, the city may extend its rapid transit fixed guideway system toward Ewa and central Oahu from the proposed maintenance and vehicle storage yard near Leeward Community College. A possible alternative corridor for the westbound extension is Farrington Highway through Waipahu. If this alternative transit corridor is pursued, significant conflicts with the Farrington Overhead alternative would result because the double-circuit transmission lines would occupy the highway's median. Possible future extensions of the rapid transit project toward central Oahu would result in minor crossovers for the H-1 alternatives and the Farrington Overhead alternative.

The State Department of Transportation has future plans to improve Farrington Highway. The Farrington alternatives could conflict with these plans.

Permits and Approvals

Table 1-3 is a list of the potential permits and approvals for construction of any of the alternatives.

Table 1-3
Potential Permits/Approvals Required for Transmission Line Alternatives

Authorizing Agency	Permit/Approval	Alternative: H-1 Overhead	H-1 Overhead/ Underground	Farrington Overhead	Farrington Underground	OR&L Overhead/ Underground
Federal						
U.S. Army Corps of Engineers	General Permit/Section 10 Permit	P	P	P	P	P
U.S. Army Corps of Engineers	Section 404 Permit					P
Federal Highway Administration	Use of Freeway Right-of-Way (concurrence with State DOT)	Y	Y			
Council on Environmental Quality	NEPA Compliance	P	P	P	P	Y
U.S. Navy	Use of Federal Lands	Y		Y		Y
Coast Guard	Bridge Permit					P
State						
Office of State Planning	Coastal Zone Management (CZM) Federal Consistency	P	P	P	P	P
Department of Health	Variance from Community Noise Control Rules	Y	Y	Y	Y	Y
Department of Land and Natural Resources	Historic Site					P
	Stream Channel Alteration Permit					P
	Use of State Lands	Y	Y	Y	Y	Y
	Conservation District Use Permit					P
Department of Transportation	Use of Energy Corridor					Y
	Work on State Highways	Y	Y	Y	Y	Y
	Freeway Crossing of Utility Line	Y	Y	Y	Y	
	Use of Freeway Right-of-Way	Y	Y			

Y = Yes, permit probably required.
P = Permit potentially required, depending on location of alignment.

Table 1-3
Potential Permits/Approvals Required for Transmission Line Alternatives

		Alternative				
Authorizing Agency	Permit/Approval	H-1 Overhead	H-1 Overhead/ Underground	Farrington Overhead	Farrington Underground	OR&L Overhead/ Underground
State (continued)						
Office of Environmental Quality Control	State Environmental Impact Statement Law Compliance	Y	Y	Y		Y
Public Utilities Commission	Approval for Construction in Residential Area	Y	Y	Y	Y	Y
	Exemption from Requirements Relating to Conflicting Lines					
	Approval of Capital Expenditure Exceeding $500,000	Y	Y	Y	Y	Y
City/County						
Department of Land Utilization	Conditional Use Permit, Type 1	Y	Y	Y	Y	Y
	Shoreline Setback Variance					Y
	SMA Use Permit	Y	Y	Y	Y	Y
Public Works Department	Construction within County Road ROW	Y	Y	Y	Y	Y
Department of Transportation Services	Street Usage Permit	Y	Y	Y	Y	Y

Y = Yes, permit probably required.
P = Permit potentially required, depending on location of alignment.

CHAPTER 2

Chapter 2
Purpose and Need for the Action

The Waiau-CIP Transmission Line Part 2 Project is proposed as double-circuit, 138 kilovolt (kV) alternating current (AC) transmission lines between the new Ewa Nui Substation, next to Farrington Highway in the Ewa District, and the Waiau Power Plant. The lines will extend a distance of 7.8 miles.

The proposed transmission lines are the eastern portion of a new 138 kV transmission line system that will interconnect the Campbell Industrial Park (CIP) Substation with the Waiau Power Plant. The western portion of the system is called the Waiau-CIP Transmission Line Part 1. This EIS addresses the eastern portion, Part 2. Both Part 1 and Part 2 are needed to meet transmission requirements for new power generation projects located in the Campbell Industrial Park and to improve islandwide transmission system reliability.

The Waiau-CIP Transmission Line Part 2 Project is needed for three reasons:

- To increase system reliability by establishing an alternate transmission line corridor, as recommended in 1984 (Stone & Webster, 1984).
- To provide additional transmission capacity in leeward and central Oahu to meet expected load growth.
- To meet transmission requirements for existing and planned power generation projects in the Campbell Industrial Park area.

Each of these reasons is discussed below.

System Reliability

The Hawaiian Electric Company, Inc. (HECO), provides nearly all the electricity for a population of 817,000 on the Island of Oahu. It maintains service to approximately 250,000 metered accounts through its generation, transmission, and distribution systems. The system peak load was 1,141 megawatts (MW) as of November 1991.

Historically, HECO has provided a high level of reliable electric service and, until the early 1980s, the island 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. On July 13, 1983, one of these plus 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 caused circuit breakers to remove 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 islandwide 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 safely be 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 only one of the four circuits leading from the Kahe Power Plant in service. An automatic shutdown of most of the island's generating units occurred, resulting in a blackout that lasted up to 7 hours in some locations.

On April 9, 1991, an islandwide 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 exporting power from the Kahe Power Plant shut down to prevent damage to itself. An automatic shutdown of the island's generating units occurred. Findings on the causes of the power outage are inconclusive and are still under investigation.

After the 1983 blackout, Stone & Webster undertook a comprehensive investigation of the system (Stone & Webster, 1984). One of the recommendations of this investigation was for HECO to develop a physically separate power transmission corridor from Kahe to the Waiau Power Plant. Such a corridor would reduce the possibility of multiple line outages from a single catastrophe, such as a windstorm or fire. This second transmission corridor, which would be established with the addition of the new Waiau-CIP 138 kV lines, would provide an alternate path along which power could flow if the existing multiple lines out of Kahe were lost. This would improve the reliability of the entire transmission system and would have prevented the systemwide outage of April 9, 1991.

Load Growth

HECO's Forecast Planning Committee updates its forecasts of future loads semiannually. 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 level, 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 rate of 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 is because numerous major residential, commercial, industrial, and recreational developments are planned for the central Oahu and Ewa Plain area.

New Power Generation

New generation resources are required because of the growth in demand for electricity. Since September 1987, when HECO withdrew its application with the Hawaii Public Utilities Commission for the construction of a new 146 MW generating unit at the Kahe Power Plant, HECO has agreed to purchase power from independent power producers in Campbell Industrial Park. Two of the independent power plants are in operation:

- Kalaeloa Partners Limited Partnership's (KP) 185 MW, combined-cycle plant consisting of two oil-fired combustion turbines and one steam turbine
- Honolulu Resource Recovery Venture's (H-Power) 60 MW refuse/waste recovery power plant

A third independent power plant is under construction by Applied Energy Services-Barbers Point (AES-BP) of Arlington, Virginia. AES-BP plans to have a 180 MW coal-burning plant online 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 Campbell Industrial Park. The plant would come online in two phases: Phase 1 in 1995 and Phase 2 in 1996.

The new generation sources at the Campbell Industrial Park 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

Chapter 3

Project Description

Location

The study area for the Waiau-CIP Parts 1 and 2 routing study occupies approximately 75 square miles of the southwest quadrant of Oahu (see Figure 3-1). It includes approximately 5 square miles of water area within Pearl Harbor's West, Middle, and East Lochs (7 percent of the study area). The study area occupies all of the Ewa Plain from the shoreline mauka to the existing Kahe 138 kV transmission line corridor and portions of central Oahu, Pearl Harbor, Pearl City, and Waipahu.

The Part 2 study area has narrowed to three potential corridors to be analyzed in this EIS. One alignment generally follows the H-1 freeway, one follows Farrington Highway, and the third generally follows the Oahu Railway and Land Company (OR&L) right-of-way. In each case the western terminus is the Ewa Nui Substation, and the eastern terminus is the Waiau Power Plant.

Ownership

The study area includes property under the jurisdiction of the U.S. Department of Defense, other federal agencies, the State of Hawaii, the City and County of Honolulu, and private landowners. Military lands make up about 23 percent of the study area; most of these are under the jurisdiction of the U.S. Navy in the Pearl Harbor Naval Base Complex. Properties in nonmilitary federal ownership include the Waipahu Monitoring Station (Federal Communications Commission), a communication site (Federal Aviation Administration), and the Pacific Tsunami Warning Center (U.S. Department of Commerce).

The State of Hawaii owns and/or administers approximately 1,612 acres of land (3 percent of the study area). These properties include the Leeward Community College campus, Waipahu Intermediate and High Schools, the Villages of Kapolei residential development, and several other school properties plus additional land in the form of interstate and major highway rights-of-way and interchanges. The state is in the process of acquiring 1,100 acres of Campbell Estate land for land banking and agricultural preservation purposes.

The City and County of Honolulu owns, and through various departments administers approximately 1,612 acres (4 percent of the study area) used for the Makalena Golf Course, the West Loch Estates and Fernandez Village housing areas, the Honouliuli Sewage Treatment Plant, and several school and park properties (including West Loch Golf Course).

Project Proposal

Since July 1987, HECO has conducted an extensive routing study for both Parts 1 and 2. A key component of the 4-1/2-year study has been the community involvement program. As a result of public concerns about the preferred alignment expressed at public meetings in mid-1989, HECO reevaluated corridors and alignments for the transmission line project. It was at that time that the project was split into two parts. HECO selected a preferred alignment for Part 1, which covers the area between the Campbell Industrial Park Substation and the new Ewa Nui Substation. After consulting with the Ewa Neighborhood Board, HECO submitted an application to the Public Utilities Commission on October 25, 1991.

For Part 2 of the Waiau-CIP transmission line, a number of technical studies on alternative alignments along H-1 freeway, Farrington Highway, and the OR&L right-of-way were completed in the fall of 1991. In its alternative analysis, HECO considered all-overhead, partial-underground, and all-underground configurations. These configurations and alignment alternatives are described in Chapter 4 of this report. HECO selected a preferred alignment in late 1991 based on a comprehensive comparative analysis that included environmental factors, community concerns, regulations, feasibility of construction, cost, and ability to have the lines operational by the end of 1994. As in the case of Part 1, HECO was compelled to select the least objectionable alignment because of the urgency to provide an alternate transmission corridor to the existing Kahe lines. HECO's preferred alignment from the Ewa Nui Substation to the Waiau Power Plant is shown in Figure 3-2. This alignment, called **H-1 Overhead**, consists of the following elements:

- Double-circuit overhead line that follows the existing 46 kV easement mauka of the Ewa Nui Substation along a cane haul road and crosses to the mauka side of H-1; then eastward along the mauka edge of the H-1 right-of-way (with one circuit overhanging the right-of-way) to the Kunia Road/H-1 Interchange; then through the interchange to follow the existing 46 kV easement between H-1 and a cane haul road to Waikele Gulch. Several poles would be placed within the H-1 right-of-way. The existing 46 kV lines would be underbuilt.

- Double-circuit overhead line that spans Waikele Gulch to a point between H-1 and a new drainage ditch; then along H-1 through Waikele Gulch to the vicinity of the new Waipiolani Substation at the H-1/H-2 Interchange.

- From the vicinity of the existing Waipiolani Substation, the alignment would follow an existing 46 kV easement to the Pearl City Industrial Park. The existing 46 kV lines would be underbuilt.

- From the Pearl City Industrial Park to the Waiau Power Plant, the H-1 Overhead alignment has two single-circuit overhead lines that generally follow existing 46 kV easements:

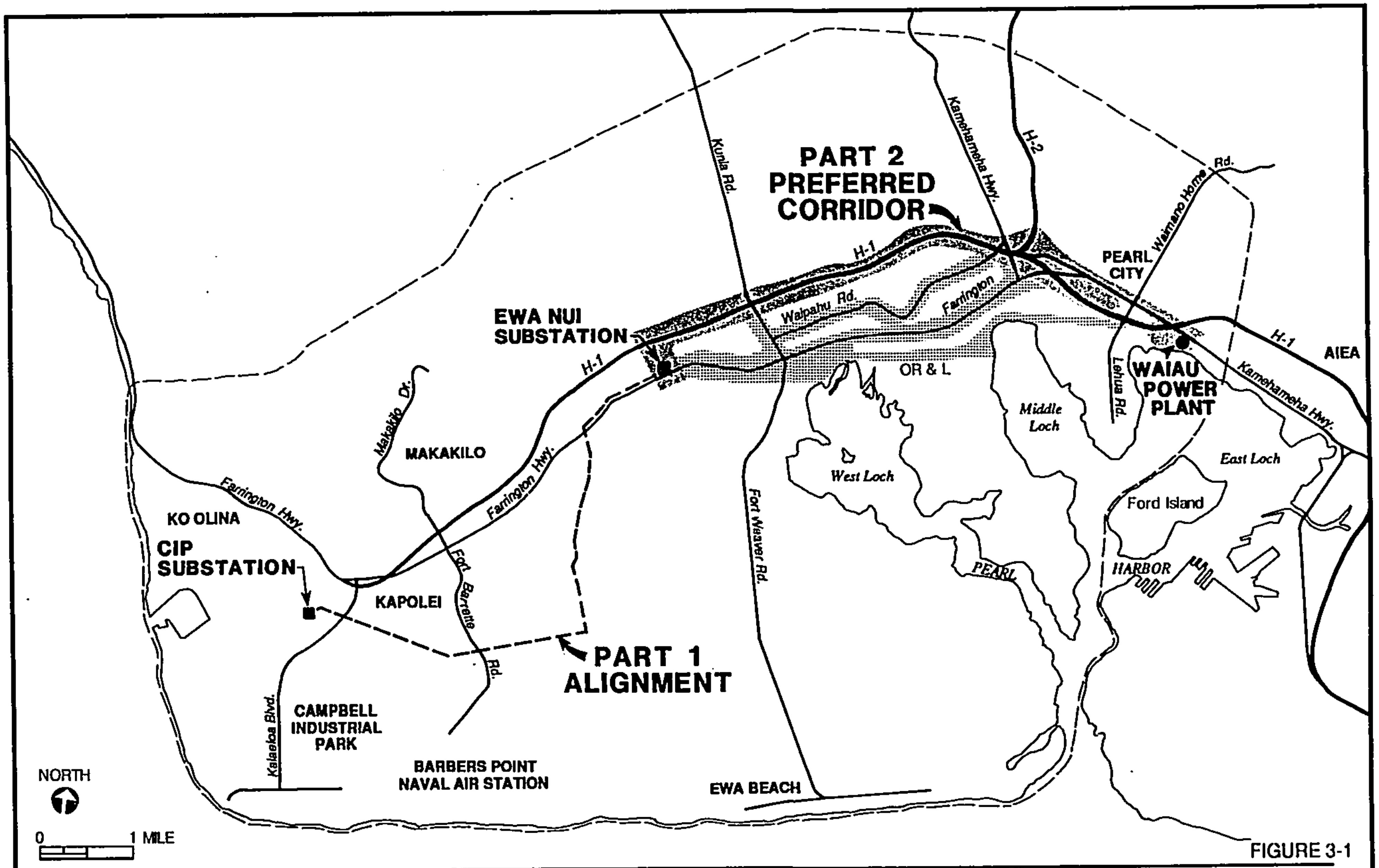


FIGURE 3-1

WAIAU-CIP
138 kV TRANSMISSION LINE
PARTS 1 AND 2

Study Area Boundary
Part 2 Preferred Corridor
Part 2 Alternative Corridor

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

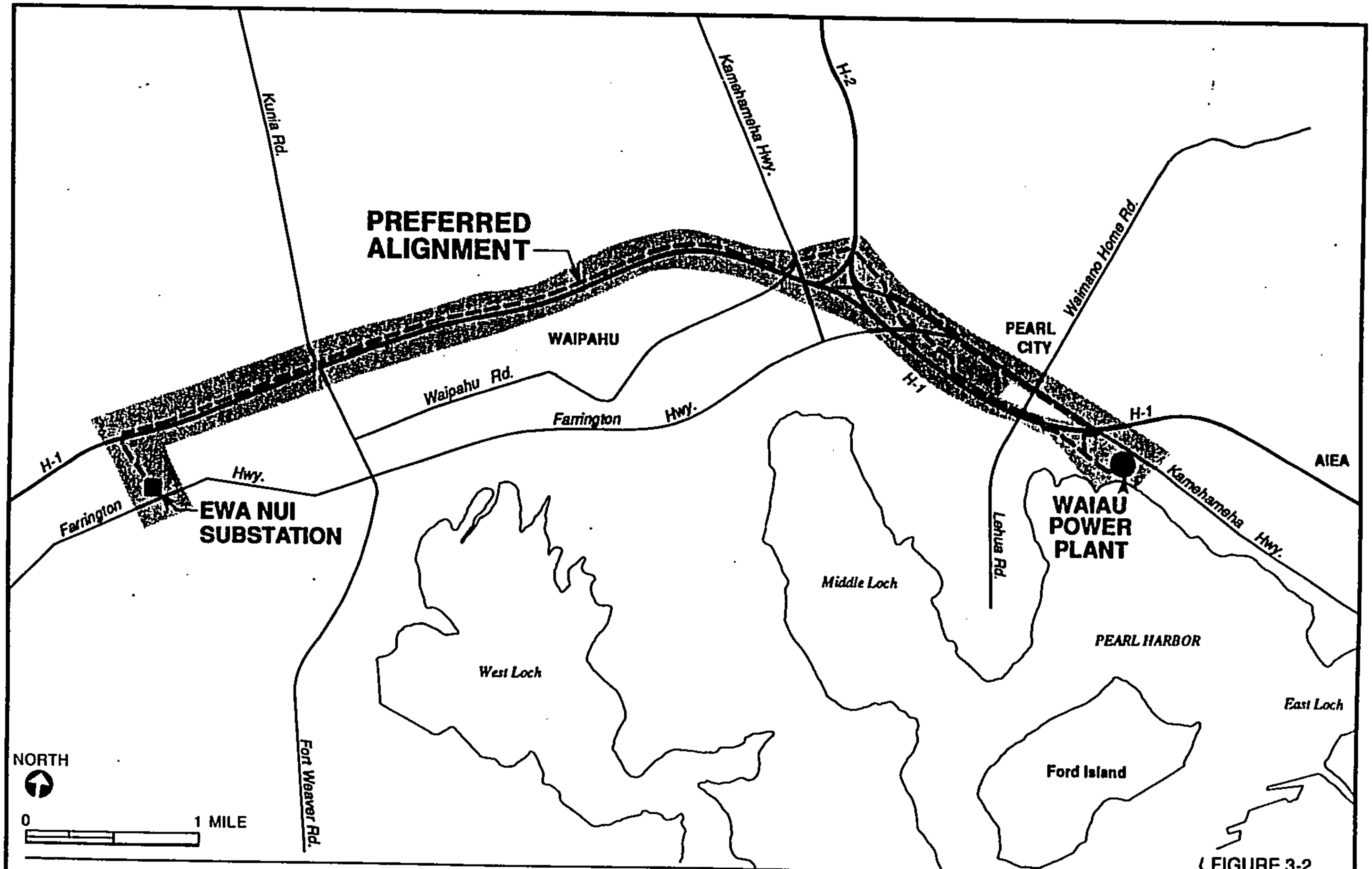


FIGURE 3-2

PREFERRED ALIGNMENT
WAIAU-CIP 138 kV
TRANSMISSION LINE, PART 2

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

- Single-circuit overhead line that follows a 46 kV easement along the makai side of Kamehameha Highway to a point between H-1 and the power plant; from that point, the line backtracks along HECO property to join the 46 kV easement from the OR&L. The 46 kV lines would be underbuilt. The existing 12 kV line along the makai side of Kamehameha Highway would be placed underground.

- Single-circuit overhead line that crosses Kamehameha Highway to an existing 46 kV easement along Waiawa Stream to the University of Hawaii's Extension Program experimental station; then along 2nd Street mauka of H-1 to a point east of Lehua Avenue; then follows the existing easement to the power plant. The two single-circuit alignments would become a double-circuit alignment near the diesel tanks at the power plant. The existing 46 kV and 12 kV lines would be underbuilt.

Public ownership along the H-1 Overhead alignment consists of:

- U.S. Navy

  - Waikele Gulch is located about one mile east of Kunia Road. At the west edge of Waikele Gulch, a new 50-foot-wide easement over the U.S. Navy's access road to the Naval Magazine Lualualei Waikele Branch will be required. This new 50-foot-wide easement will be adjacent to the mauka edge of the H-1 freeway right-of-way.

  - From a point makai of the H-1 freeway and about 1/8 mile east of Lehua Road (near Lehua School) eastward to the Waiau Power Plant, HECO has an existing 25-foot-wide easement that was granted by the U.S. Navy. The western portion of this U.S. Navy property is being leased by Leeward Wholesale Nursery, and the eastern portion is being leased by Gushing Waters, Inc. HECO may require an additional 25 feet of easement for a total width of 50 feet, depending on final design.

- State of Hawaii

  - Situated about 3/4 mile west of the Kamehameha Highway/Waipahu Road intersection with the H-1 freeway, the State of Hawaii has a reservoir site located adjacent to the mauka edge of the H-1 freeway, near Mahoe Street. HECO will require a new 65-foot-wide easement across this State of Hawaii property. The new easement will be encumbered by an existing 20-foot-wide waterline easement abutting the freeway right-of-way.

- In an area located makai of Kamehameha Highway, mauka of the H-1 freeway, and east of Farrington Highway, HECO has a 25-foot-wide perpetual easement across State of Hawaii (University of Hawaii) property. HECO requires an additional 25-foot easement for a total easement of 50 feet. The final easement will extend 25 feet on either side of the centerline of the existing easement.

- Permission from the State Department of Transportation Highways Division is required to overhang one circuit into the freeway right-of-way, cross the freeway, and to place several poles in the H-1 freeway right-of-way, as follows:

  - Overhang of one circuit into the H-1 freeway right-of-way from the vicinity of the Ewa Nui Substation along the mauka edge of the H-1 freeway eastward to Kunia Road, and from Kunia Road eastward about one mile to Waikele Gulch.

  - Cross from the makai to mauka side of the H-1 freeway north of the Ewa Nui Substation.

  - Cross through the Kunia Road/H-1 freeway Interchange.

  - Cross Kamehameha Highway at the Waiawa Interchange.

  - Cross H-2 freeway at the Waiawa Interchange.

  - Cross from the mauka to makai side of Kamehameha Highway east of the Waiawa Interchange.

  - Cross from the mauka to makai side of Farrington Highway east of the Waiawa Interchange.

  - Cross from the mauka to makai side of H-1 freeway east of Waimano Home Road/Lehua Road.

  - Cross from the mauka to makai side of H-1 freeway where the elevated section of the H-1 freeway crosses over Kamehameha Highway near the Waiau Power Plant.

  - Place several poles within the mauka edge of the H-1 freeway right-of-way, beginning at a point east of Kunia Road at a Cane Haul Road (near Kupuna Loop) and ending farther to the east at the Navy's access road (at the west edge of Waikele Gulch).

Maps of lands under the jurisdiction of the U.S. Navy and State of Hawaii are shown in Figures 5-14, 5-15, and 5-16 in Chapter 5.

Construction Practices

During the construction of the overhead transmission lines, 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 3-1 lists equipment typically used during construction.

Surveying Phase

Surveying for construction of the transmission lines includes property, right-of-way, ground profile, access road, and construction surveys. A typical survey crew includes three people. Additionally, geotechnical investigations at selected locations will determine the types of foundations required at each pole site.

Clearing Requirements

Right-of-way clearing is done when necessary to prepare for efficient installation of poles and conductors and to provide for required electrical clearances.

Access Requirements and Traffic Management Practices

When poles are installed adjacent to roads, such as Kamehameha Highway, part of the road must sometimes be occupied by equipment used for installation of foundations, poles, and conductors. Work on public roads must follow 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 adjacent 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.

According to state procedures, 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 (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/or police officers (State of Hawaii Department of Transportation, 1984; U.S. Federal Highway Administration, 1978).

Table 3-1
Typical Equipment Used During Construction

Page 1 of 2

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, 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	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

Table 3-1
Typical Equipment Used During Construction

Construction Category	Purpose
15-ton cranes (mobile)	Erect structures
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	Supervision and clerical office

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 days over the course of 3 to 4 months.

Construction and maintenance of the project from a federally funded freeway, such as H-1, are not permitted by federal and state regulations. Construction access outside the freeway right-of-way must be obtained.

Construction Yards

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 field office; pole and davit arm laydown areas; storage of materials, equipment, and vehicles; and security.

Foundation Installation

The next phase in the construction of transmission lines is foundation installation. Foundations for the Waiau-CIP Part 2 Line will be of the conventional pier type.

Foundation installation requires boring a large-diameter hole in the ground and placing a reinforcing steel and anchor bolt cage in the hole. Each hole is then filled with concrete to a depth of 2 feet below finished grade. While the concrete is curing, backfill is placed and compacted, as necessary, around the foundations. Where holes fill with water during augering or hole walls are unstable, a corrugated steel culvert pipe is lowered or driven as a form. Concrete is then tremied into the hole, allowing water to be pumped out for conventional completion of the work. Concrete is allowed to cure for a period of 2 to 4 weeks before the poles are placed on the foundations. After the poles are erected, a 6-inch grout is packed under the steel pole.

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 adjacent 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.

The base section of each steel pole is fitted with a baseplate with an array of anchor bolt holes that match the anchor bolt pattern installed in the foundation. Anchor bolt leveling nuts are tightened in accordance with the manufacturer's recommendations before the pole is erected. Insulator hardware is assembled and installed on each pole after it is erected.

Approximately two to four poles per day can be erected by four to seven workers.

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" is 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. The conductors, the tensioner, the puller, and other related equipment and material are assembled at sites located along the route at 1- to 2-mile intervals. A pulling line or sock line, which is usually a dacron or nylon rope, is pulled from pole to pole through pulleys (sheaves) attached to the insulators. The conductor is then pulled through the sheaves behind the sock line, brought to a specified ground clearance (sag), and clipped in the dead-end or suspension insulator clamps.

In pole locations adjacent 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 generally 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

Schedule

Construction of the transmission lines will take about 12 months, from October 1993 to October 1994. Startup of the lines is scheduled for December 1994, at which time the entire length of the Waiau-CIP 138 kV Transmission Line Project (Parts 1 and 2) will be in operation.

CHAPTER 4

Chapter 4
Alternatives Considered

Transmission Technologies

There are two technically possible methods of constructing 138 kV transmission lines between the Waiau Power Plant and the Ewa Nui Substation: 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 transmission technologies and compares the environmental and economic considerations of construction and maintenance for the two.

Overhead Transmission Line

Conventional overhead 138 kV construction (Figure 4-1) 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. HECO transmission lines are designed to meet or exceed the standards of the Public Utilities Commission's (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 and conductor clearances, as well as other construction standards, to ensure safe and efficient service.

The type of support structure selected depends primarily on the topography and land uses in and around the proposed right-of-way. Lattice steel and multipole wood structures are used in remote or mountainous terrain where span lengths are long (600 to 1,200 feet). The cost per mile is relatively low; however, the steel towers can be visually intrusive. Tubular steel poles (Figure 4-1) 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) or where permanent easements cannot be obtained. 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 and tubular steel poles can be painted to blend in with or complement the surrounding environment.

Underground Transmission Cable

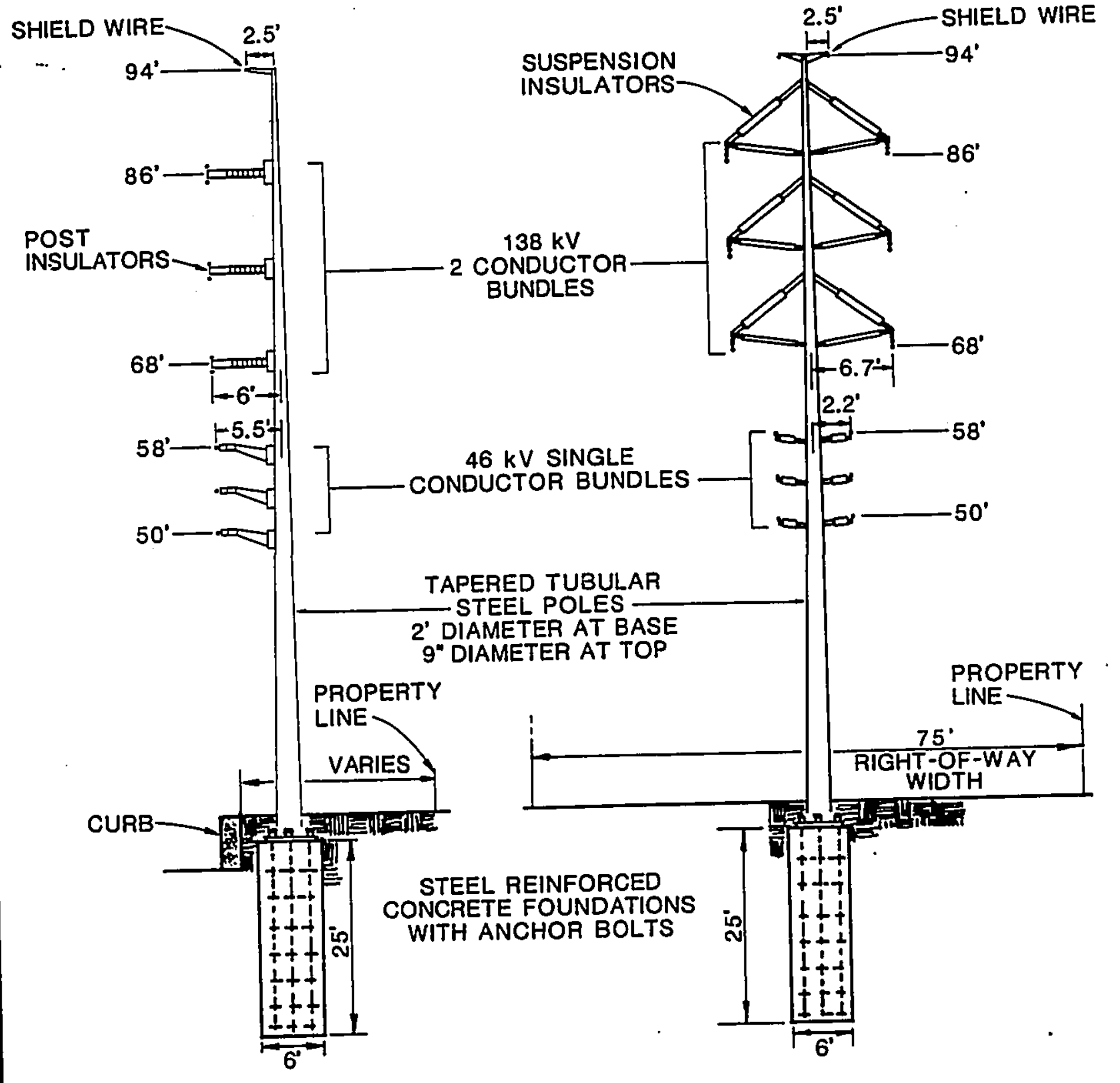
Most underground transmission cable systems in the United States are high-pressure fluid-filled pipe systems (HPFF) (Electric Power Research Institute, 1975). Other systems include low-pressure fluid-filled (LPFF) or self-contained fluid-filled cables, and gas and solid dielectric cables. Gas dielectric systems are used in situations where short, high-capacity lines are needed and generally are not used for long-distance transmission. LPFF self-contained cables require a duct for each cable and involve larger excavations and higher overall costs than do dielectric systems. 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. However, HECO's engineers believe that over short distances (around 2,000 feet), solid dielectric cables can provide reliable service for 138 kV lines.

HPFF systems are the most reliable systems available. Their excellent operating record and physical ruggedness make them particularly appropriate for the Waiau-CIP Line. HECO has used HPFF systems for its existing, 2-mile, Iwilei-to-Archer and School-to-Archer 138 kV lines.

The HPFF 138 kV underground system evaluated for the project consists of three paper-insulated cables installed in a fluid-filled pipe (Figure 4-2). The pipe contains a low-viscosity dielectric fluid under nominal pressure of 200 pounds per square inch (psi). 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 conditions of the soils on Oahu. The number of pipes installed depends on the power and reliability requirements of the system. For the Waiau-CIP 138 kV transmission lines, it is assumed that three circuits would be installed.

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 adjacent to the cable pipe. Special terminations are used at the line terminals for the transition from the cable insulation 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 station with a capacity of 525,000 British thermal units [Btu] is 10 feet wide by 30 feet long by 9 feet high.) If forced cooling is not required, only fluid pressurization stations need to be installed at the terminals. Splice vaults (manholes) are required at varying intervals along the line, with a maximum interval of 2,000 to 4,000 feet.



SINGLE CIRCUIT
TYPICAL SPANS 300' - 600'

DOUBLE CIRCUIT
TYPICAL SPANS 300' - 600'

NOT TO SCALE

FIGURE 4-1

TYPICAL 138 kV STRUCTURES

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

Conclusion

After reviewing transmission line alternatives, HECO determined that the conventional overhead line technology is the most reasonable and cost-effective technology for the Waiau-CIP Transmission Line Part 2 Project.

The underground cable technology has both advantages and significant disadvantages. The principal advantages are the low level of visual impact and greater protection from hurricanes, fire, etc., than overhead lines. The disadvantages include significantly higher construction and maintenance costs and much longer time required for construction and repair than required for a conventional overhead line. In addition, the extensive excavation needed to construct an underground cable would pose a greater risk to biological and cultural resources in sensitive areas. 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 would increase the cost of electricity to customers.

Nonetheless, HECO retained the underground alternative for further analysis because of the Public Utilities Commission Decision and Order No. 11135 for the Waiau-Makalapa No. 2 138 kV Transmission Line Project, in which HECO is directed to "consider underground placement of the lines (in part or in whole)."

In conclusion, the overhead and underground alternative technologies were retained for further analysis in the identification of alternative alignments and selection of a preferred alignment.

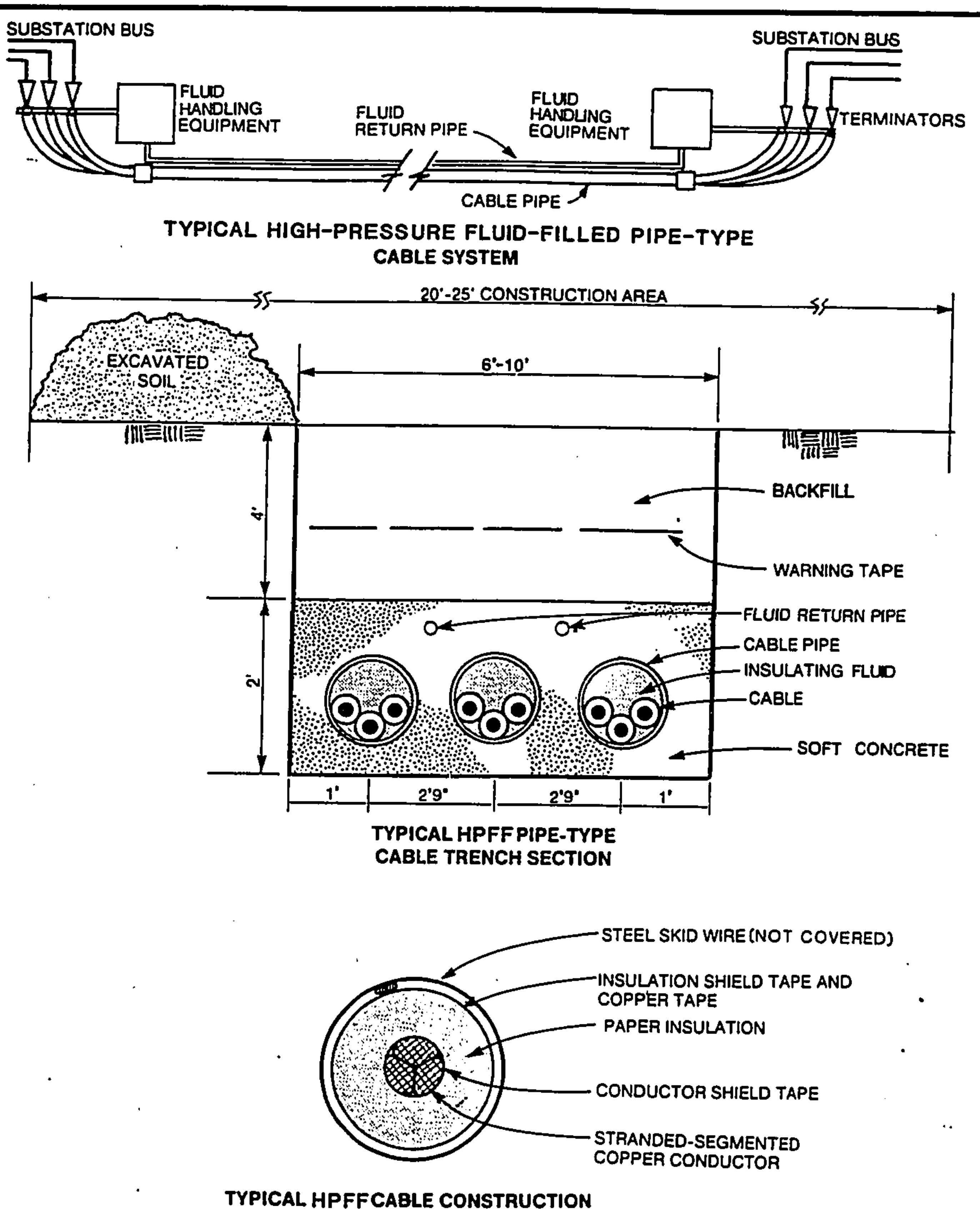
Corridor Alternatives

An opportunities and constraints analysis was conducted to identify possible corridor alternatives. Corridors were defined as being one-quarter to one-half mile wide. The alternative corridors were located primarily along existing transportation corridors or linear facilities, such as existing 46 kV transmission line rights-of-way. After the environmental and land use characteristics; permitting issues; and public, agency, and landowner comments were reviewed, each corridor was compared with the others and either retained or dropped. Following are a brief description of each corridor and a summary of its positive and negative features.

Waipahu Section

H-1 Freeway

This corridor follows the H-1 freeway. Although this corridor is adjacent to existing and planned residential areas, it also offers opportunities for siting a new transmission line that reduce the impacts of the new line. The H-1 freeway provides a linear corridor that could generally accommodate both circuits of the new transmission line. The City and



NOT TO SCALE

FIGURE 4-2

TYPICAL 138KV UNDERGROUND SYSTEM

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

County of Honolulu's Department of General Planning prefers this corridor to alternatives along Farrington Highway. Neighborhood groups have mixed opinions about this corridor: The Village Park Community Association opposes it, whereas the Waipahu Neighborhood Board expressed opinions in support of it. Because this corridor does have some features making it potentially suitable as a transmission corridor, it was retained for further study.

Waipahu Street

This corridor follows a fairly narrow street that runs through dense residential and commercial areas. It includes two schools and the Waipahu Cultural Garden Park. Because of the narrowness of Waipahu Street and the sidewalks on either side of it, the double-circuit line would have to be split into two single-circuit lines, with one circuit on either side of the street. Public and agency comments were almost uniformly against the use of this corridor. For these reasons, it was eliminated from further consideration.

Farrington Highway

This corridor provides a straightforward alignment through Waipahu along a relatively wide highway. It has fewer residential areas than Waipahu Street. It is opposed by the City and County of Honolulu Department of Transportation Services and Department of General Planning (because of possible plans to extend the rapid transit system along Farrington Highway toward Waianae). The State Department of Transportation noted potential conflicts because of future plans to widen and improve the highway. However, the U.S. Navy supports selection of this corridor because it minimizes impacts to Navy property. This corridor has features that could make it a feasible transmission line corridor; thus, it was retained for further study.

OR&L Corridor

This corridor crosses industrial, residential, recreational, and public facility uses. It is adjacent to Pearl Harbor and has areas of wetlands and wildlife habitat. Portions of the corridor include the State of Hawaii's Energy Corridor and private gas and oil pipelines. Construction adjacent to the pipelines in wet soils would probably be difficult and expensive, and could expose HECO to unlimited liability related to any oil-contaminated soils discovered during construction. State and federal natural resource agencies are concerned about potential impacts to sensitive bird species that nest and feed in and around this corridor. Use of this corridor would require numerous permits from federal, state, and local agencies. However, some community groups (e.g., Village Park) prefer this corridor, viewing it as a way to avoid impacts to residential and commercial areas. Because this corridor is supported by community groups, and because it does provide a way to avoid some residential and commercial areas, it was retained for further study.

Pearl City Section

H-1/Kamehameha Highway

In the Pearl City area, this corridor includes both Kamehameha Highway and the H-1 freeway. It includes primarily commercial and industrial land uses, and smaller areas of residential and public uses, including an elementary school and Leeward Community College. It provides several opportunities to follow existing road rights-of-way and existing 46 kV lines to the Waiau Power Plant. Although the rapid transit system is planned to follow Kamehameha Highway, the City's Department of Transportation Services has indicated that, if planned jointly, the line could be accommodated with the rapid transit system. For these reasons, this corridor was retained for further study.

OR&L Corridor

This corridor crosses wetland areas just mauka of the Waiawa Unit of Pearl Harbor National Wildlife Refuge. It includes the State's Energy Corridor and other oil pipelines, and passes near Lehua School and some houses. Although it shares the problems and liabilities described above for the OR&L corridor in the Waipahu area, this corridor was retained for further study because it is supported by neighborhood groups, and it provides a way to avoid some residential and commercial areas.

Alignment Alternatives

HECO used a series of environmental, land use, engineering, and cost criteria as well as guidance from the Public Utilities Commission (PUC) to guide the identification of alternative 100-foot-wide alignments. These include alternatives that would be entirely above ground, alternatives that would be entirely below ground, and alternatives that combine overhead and underground sections. HECO also identified ways to improve the appearance of the proposed and existing electrical transmission and distribution system by combining existing lines onto the same poles as the new line, or (in some cases) by proposing to place existing 12 kV lines underground, subject to PUC approval. Following is a description of the alternatives retained for analysis in this EIS (see Figure 4-3).

H-1 Overhead Alternative

This alternative, which is overhead for its entire length, would consist of the following components:

- Double-circuit overhead line that follows the existing 46 kV easement mauka of the Ewa Nui Substation along a cane haul road and crosses to the mauka side of H-1; then eastward along the mauka edge of the H-1 right-of-way (with one circuit overhanging the right-of-way) to the Kunia Road/H-1 Interchange; then through the interchange to follow the existing 46 kV easement between H-1 and a cane haul road to Waikele Gulch. Several poles would be placed within the H-1 right-of-way. The existing 46 kV lines would be underbuilt.

- Double-circuit overhead line that spans Waikele Gulch to a point between H-1 and a new drainage ditch; then along H-1 through Waikele Gulch to the vicinity of the new Waipiolani Substation at the H-1/H-2 Interchange.

- From the vicinity of the new Waipiolani Substation, the alignment would follow an existing 46 kV easement to the Pearl City Industrial Park. The existing 46 kV lines would be underbuilt.

- From the Pearl City Industrial Park to the Waiau Power Plant, the H-1 Overhead alignment has two single-circuit overhead lines that generally follow existing 46 kV easements:

    - Single-circuit overhead line that follows a 46 kV easement along the makai side of Kamehameha Highway to a point between H-1 and the power plant; from that point, the line backtracks along HECO property to join the 46 kV easement from the OR&L. The 46 kV lines would be underbuilt. The existing 12 kV line along the makai side of Kamehameha Highway would be placed underground, subject to PUC approval.

    - Single-circuit overhead line that crosses Kamehameha Highway to an existing 46 kV easement along Waiawa Stream to the University of Hawaii's Extension Program experimental station; then along 2nd Street mauka of H-1 to a point east of Lehua Avenue; then follows the existing easement to the power plant. The two single-circuit alignments would become a double-circuit alignment near the diesel tanks at the power plant. The existing 46 kV and 12 kV lines would be underbuilt.

H-1 Overhead/Underground Alternative

This alternative, which has both overhead and underground sections, would be the same as the H-1 Overhead alternative described above from the Ewa Nui Substation to the Pearl City Industrial Park. It would consist of the following elements:

- A double-circuit overhead line that would follow the existing 46 kV line easement mauka of the Ewa Nui Substation along a cane haul road and cross to the mauka side of H-1; then eastward along the mauka edge of the H-1 right-of-way (with one circuit overhanging the right-of-way) to the Kunia Road/H-1 Interchange; then through the interchange to follow the existing 46 kV line easement between H-1 and a cane haul road to Waikele

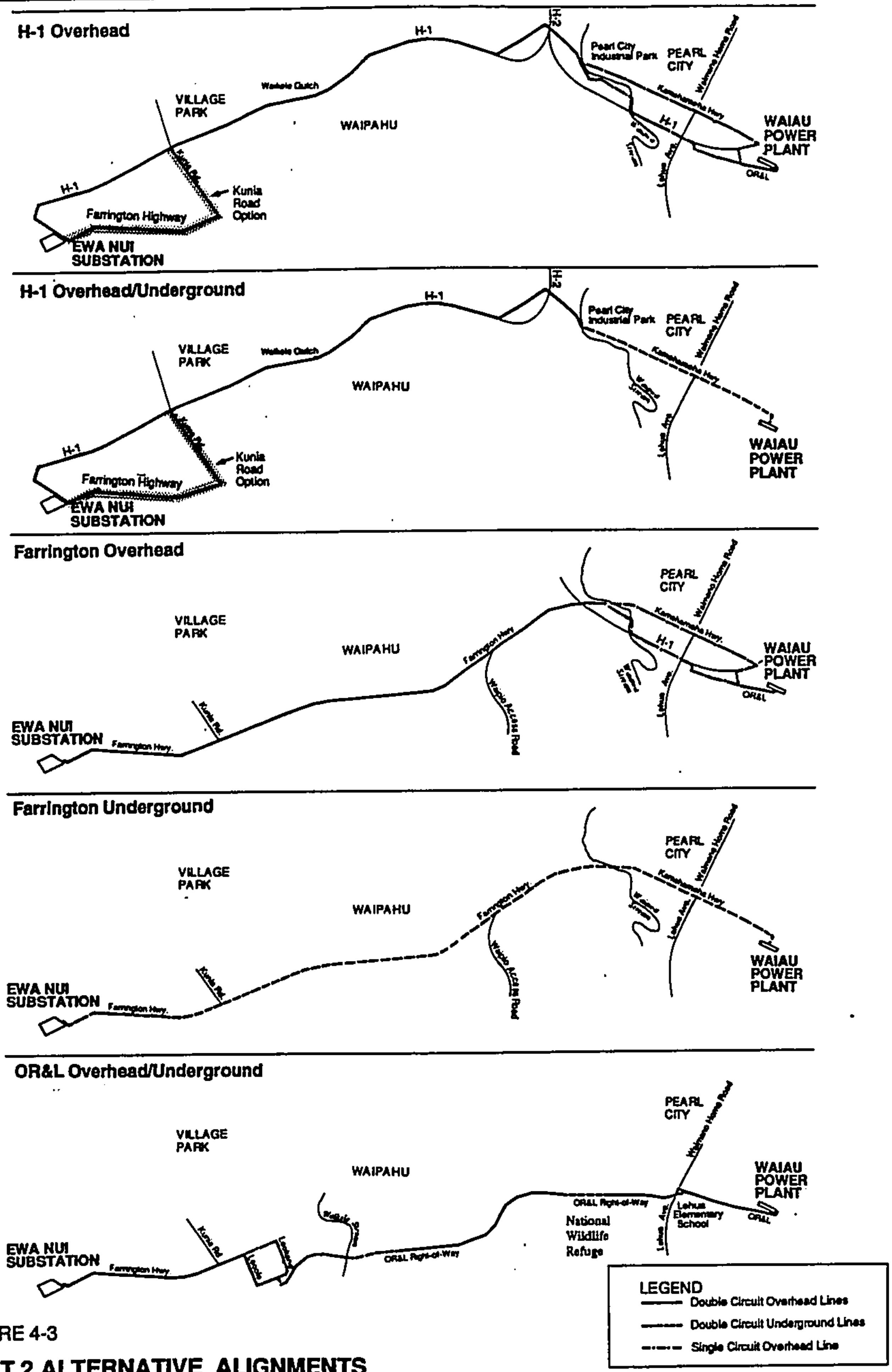


FIGURE 4-3

PART 2 ALTERNATIVE ALIGNMENTS

CH2M HILL

Gulch. Several poles would be placed within the H-1 right-of-way. The existing 46 kV lines would be underbuilt.

- A double-circuit overhead line that spans Waikele Gulch to a point between H-1 and a new drainage ditch; then along H-1 through Waikele to the vicinity of the new Waipiolani Substation at the H-1/Kamehameha Highway Interchange.

- From the vicinity of the new Waipiolani Substation, the alignment would follow an existing 46 kV easement in a mauka direction and cross H-2; it would then follow the 46 kV easement to the Pearl City Industrial Park. The existing 46 kV lines would be underbuilt.

- From the Pearl City Industrial Park to the Waiau Power Plant, this alternative would go underground, following the Kamehameha Highway right-of-way into the Waiau Power Plant. In the underground sections, this alternative would use HPFF pipe technology. Three circuits would be installed. A transition station would be constructed on 5 to 6 acres at the point where the overhead lines go underground.

Farrington Overhead Alternative

This alternative, which would be entirely above ground, is as follows:

- A double-circuit line along the mauka edge of Farrington Highway from the Ewa Nui Substation to a point east of the Kunia Road overpass. This segment would include a single-circuit 46 kV and 12 kV underbuild.

- A double-circuit line in the median strip of Farrington Highway to a point east of Waipio Point Access Road. This segment would include a single-circuit 46 kV underbuild. The existing 12 kV line along Farrington Highway in Waipahu would be placed underground subject to PUC approval.

- A double-circuit line from Waipio along the mauka edge of Farrington Highway to a point east of the H-2 on-ramp. This segment would include a single-circuit 46 kV underbuild.

- At this point, the double-circuit alignment would split into two single-circuit lines:

    - A single-circuit overhead line that would follow an existing 46 kV easement along the makai side of Kamehameha Highway to a point between H-1 and the power plant; from that point the alignment would backtrack along H-1 to join the 46 kV easement from the

OR&L. The 12 kV line in this segment would be placed underground, subject to PUC approval.

- A single-circuit overhead line that would cross Kamehameha Highway to an existing 46 kV easement along Waiawa Stream to the University of Hawaii's Extension Program experimental station; then along Second Street mauka of H-1 to a point east of Lehua Avenue; then across H-1 to an existing 46/12 kV easement to the power plant. The existing lines would be underbuilt.

Both single-circuit lines would join near the power plant to form a double-circuit alignment into the power plant. The existing 46 kV line would be underbuilt.

Farrington Underground Alternative

This alternative would be entirely underground, using HPFF pipe technology. For the EIS analysis, it is assumed that three circuits would be installed. The alignment would be located in the right-of-way of Farrington Highway and Kamehameha Highway all the way from the Ewa Nui Substation to the Waiau Power Plant.

OR&L Overhead/Underground Alternative

This alternative would consist of overhead and underground components, as described below:

- A double-circuit line along the mauka edge of Farrington Highway from Ewa Nui Substation to a point east of the Kunia Road overpass. This segment would include a single-circuit 46 kV and 12 kV underbuild.

- Two single-circuit lines:

  - One circuit on the mauka side of Farrington Highway to Leokane Street; then makai to the county's drainage canal and HECO's existing 46 kV line; then to the OR&L corridor at Pearl Harbor. The existing 46 kV line would be underbuilt. The existing 12 kV line would be relocated.

  - One circuit on the makai side of Farrington Highway to Leoole Street; then down Leoole Street on the east side to the makai side of Leokane Street; then to the drainage canal; then to the OR&L corridor at Pearl Harbor.

- A double-circuit line along the OR&L corridor from Waipahu Canal to Lehua Avenue. Two 2,200-foot segments would be placed underground using solid dielectric cables, a technology that is feasible for 138 kV lines in relatively short sections. The pile-supported underground sections would consist of two solid dielectric extruded cables per phase, or six cables per circuit (i.e., a total of twelve cables for the two circuits). The underground sections are:

- From Waikele Stream to Waipahu Depot Road. This section is adjacent to or in a Protective Subzone of the State Conservation District. The Hawaii Division of Forestry and Wildlife stated that it would oppose an overhead alignment in this area because protected bird species that use the area might collide with overhead lines at night.

- Adjacent to the Waiawa Unit of Pearl Harbor Wildlife Refuge. This section would be placed underground for the same reasons as the section near Waikele Stream.

• At Lehua Avenue, the double-circuit line would split into two single-circuit lines:

  - One circuit would go underground using solid dielectric cables along the existing 46 kV easement to a point east of Lehua Elementary School.

  - A second single-circuit overhead line would turn mauka at Lehua Avenue; it would then turn east along First Street to a point east of the school.

• East of Lehua Elementary School, this alternative would consist of a double-circuit overhead line along the 46 kV easement to the Waiau Power Plant.

This alternative would require reconstruction and/or widening of existing bridges, as well as construction of an all-weather access road for maintenance purposes. The improved bridges would cross Waikele Stream, Kapakahi Stream, Wailani Flood Control Channel, Hoaeae Drainage Channel, Wailani Culvert, and Waiawa Springs.

Kunia Options

The H-1 Overhead/Underground and the H-1 Overhead alternatives each have an optional alignment in the westerly section between the Ewa Nui Substation and the H-1/Kunia Interchange. This option consists of a double-circuit line along the mauka edge of Farrington Highway from the Ewa Nui Substation to a point west of the Kunia Road overpass. This segment would include a single-circuit 46 kV and 12 kV underbuild. At that point the alignment would turn mauka, following the alignment of an existing 46 kV line, and parallel the west side of Kunia Road to the mauka side of the Kunia/H-1 Interchange.

From there, this alternative would be a double-circuit line along the mauka side of the H-1 freeway and across the H-1/H-2 Interchange to Pearl City Industrial Park (as described above for the H-1 Overhead/Underground alternative). Near the Pearl City Industrial Park, the lines would either become underground lines located within the Kamehameha Highway right-of-way from the Pearl City Industrial Park to the Waiau Power Plant or split into two single-circuit overhead lines, as described under the H-1 Overhead alternative. In the underground sections, this alternative would use HPFF pipe technology. Three underground circuits are assumed for this EIS.

Bike Path Options

The H-1 Overhead, the Farrington Overhead, and the OR&L Overhead/Underground alternatives all have an identical optional alignment located in the easterly section of the project area between a point east of Lehua Elementary School and the Waiau Power Plant. This common alignment begins at a point approximately 500 feet east of Lehua Avenue on the makai edge of H-1 freeway, on Navy property. The alignment follows the makai edge of an existing bike path in an easterly direction along H-1 freeway. Just east of the Waimano Stream on HECO property, the bike path option becomes the alignment as identified for the H-1 Overhead and Farrington Overhead alternatives. For the H-1 Overhead and the Farrington Overhead alternatives, the bike path option consists of a single-circuit overhead line. For the OR&L Overhead/Underground alternative, this option consists of a double-circuit overhead line. At the east end of the bike path option, where it meets the H-1 Overhead and Farrington Overhead alternatives, the lines would be in a double-circuit configuration for all of the alternatives. The bike path option may result in the relocation of the existing 46 kV lines to the new steel poles in this common section of the above alignments.

No Action

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 Waiau Power Plant. The purpose and need for the project would not be met and the risk of major electrical system outages would increase.

CHAPTER 5

Chapter 5

Environmental Setting, Probable Impacts, and Mitigations

A. Land Use, Demographics, and Employment

Environmental Setting

For purposes of this analysis, the Waiau-CIP Part 2 study area is divided into three sections based on location, principal use, ownership, and development patterns:

- Ewa Section: the area from the Ewa Nui Substation site east to Kunia Road/New Fort Weaver Road and across Honouliuli, from the area mauka of the H-1 freeway makai to the West Loch shoreline

- Waipahu Section: the area of Waipahu Town from Kunia Road/New Fort Weaver Road east to Waiawa Interchange, including Village Park, the Waipio Peninsula, and the Lualualei Naval Magazine (Waikele Branch)

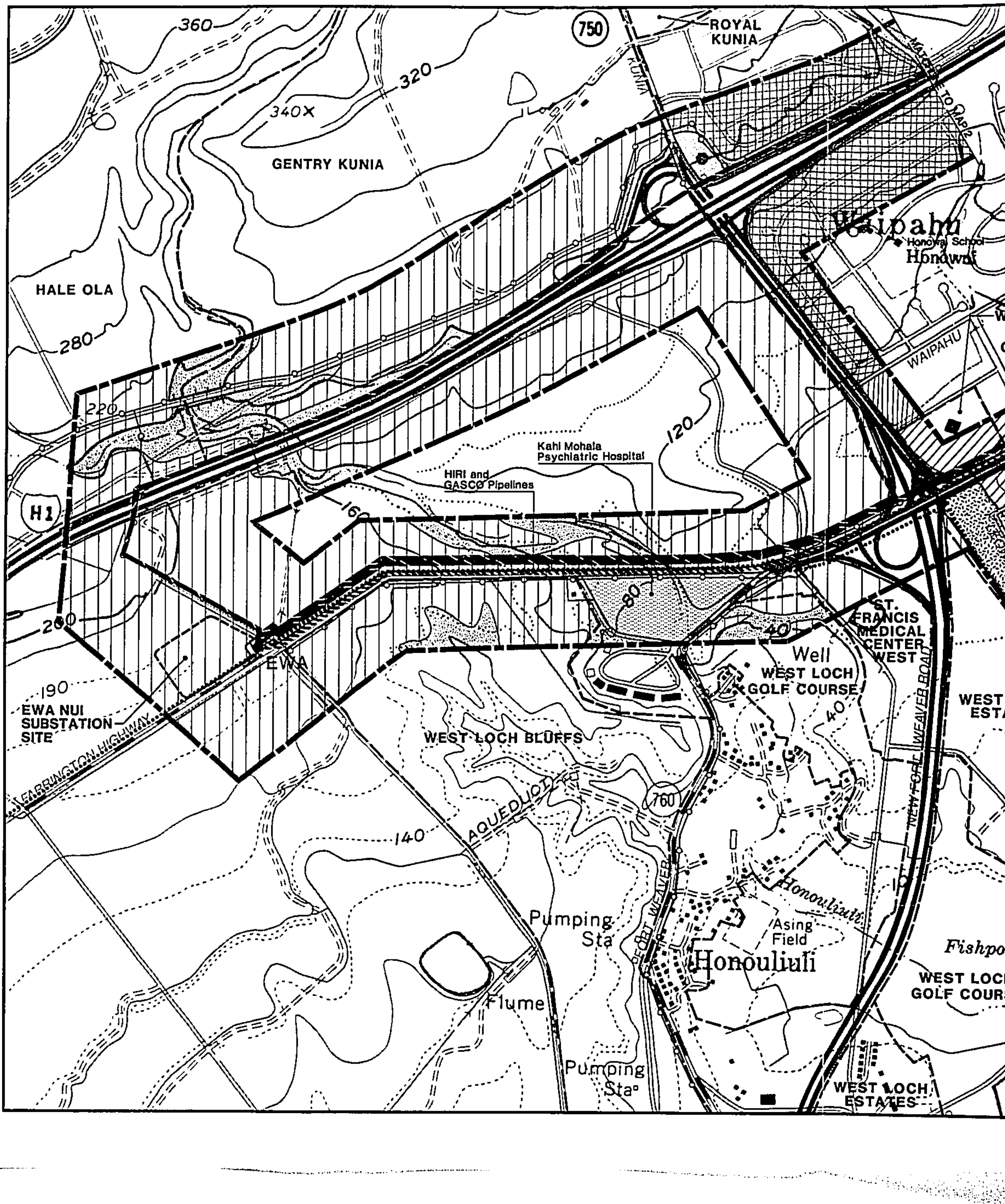
- Pearl City Section: the area of Pearl City from Waiawa Interchange east to the Waiau Power Plant, including Crestview, the Pearl Harbor Naval Base, and Pearl City Peninsula

Existing and proposed land uses in these three sections are shown in Figures 5-1, 5-2, 5-2a, 5-3, and 5-3a. Proposed land uses for Ewa, Waipahu, and Pearl City are also shown in Figure 5-3b.

Ewa Section

Nearly all of the Ewa section mauka of Farrington Highway and west of Kunia Road is currently under sugar cane cultivation. The remaining acreage contains some undeveloped land, usually with steep slopes or gullies that cannot be cultivated. Most of the developable land in this section has historically been used for agriculture. The Ewa section has been used for sugar cane production since the turn of the century.

The Kahi Mohala, a psychiatric hospital, is located near the intersection of Farrington Highway and Old Fort Weaver Road. The hospital is composed of four modules, each of which has residential, educational, and medical facilities. The Saint Francis Medical Center West is farther east near the Farrington Highway/New Fort Weaver Road intersection. The first phase of the medical center was completed in 1988, and an additional phase is planned for 1993.



360
320
340X
750
ROYAL KUNIA
KUNIA
GENTRY KUNIA
HALE OLA
280
220
H1
Waipahu
Honowai School
Honowai
WAIPAHU
120
Kahi Mohala Psychiatric Hospital
HIRI and GASCO Pipelines
160
80
40
200
190
EWA
EWA NUI SUBSTATION SITE
FARRINGTON HIGHWAY
ST. FRANCIS MEDICAL CENTER WEST
Well
WEST LOCH GOLF COURSE
WEST LOCH BLUFFS
AQUEDUCT
760
140
NEW FORT WEAVER ROAD
FORT WEAVER
Pumping Sta
Flume
Honouliuli
Asing Field
Fishpo
WEST LOC
GOLF COUR
WEST LOCH ESTATES
WEST
ESTA

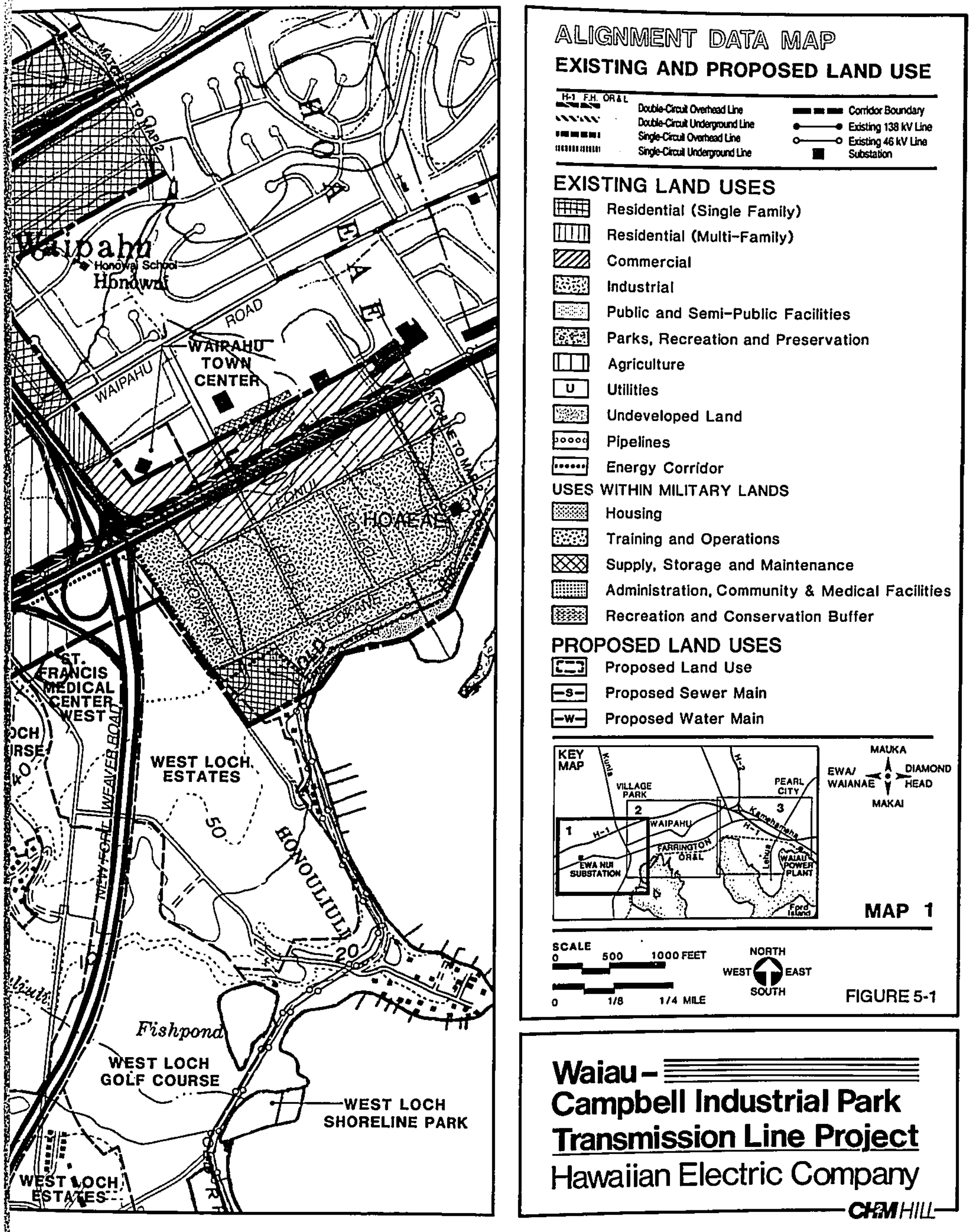
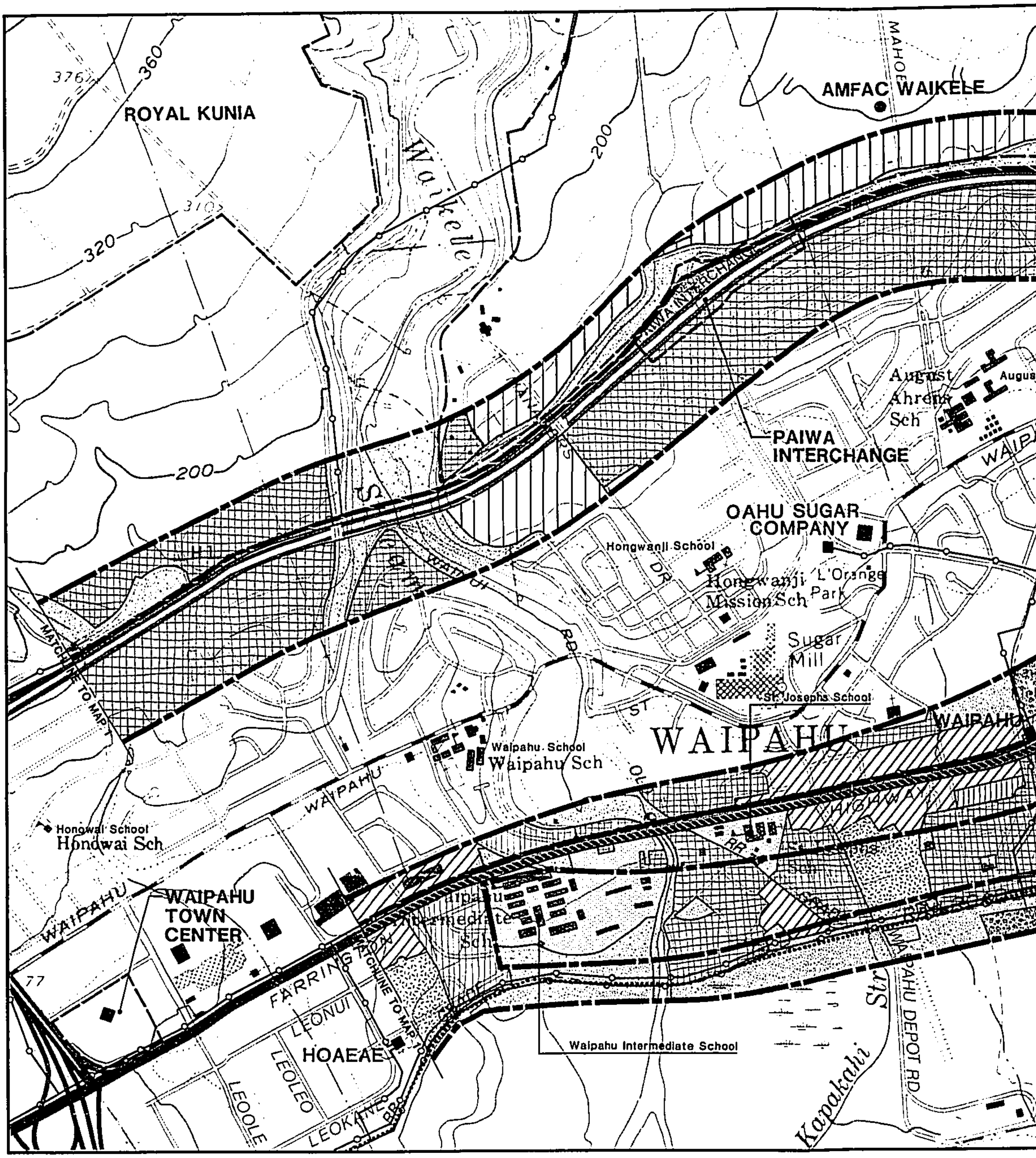
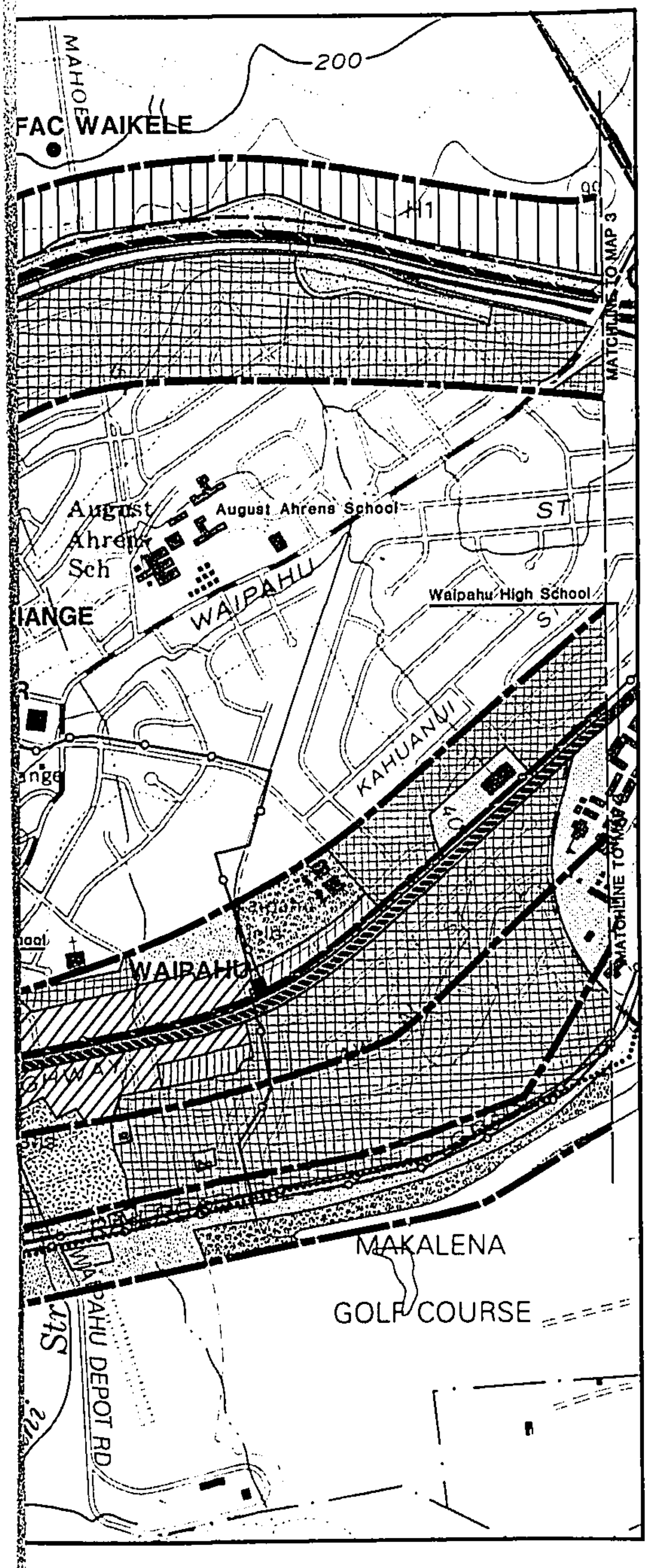


FIGURE 5-1

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



ROYAL KUNIA
AMFAC WAIKELE
MAHOE
Waikele
PAIWA INTERCHANGE
August Ahrens Sch
OAHU SUGAR COMPANY
Hongwanji School
Hongwanji Mission Sch
L'Orange Park
Sugar Mill
St. Josephs School
WAIPAHU
Waipahu School
Waipahu Sch
Honowai School
Honowai Sch
WAIPAHU TOWN CENTER
FARRINGTON
MATCHLINE TO MAP 1
HOAEAE
LEONUI
LEOLEO
LEOOLE
LEOKANE
Waipahu Intermediate School
WAIPAHU DEPOT RD
Kapakahi
HIGHWAY
320
360
200
376



ALIGNMENT DATA MAP

EXISTING AND PROPOSED LAND USE

H-1 F.H. OR&L

- Double-Circuit Overhead Line
- Double-Circuit Underground Line
- Single-Circuit Overhead Line
- Single-Circuit Underground Line
- Corridor Boundary
- Existing 138 kV Line
- Existing 46 kV Line
- Substation

EXISTING LAND USES

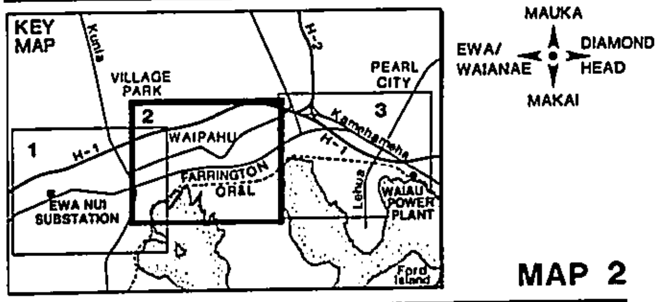
- Residential (Single Family)
- Residential (Multi-Family)
- Commercial
- Industrial
- Public and Semi-Public Facilities
- Parks, Recreation and Preservation
- Agriculture
- U Utilities
- Undeveloped Land
- Pipelines
- Energy Corridor

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
- S Proposed Sewer Main
- W Proposed Water Main



MAP 2

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

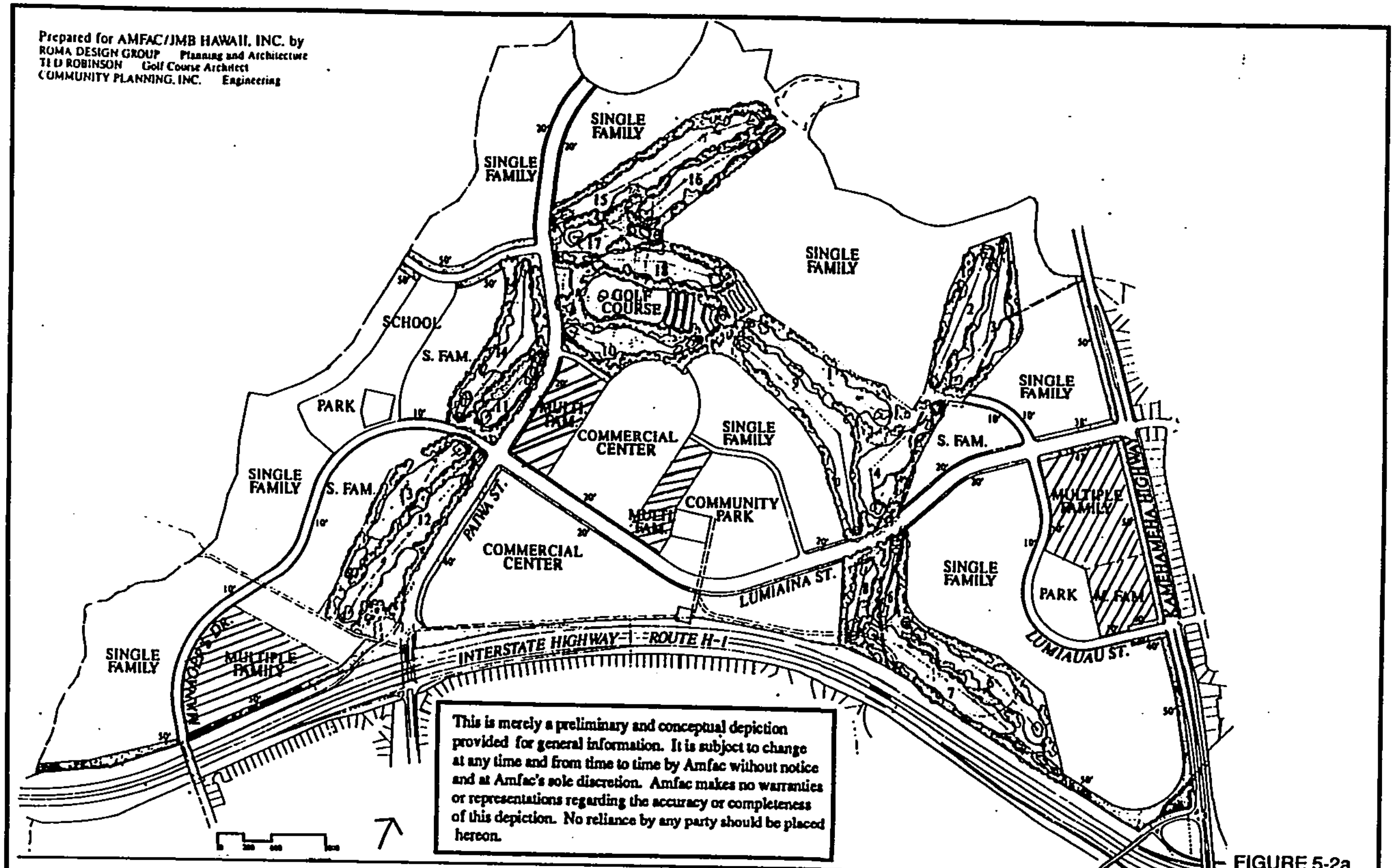
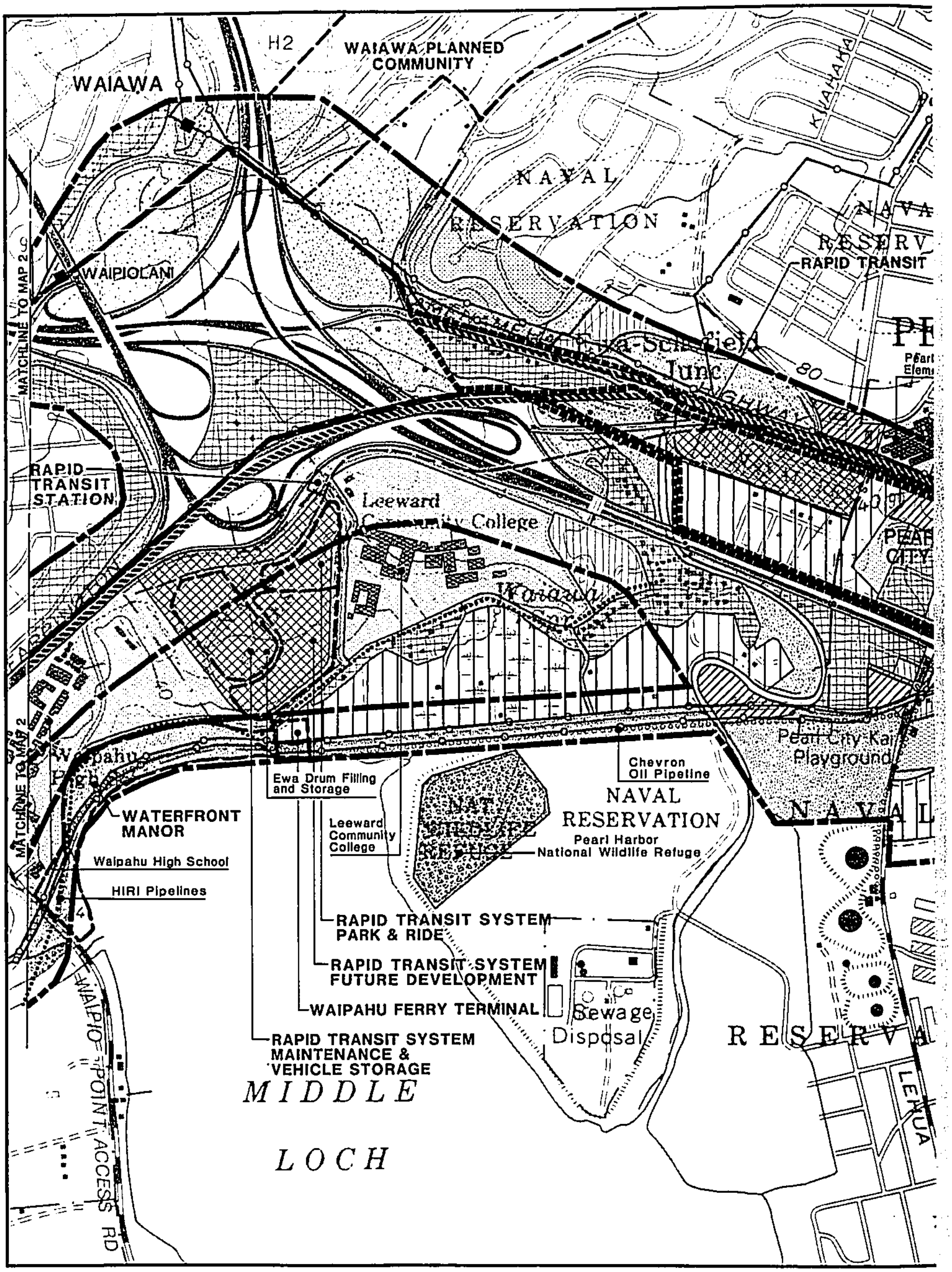


FIGURE 5-2a

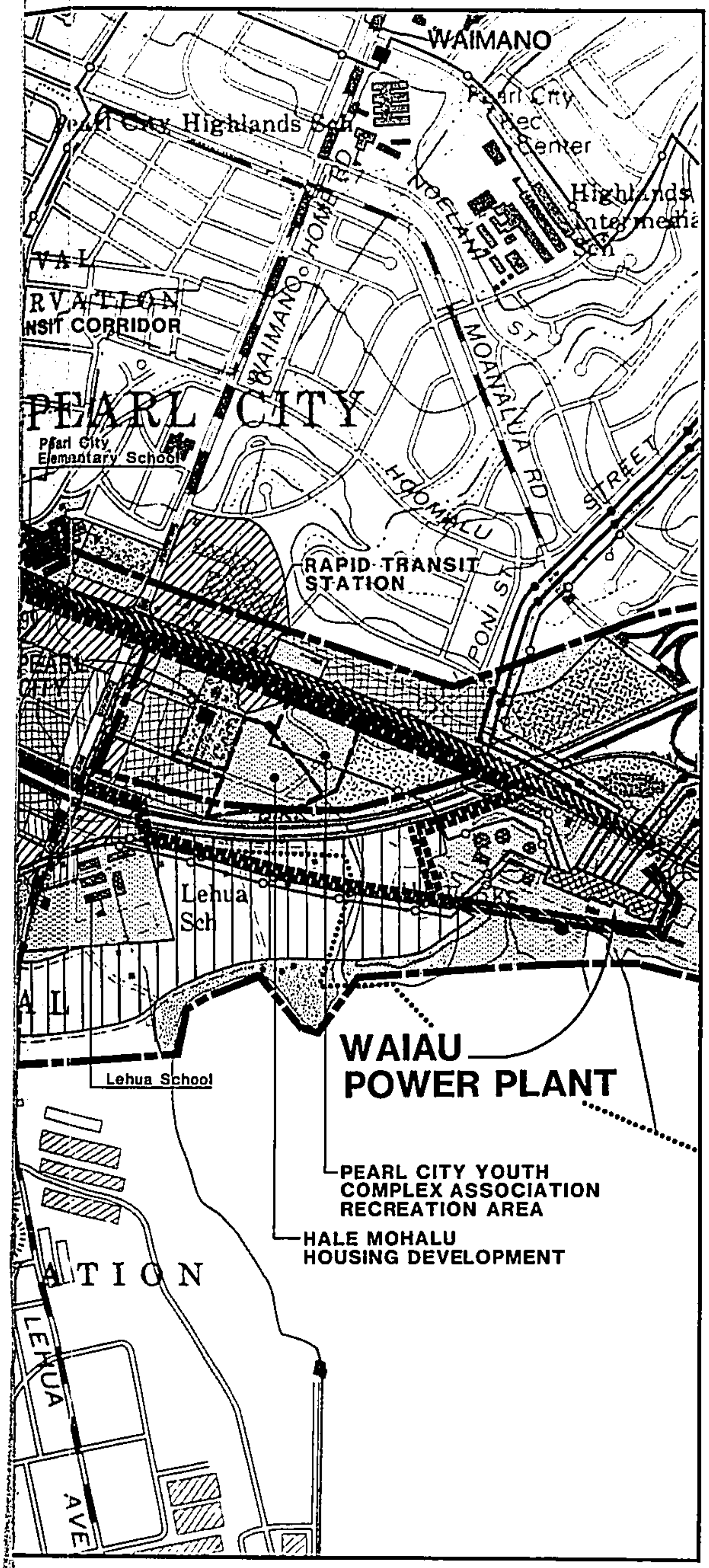
WAIKELE CONCEPTUAL MASTER PLAN

Waiau-
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company

CH2M HILL



WAIAWA PLANNED COMMUNITY
H2
WAIAWA
NAVAL RESERVATION
WAIPIOLANI
MATCHLINE TO MAP 2
RAPID TRANSIT
RAPID TRANSIT STATION
Leeward Community College
Waiawa
80
Pearl City
Ewa Drum Filling and Storage
Chevron Oil Pipeline
Pearl City Kai Playground
WATERFRONT MANOR
Waipahu High School
HIRI Pipelines
Leeward Community College
NAVAL RESERVATION
Pearl Harbor National Wildlife Refuge
RAPID TRANSIT SYSTEM PARK & RIDE
RAPID TRANSIT SYSTEM FUTURE DEVELOPMENT
WAIPAHU FERRY TERMINAL
Sewage Disposal
RAPID TRANSIT SYSTEM MAINTENANCE & VEHICLE STORAGE
MIDDLE
LOCH
WAIPIO POINT ACCESS RD
LEHUA



ALIGNMENT DATA MAP

EXISTING AND PROPOSED LAND USE

H-1 F.H. OR&L

- Double-Circuit Overhead Line
- Double-Circuit Underground Line
- Single-Circuit Overhead Line
- Single-Circuit Underground Line
- Corridor Boundary
- Existing 138 kV Line
- Existing 46 kV Line
- Substation

EXISTING LAND USES

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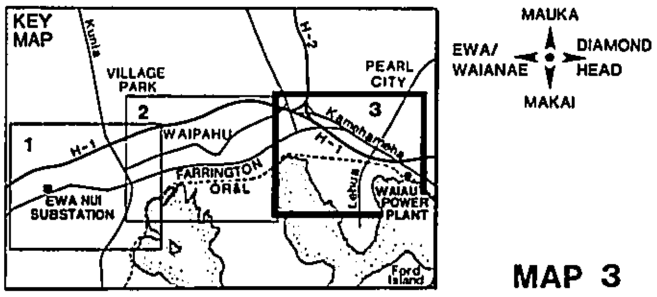
- Residential (Multi-Family)
- Commercial
- Industrial
- Public and Semi-Public Facilities
- Parks, Recreation and Preservation
- Agriculture
- U Utilities
- Undeveloped Land
- Pipelines
- Energy Corridor

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
- S Proposed Sewer Main
- W Proposed Water Main



MAP 3

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

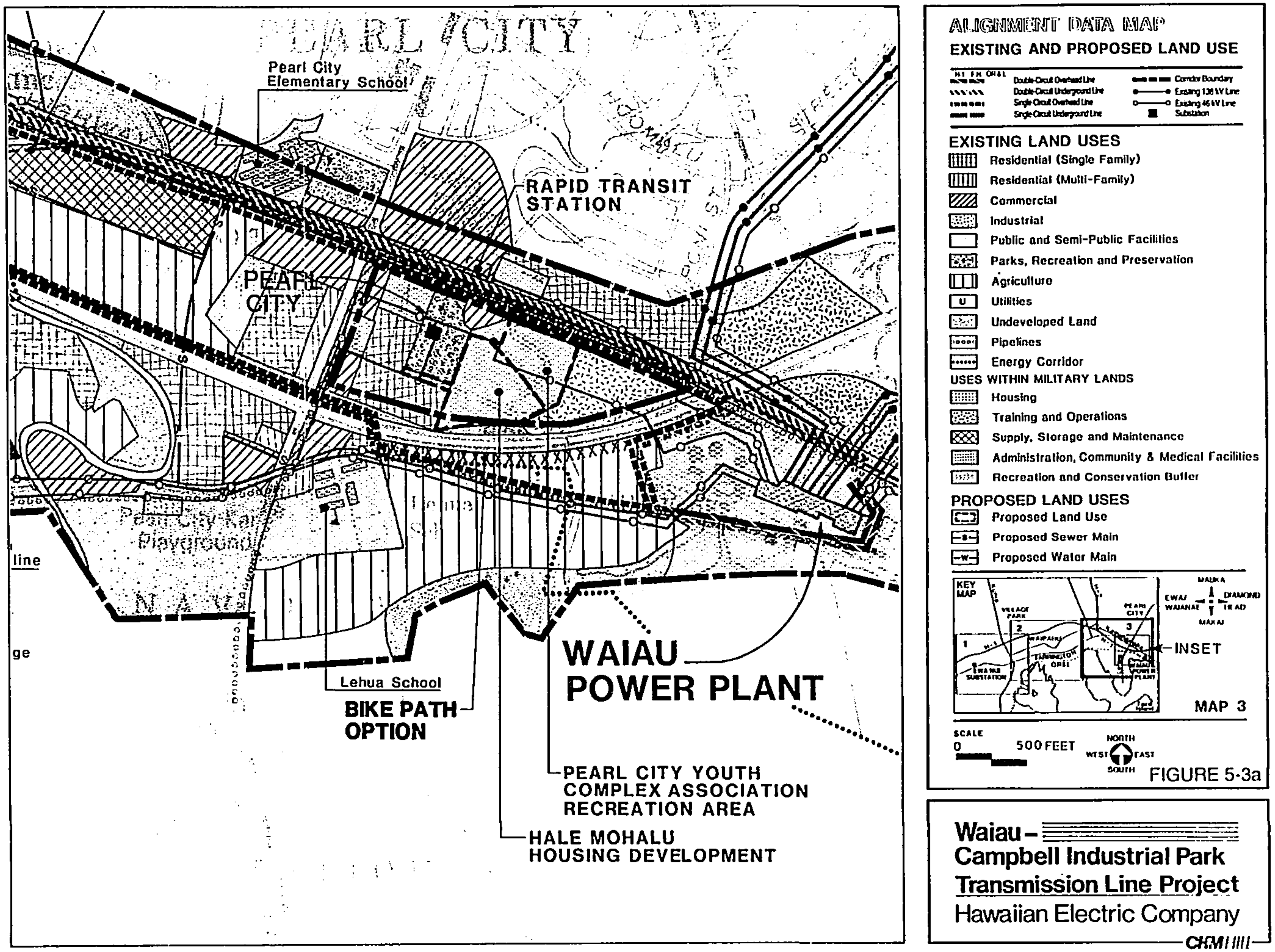
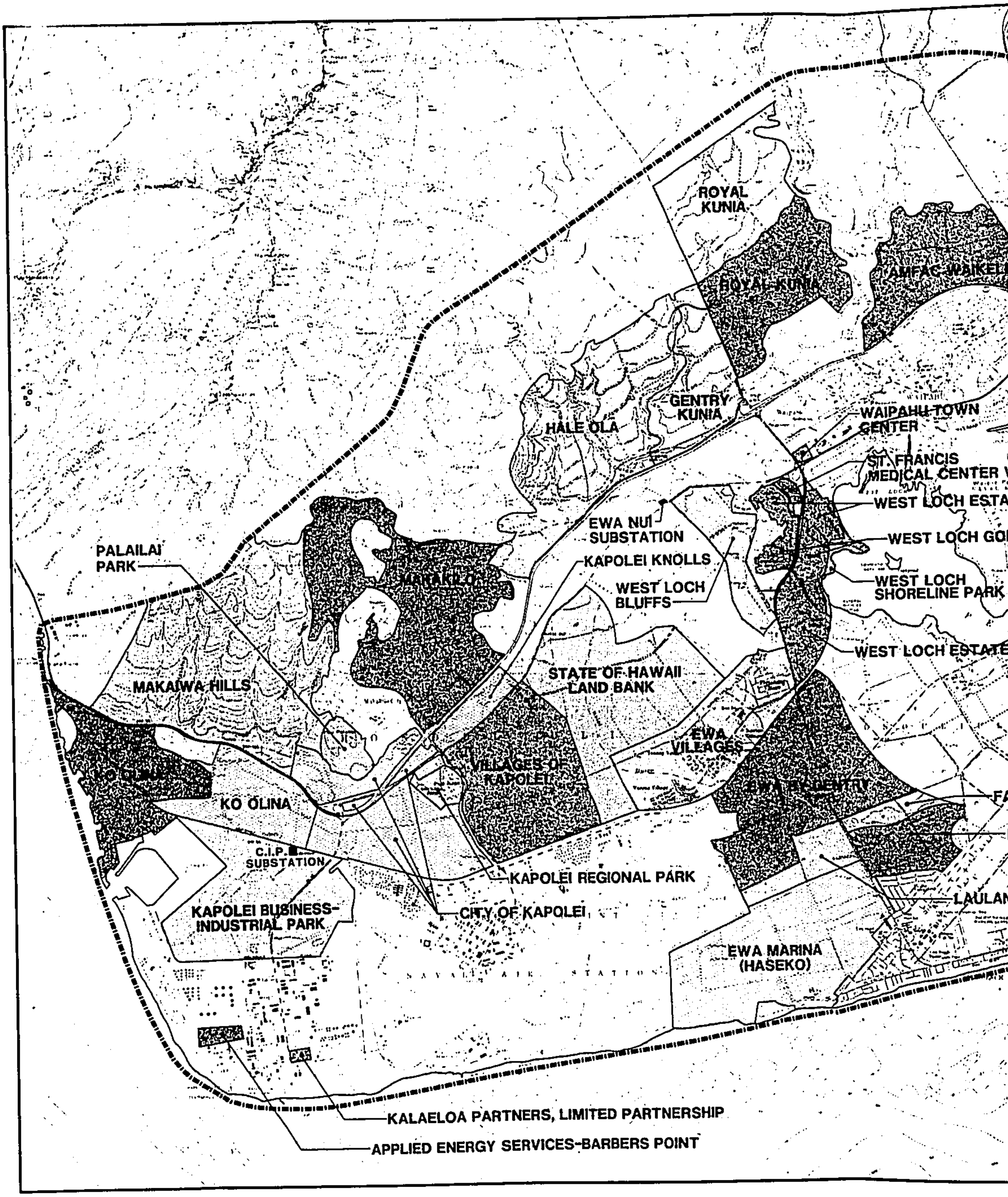
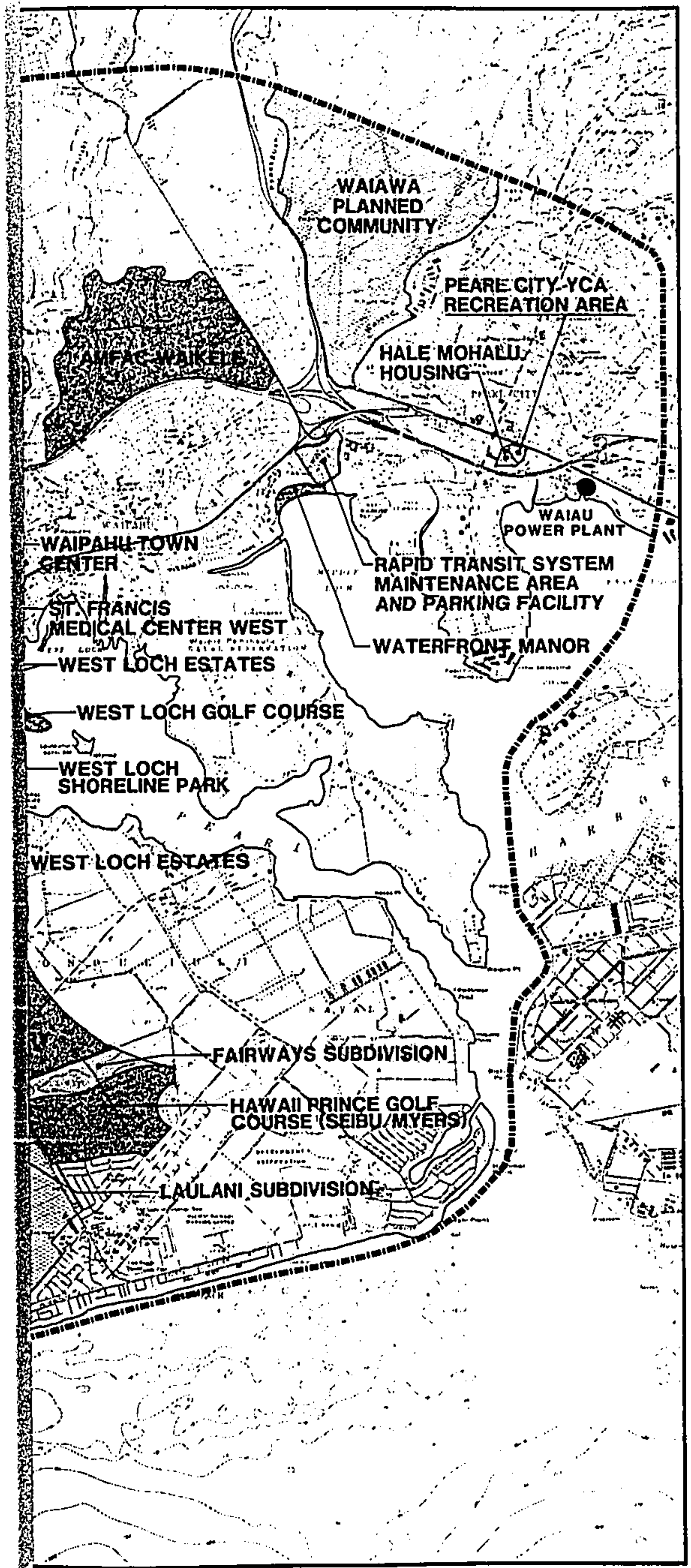


FIGURE 5-3a

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



ROYAL KUNIA
ROYAL KUNIA
GENTRY KUNIA
HALE OLA
WAIPAHU TOWN CENTER
ST. FRANCIS MEDICAL CENTER
WEST LOCH ESTA
EWA NUI SUBSTATION
WEST LOCH GO
PALAILAI PARK
KAPOLEI KNOLLS
MAKAKILO
WEST LOCH BLUFFS
WEST LOCH SHORELINE PARK
WEST LOCH ESTATE
MAKAIWA HILLS
STATE OF HAWAII LAND BANK
EWA VILLAGES
VILLAGES OF KAPOLEI
KO OLINA
KO OLINA
EWA BY GENTRY
C.I.P. SUBSTATION
KAPOLEI REGIONAL PARK
LAULAN
KAPOLEI BUSINESS-INDUSTRIAL PARK
CITY OF KAPOLEI
EWA MARINA (HASEKO)
NAVAL AIR STATION
KALAELOA PARTNERS, LIMITED PARTNERSHIP
APPLIED ENERGY SERVICES-BARBERS POINT



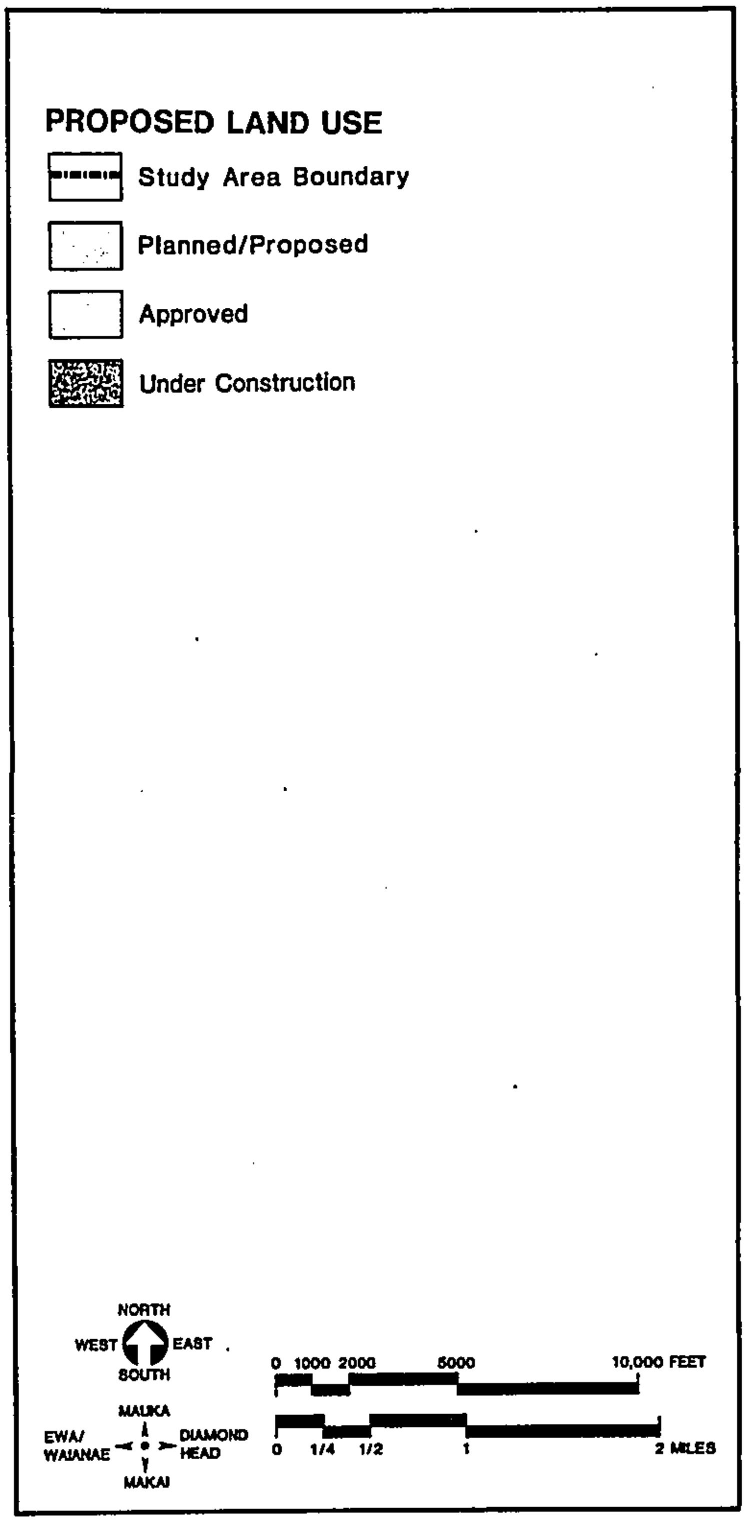


FIGURE 5-3b

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

Much of the Ewa section makai of Farrington Highway is being developed or has been proposed for residential development. The City and County of Honolulu's West Loch Estates residential development, West Loch Golf Course, and West Loch Shoreline Park are under construction. West Loch Estates is the largest residential area in close proximity to the project. It includes 1,600 completed residential units, representing an estimated population of 4,800 based on three persons per household.

Other projects are in various stages of planning. Mauka of the H-1 freeway, proposed residential projects include Hale Ola and Gentry Kunia. Makai of Farrington Highway, the West Loch Bluffs residential project has been proposed. The State Department of Transportation has future plans to improve the H-1/Kunia Road Interchange.

Within the Ewa Beach Census Designated Place (CDP), a population of 14,315 and housing units numbering 3,426 were reported. While it was not possible to break down data to the area immediately in the project vicinity, aggregated data for the Ewa Beach CDP 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 replacement of lands with urban residential development, agriculture-related employment has also been in a steady decline. Saint Francis Medical Center West and Kahi Mohala Hospital are the major employers in the Ewa section.

Waipahu Section

Land uses in this section reflect a high-density, urban development pattern, with a predominance of single- and multifamily residential development. The mauka side of the H-1 freeway east of Kunia Road is primarily single-family housing up to the edge of Waikele Gulch. On the makai side of H-1, single-family residential development fills the area between the H-1 freeway and Farrington Highway. Pockets of multifamily housing units are found makai of Waipahu Street between Kunia Road and Pouhala Road, adjacent to the Waipahu Intermediate School.

Historically, the processing of sugar cane formed the industrial base of the communities in Ewa and Waipahu. The Waipahu Sugar Mill remains today as a link to Waipahu's agricultural past. Other than the sugar mill, industrial development in Waipahu is concentrated makai of Farrington Highway. Industrial activities consist primarily of warehousing and distribution. Other light industrial uses are located in the Waipahu Industrial Park near Kunia Road.

Commercial development in this area primarily serves the local community. Farrington Highway forms the commercial spine of the community, with a number of small commercial establishments on the mauka side of the highway serving local residents. The initial phase of the 12-acre Waipahu Town Center retail commercial area (mauka of Farrington Highway, east of Kunia Road) has been completed, with additional phases under construction. The mauka and makai edges of Farrington Highway contain primarily industrial, commercial, and educational facilities, but there is also some single-family housing on the makai side.

The old OR&L right-of-way is 40 feet wide and defines the makai edge of most of the developed areas in the Waipahu section. Most of the land makai of this right-of-way is undeveloped or open space. The Federal Communications Commission (FCC) owns and operates a monitoring station on a 160-acre site west of the Makalena Golf Course. The City and County of Honolulu owns and operates the golf course. The U.S. Fish and Wildlife Service manages two refuge units in the Waipahu area: the West Loch and Waiawa Units of the Pearl Harbor National Wildlife Refuge. The West Loch Unit is located on the west side of West Loch, Pearl Harbor. The land mauka of the OR&L is in mixed use, similar to that along Farrington Highway.

Waipahu has churches, police facilities, fire stations, and city and county buildings and offices, distributed throughout the entire area. A police training facility is located on Waipio Peninsula west of Makalena Golf Course. The Waipahu Refuse Convenience Center is located on the Waipio Peninsula, between Kapakahi Stream and the Makalena Golf Course. A one-acre parcel of land has been paved and several dumpsters have been established there for individuals to dispose of their large articles of refuse. A refuse incinerator is also on the Waipio Peninsula, at the end of Waipahu Depot Road.

Waipahu has a number of elementary, middle, and high schools to serve the local population. Along Farrington Highway alone are the Waipahu Intermediate School, Waipahu High School, and St. Joseph's High School. Other schools, such as Waipahu School, Honowai Elementary School, Hongwanji School, and August Ahrens Elementary School, are located within the residential neighborhoods. Waipahu also has a number of parks and recreational amenities, including Waipahu Cultural Garden Park, Hans L'Orange Park, and Waipahu Field.

Small farming operations remain within the Waipahu area, including some wetland farming adjacent to the Waipahu Cultural Garden Park. Although undeveloped land is relatively scarce in Waipahu, there are potential infill parcels located in Waipahu Town and in the areas makai of the OR&L right-of-way.

The Lualualei Naval Magazine (NAVMAG) has three branches, two of which (West Loch and Waikele) are within the Waipahu section of the study area. The West Loch Branch, adjacent to the West Loch of Pearl Harbor, occupies almost 4,100 acres. This installation has magazines, operating buildings, community and personnel support facilities, and wharves for loading and off-loading ordnance. The major tenants and supported commands at the West Loch Branch include Guard Company, Marine Barracks Hawaii; Navy Exchange Pearl Harbor; Mobile Mine Assembly, Group Detachment 7 Lualualei; Explosive Ordnance Disposal Group One; Naval Submarine Base Pearl Harbor; Naval Dental Clinic Pearl Harbor; and Naval Medical Clinic Pearl Harbor. The major operational facilities are the helicopter landing pad, ordnance operating buildings, explosive shipping and transfer depot, and the "Whiskey" wharves. As noted in the *Naval Magazine Lualualei Master Plan* (1986), "the Explosive Safety Quantity Distance (ESQD) zones emanating from the Whiskey wharves constitute the major development constraint at the West Loch Branch. The ESQD arcs encumber a majority of West Loch and Waipio Peninsula."

The Waikele Branch, occupying about 518 acres, is located in south-central Oahu, about one-half mile north of Waipahu Town. The Waikele and Kipapa Streams enter and then converge within the Waikele Branch. Major tenants of this installation are the U.S. Army Support Command Hawaii and Navy Manpower Engineering Center Detachment Pearl Harbor. The major activity at the Waikele Branch is the storage of ordnance in a total of 120 cave magazines, 8 earth-covered magazines, and an open storage pad. As in the West Loch Branch, the ESQD zones emanating from the cave magazines are the major development constraints at the Waikele Branch. The Pearl Harbor Naval Base Complex consists of a core area within the controlled area of the Naval Complex as well as adjacent, noncontiguous facilities. A portion of the Pearl Harbor Naval Complex lands is located on Waipio Peninsula, including Beckoning Point. Most of Waipio Peninsula is in the ESQD zone and used for military purposes.

Proposed projects in the area include expansion of the Royal Kunia residential project, which is mauka of the existing Village Park mauka of H-1. Farther east along the mauka side of H-1, the Amfac Waikele residential development between Waikele Gulch and the Waiawa Interchange is being constructed in phases (Figure 5-2a). Within the Amfac Waikele project area, a 17.2-acre retail complex is proposed for the area east of Paiwa Road. In anticipation of the need to provide highway access to this area, a new interchange with the H-1 freeway is under construction at Paiwa Road. Makai of Waipahu High School near the Pearl Harbor Middle Loch shoreline, the Waterfront Manor residential project is under construction. Farrington Highway may be improved by the State Department of Transportation. The highway may also be an alternative corridor for the city rapid transit fixed guideway if it is extended in the future from Pearl City toward Ewa.

In the Waipahu Census Designated Place (CDP), a population of 31,435 and housing units numbering 7,739 were reported. About 98 percent of the housing units were occupied. The housing unit occupancy by race was: 15 percent Caucasian, 80 percent Asian or Pacific Islander, 3 percent Black, and 2 percent Other. The median age was 29.5 years. About 52 percent of the homes were owner-occupied, and the median home value was $234,800.

The decline of the sugar industry has resulted in a reduction in agricultural and industrial employment based on the growing, harvesting, and processing of sugar cane. Industrial employment continues, but is now based more on warehousing, distribution, and other light industrial activities. Commercial employment is centered along the Farrington Highway commercial spine, where commercial activities serve mostly the local community. Additional commercial employment is anticipated with the proposed 17.2-acre retail complex within the Amfac Waikele project area. The State of Hawaii, the City and County of Honolulu, and the U.S. government (including the U.S. military) operate a large number of facilities in the Waipahu section, and these constitute a significant employment base in the section.

Pearl City Section

Of the three study area sections, Pearl City (which consists of the Crestview and Pearl City communities) has the greatest mix of land uses and has the highest density. The Waiawa Interchange and major thoroughfares in this section occupy a substantial amount of the land area. Other uses include a Navy housing area, two Navy supply areas, schools, retail establishments, restaurants, parks, and residential areas. The Waiau Power Plant is located at the diamond head (east) end of the Pearl City section, where several large parcels are developed for industrial use. The makai portion of the Pearl City section is adjacent to the OR&L right-of-way in marshy areas close to the shoreline. The portion near the OR&L right-of-way is primarily undeveloped land.

The Crestview residential community is located between Kamehameha Highway and the H-2 freeway, mauka of the Waiawa Interchange. At Crestview, multifamily units are located in a partial radial pattern surrounding the park mauka of Kanoelani Elementary School. The Gentry Business Park is the major industrial area in Crestview. A commercial center (Waipio Shopping Center) is located at the northeast corner of the intersection of Kamehameha Highway and Waipio Uka Street.

In the Pearl City residential community, residences are located primarily mauka of Kamehameha Highway but are scattered throughout the area. Single-family units make up the great majority of the housing stock. Kamehameha Highway is an important strip of highway commercial activities.

The Waiau Power Plant, at the east end of the Pearl City section, is the terminus of the Waiau-CIP Transmission Line Project and a major utility in the Pearl City area. The Waiau Power Plant is a major element of HECO's facilities serving the Island of Oahu. Other utilities in the Pearl City section include a wastewater treatment plant and water tanks on the west side of the Pearl City Peninsula.

A portion of the Pearl Harbor Naval Complex lands is located on the Pearl City Peninsula, containing industrial, residential, and recreational uses. Light industrial uses are located near the Waiau Power Plant, mauka of Kamehameha Highway, and mauka of the H-1 freeway. A bike path originates on Navy property just east of Lehua Avenue in the vicinity of Lehua Elementary School and runs easterly adjacent to H-1 freeway to Waimano Stream. There it crosses into HECO property, and continues in a southeasterly direction through agricultural land, then through the Waiau Power Plant site and beyond.

Pearl City also contains churches, police stations, fire stations, and City and County of Honolulu buildings and offices, distributed throughout the entire area. A number of elementary, middle, and high schools serve the local population, including Pearl City Elementary School, Leeward Community College, Pearl City Highlands Elementary and Intermediate Schools, and Pearl City High School.

Small farming operations remain within Pearl City. Makai of Leeward Community College, a watercress farm lies between the OR&L right-of-way and Kamehameha Highway. Several other wetland farming sites are found in the section. Undeveloped land is relatively scarce within the Pearl City section. The most significant undeveloped open space lies between Crestview and Pearl City mauka of the H-1 freeway. Other undeveloped land parcels are between the eastern border of Crestview and the H-2 freeway.

Six proposed development projects are under construction or scheduled to be constructed in the Pearl City section. The City's Department of Transportation Services plans to purchase the old Ewa Drum Filling and Storage site from the Navy to serve as a vehicle maintenance yard, park-and-ride facility, and storage for the Rapid Transit System Project. The proposed rapid transit fixed guideway would follow Kamehameha Highway through Pearl City. A transit station is proposed near Waimano Home Road.

Three residential developments are planned or under construction within the Pearl City section. Waterfront Manor, on the shoreline near Waipahu High School, is under construction; the Hale Mohalu Housing Complex in central Pearl City is being planned; and Gentry's Waiawa Planned Community (mauka of the Waiawa Interchange and east of the H-2 freeway) is being developed. The City's Public Facilities Map shows that the Waipahu Ferry Terminal is proposed for the site adjacent to the Waterfront Manor; the status of this Ferry Terminal proposal is unknown. The Pearl City Youth Complex Association is constructing an outdoor recreation area mauka of the proposed Hale Mohalu Housing area.

In the Pearl City Census Designated Place (CDP), a population of 30,993 and housing units numbering 8,999 were reported. About 99 percent of the housing units are occupied. The housing unit occupancy by race was: 25 percent Caucasian, 70 percent Asian or Pacific Islander, 3 percent Black, and 2 percent Other. The median age was 32.7 years. About 68 percent of the homes were owner-occupied, and the median home value was $252,300.

Probable Impacts

H-1 Overhead Alternative

Ewa Section. The H-1 Overhead alternative uses the mauka side of the H-1 freeway through the Ewa section and is not adjacent to any existing development. Two future residential projects, Gentry Kunia, and the City and County of Honolulu's Hale Ola project, have been proposed for the area mauka of H-1. Placement of the alignment along H-1 at the extreme makai edges of these planned residential areas reduces the potential impact on these proposed urban land uses.

The Kunia Road option follows Farrington Highway and Kunia Road along existing 46 kV transmission lines. This option would be near the Kahi Mohala Hospital and the Saint Francis Medical Center West, both located makai of Farrington Highway. It would be mauka of the existing West Loch Estates residential community, and would be separated from it by the Farrington Highway/New Fort Weaver Road intersection.

The portion of the optional route going mauka from Farrington Highway along the edge of Kunia Road is near the west edge of Waipahu Town, but the roadway separates it from the residential community. The option would significantly conflict with the State Department of Transportation's plans to improve the H-1/Kunia Road intersection.

The optional route along Farrington Highway would have no impact on the operations of Kahi Mohala Hospital and Saint Francis Medical Center West, except for some limited short-term impacts during construction. Because of the separation of the existing residential communities by intervening transportation corridors, the adjoining residential communities would not be affected. Placement of the alignment along Farrington Highway at the mauka edge of West Loch Bluffs reduces the potential impact on this proposed residential area.

Plans for future residential development can include an appropriate setback from the transmission line.

Demographics and existing employment areas are not affected by this alternative.

Waipahu Section. The H-1 Overhead alternative would be adjacent to the existing Village Park neighborhood and single-family housing area from Kunia Road to Waikele Gulch. Residential and commercial proposals for the area east of Waikele Gulch and mauka of H-1 include Amfac Hawaii's Waikele residential project, and a retail commercial complex for national manufacturing outlets (Figure 5-2a). Placement of the alignment in an existing 46 kV easement along the extreme makai edges of Village Park would minimize land use impacts on this existing community. The planned residential and commercial areas mauka of H-1 east of Waikele Gulch are under construction, and opportunities to provide setbacks from the transmission line are diminished. Use of land on the makai edges of the development is limited. Impacts to the proposed retail commercial complex and other properties within Amfac Hawaii's Waikele project are being investigated by HECO and the developers. See subsequent sections of this EIS for a discussion of EMF, visual resources, and other areas of potential impacts.

The single-family residential area makai of the H-1 freeway is separated from the proposed transmission lines by the freeway. As a result, it is not expected to be adversely affected.

The alignment would cross the proposed Paiwa/H-1 Interchange. No adverse impacts to the interchange or the Paiwa Road access are anticipated. To minimize any conflicts with the. proposed interchange, HECO is coordinating its plans for the proposed transmission lines with the State Department of Transportation.

There would be short-term impacts related to construction. Existing and future demographics and employment areas are not expected to be affected by this alternative.

Pearl City Section. One single-circuit alignment would follow the makai edge of Kamehameha Highway. This section of the highway is bordered by warehousing and commercial uses. No adverse land use impacts are expected.

The other single-circuit alignment would go makai and cross Kamehameha Highway to follow an existing 46 kV easement that goes along Waiawa Stream next to the University of Hawaii's Extension Program experimental station, and eastward along Second Street mauka of the H-1 freeway to a point east of Lehua Avenue. The alignment would then go makai across H-1 near Lehua School to reach the existing 46 kV transmission line easement along the OR&L right-of-way, then go eastward along the OR&L right-of-way to the power plant. This alignment would skirt some multifamily residences; military supply, storage, and maintenance areas; commercial areas; and some agricultural areas. Makai of H-1, the alignment would be outside the mauka edge of Lehua School and a small pocket of commercial and single-family uses, and pass through an agricultural area. This alignment would cross the state's Energy Corridor just west of Waimano Stream. West of the H-1 crossover near Lehua School, other land uses makai of H-1 (such as single-family and multifamily housing areas, and Leeward Community College) are separated from the alignment by H-1 itself.

The Rapid Transit System (RTS) proposed by the City and County of Honolulu is currently under consideration for future development. The route of the fixed guideway being considered may cross both alignments east of the Waiawa Interchange. A rapid transit station is being considered at Kamehameha Highway east of Waimano Home Road, that would be adjacent to the Kamehameha Highway alignment. Since the RTS is in the preliminary planning stages, very little is known about the actual alignment of the transit system and the location of the rapid transit stations. HECO would coordinate with RTS representatives to ensure that there are no conflicts between the RTS project and the transmission line project.

The two alignments would skirt two projects that are planned or under construction east of Waimano Home Road between Kamehameha Highway and the H-1 freeway. Within this area, the Hale Mohalu Housing Development project is in the preliminary planning stage, and the Pearl City Youth Complex Recreational Area is under construction. The transmission lines are not expected to adversely affect either of these two projects. Gentry's Waiawa Planned Community, located mauka of the Waiawa Interchange and east of the H-2 freeway, would not be adversely affected because the lines would be placed on the makai edge of this development.

The bike path option begins after the single-circuit alignment crosses from the mauka to the makai side of H-1 freeway, and continues easterly on Navy property adjacent to H-1 freeway, on the makai side of the existing bike path. The optional alignment enters HECO property just east of Waimano Stream, where it becomes the H-1 Overhead alternative again. The bike option would not change the recreational use provided by the existing bike path.

Placement of the transmission lines along existing roadways at the edges of existing urban development minimizes the potential impact on these existing and planned land uses.

There would be short-term impacts related to construction. Demographics and existing employment areas are not affected by this alternative.

H-1 Overhead/Underground Alternative

Ewa Section. The H-1 Overhead/Underground alternative is completely overhead within the Ewa section and is identical to the H-1 Overhead alternative. As with the H-1 Overhead alternative, this would follow one of two routes that begin at the Ewa Nui Substation and end at a point mauka of the H-1 Freeway/Kunia Road Interchange.

Impacts on land use, demographics, and employment areas are identical to those of the H-1 Overhead alternative.

Waipahu Section. In the Waipahu section, the H-1 Overhead/Underground alternative is completely overhead and is identical to the H-1 Overhead alternative.

Impacts on land use, demographics, and employment areas are identical to those of the H-1 Overhead alternative.

Pearl City Section. In the Pearl City Section, the H-1 Overhead/Underground alternative is underground in Kamehameha Highway.

The impacts of this on the proposed RTS line and station are minimal because this portion of the alternative is underground. HECO would coordinate with RTS representatives to ensure that there are no conflicts between the RTS project and the transmission line project.

The projects that are planned or under construction and are in proximity to this alternative are identical to those described for the H-1 Overhead alternative. Because this alternative is underground near these projects, adverse impacts are not expected.

There would be short-term impacts related to construction. Demographics and existing employment areas are not affected by this alternative.

Farrington Overhead Alternative

Ewa Section. The impacts of the Farrington Overhead alternative are identical to the portion of the H-1 Overhead and H-1 Overhead/Underground alternatives that uses Farrington Highway from the Ewa Nui Substation to Kunia Road.

The Farrington Overhead alternative follows Farrington Highway along existing 46 kV transmission lines adjacent to Farrington Highway from the Ewa Nui Substation to Kunia Road. The alignment would be near the Kahi Mohala Hospital and the Saint Francis Medical Center West, both of which are makai of Farrington Highway. The alignment would be mauka of the existing West Loch Estates residential community, and would be separated from it by the Farrington Highway/New Fort Weaver Road Interchange. The alignment is adjacent to the state's Energy Corridor.

The Farrington Highway alignment is not expected to have any adverse impact on the operations of Kahi Mohala Hospital and Saint Francis Medical Center West, except for some limited short-term impacts during construction. Because the Farrington Highway/New Fort Weaver Road intersection separates West Loch Estates from the proposed project, West Loch Estates would not be affected. The West Loch Bluffs proposed residential development is not expected to be affected because the alignment would be beyond the mauka edge of the proposed residential area. Plans for future residential development at West Loch Bluffs makai of Farrington Highway can include an appropriate setback from the transmission line.

Demographics and existing employment areas are not expected to be affected by this alternative. (Impacts on the state's Energy Corridor along Farrington Highway are discussed in Section F of this chapter.)

Waipahu Section. In the Waipahu section, this alternative would be constructed in the median of Farrington Highway from Kunia Road to the Waiawa Interchange. The alignment would cross primarily commercial and industrial uses, and would be adjacent to some residential, park, and school areas. The alignment would be makai of the new Waipahu Town Center commercial area, and would be directly mauka of Waipahu Intermediate School, St. Joseph's School, and Waipahu High School. This alternative would have adverse impacts on the State Department of Transportation's plans to improve Farrington Highway. It may also have significant conflicts with the city's rapid transit system if the fixed guideway is extended toward Ewa along the highway.

Other than short-term impacts related to construction, the proposed overhead transmission line along Farrington Highway from Kunia Road to the Waiawa Interchange would not affect the commercial, industrial, residential, park, and school areas along the alignment. Existing land use, demographics, and employment areas would not be affected by this alternative.

Pearl City Section. From Waipahu, the Farrington Overhead alternative follows an existing 46 kV transmission line along Farrington Highway through the Waiawa Interchange. The proposed RTS park-and-ride facility, maintenance and vehicle storage facilities, rapid transit station, and Leeward Community College are located makai of the interchange, and would be separated from the line by the interchange itself.

East of the Waiawa Interchange near the Waiawa Stream, the Farrington Overhead alternative splits into two alignments that are identical to the two single-circuit alignments in the H-1 Overhead alternative.

As with the H-1 Overhead alternative, this alternative includes a bike path option section that would begin east of Lehua Avenue, mauka of Lehua School on the makai edge of H-1 freeway and end at a point east of Waimano Stream on HECO property.

Land use impacts of this alternative, including the bike path option, are identical to the land use impacts of the H-1 Overhead alternative, described earlier. The impacts on the proposed RTS line are also identical to those of the H-1 Overhead alternative. HECO would coordinate with RTS representatives to ensure that there are no conflicts between the RTS project and the transmission line project.

The projects that are planned or under construction and are in proximity to this alternative are identical to those described for the H-1 Overhead alternative. The transmission lines are not expected to adversely affect these projects. Placement of the transmission lines along existing roadways at the edges of existing urban development minimizes the potential impacts on these land uses.

There would be short-term impacts related to construction. Demographics and existing employment areas are not affected by this alternative.

Farrington Underground Alternative

Ewa Section. An underground alignment along Farrington Highway from the Ewa Nui Substation to Kunia Road would have no impact on the operations of Kahi Mohala Hospital and Saint Francis Medical Center West, except for some limited short-term impacts during construction. The existing West Loch Estates and proposed West Loch Bluffs residential communities are not expected to be adversely affected.

Demographics and existing employment areas are not affected by this alternative.

Waipahu Section. Except for short-term construction impacts, underground lines along Farrington Highway from Kunia Road to the Waiawa Interchange would not affect the commercial, industrial, residential, park, and school areas along the alignment. There are no plans for any major developments that would conflict with the alignment of the Farrington Underground alternative.

Existing land use, demographics, and employment areas would not be affected by this alternative.

Pearl City Section. Except for short-term construction impacts, underground transmission lines along Kamehameha Highway would not affect the existing or proposed land-uses in the Pearl City section. The impacts of the underground lines on the proposed RTS facilities would be minimal. HECO would coordinate with RTS representatives to ensure that there are no conflicts between the RTS project and the transmission line project.

The projects that are planned or under construction, and are in proximity to this alternative, are identical to those described for the H-1 Overhead/Underground alternative. Because this alternative is underground in the vicinity of the proposed projects, adverse impacts are not expected.

There would be short-term impacts related to construction. Demographics and existing employment areas are not affected by this alternative.

OR&L Overhead/Underground Alternative

Ewa Section. The OR&L Overhead/Underground alternative is completely overhead in the Ewa section. The alignment would follow 46 kV transmission lines along Farrington Highway from the Ewa Nui Substation to Kunia Road. The impacts of the OR&L Overhead/Underground alternative are identical to the impacts of the Farrington Overhead alternative.

Demographics and existing employment areas are not affected by this alternative.

Waipahu Section. Within the Waipahu section, the alignment of the OR&L Overhead/Underground alternative is overhead for the portion going east from Kunia Road through the commercial areas of Waipahu along Farrington Highway, and through the industrial area makai of Farrington Highway to the OR&L right-of-way. Makai of the industrial area, the line is overhead going east following the OR&L right-of-way, except for a partial underground segment adjacent to a wetland area on Waipio Peninsula.

The overhead section of the line along the mauka side of Farrington Highway follows an existing 46 kV transmission line along a portion of the highway. Where the overhead line is makai of the Waipahu Town Center commercial area, the line splits into two separate overhead alignments, which later rejoin at the OR&L right-of way near the shoreline of Pearl Harbor's West Loch. One overhead alignment crosses to the makai side of Farrington Highway into the industrial area, goes eastward along Farrington Highway, turns makai into Leoole Street, goes east along Leokane Street, then turns makai near a drainageway to reach the OR&L right-of-way. The second overhead alignment follows existing 46 kV lines eastward along the commercial area on the mauka side of Farrington Highway, turns makai into the industrial area at Leokane Street, follows Leokane Street as it curves to the west, then turns makai near the drainageway to reach the OR&L right-of-way. The double-circuit alignment was split into two single-circuit alignments so that smaller structures could be placed along the edges of the narrow roadways in the Waipahu industrial area, minimizing potential impacts on the adjacent industrial land uses.

Existing 46 kV transmission lines, and the state's Energy Corridor, are in or adjacent to the OR&L right-of-way. Along the OR&L right-of-way eastward, the lines continue to be overhead, then go underground between Waikele Stream and Kapakahi Stream. The underground segment would be mauka of approximately 330 acres of mangrove forest, associated shallow water, and mudflats, located at the northwest corner of Waipio Peninsula. Underground placement of this section is intended to minimize potential impacts to the adjacent wildlife refuge area, which is designated by the state as a Protective Subzone in the Conservation District.

From Kapakahi Stream, the lines would be overhead as they go eastward along Pearl Harbor's Middle Loch shoreline. The lines would go along the mauka edge of the Makalena Golf Course. A residential project, Waterfront Manor, is currently under construction, mauka of the lines next to Waipahu High School.

The OR&L Overhead/Underground alternative would have short-term construction impacts. Adverse impacts on existing land uses, demographics, and employment areas are not anticipated.

Pearl City Section. The transmission lines would be overhead east of Waipahu High School to the Pearl City Peninsula. The lines would be makai of the proposed rapid transit maintenance and vehicle storage facilities and park-and-ride facilities. At the Pearl Harbor Middle Loch shoreline, a ferry terminal is proposed.

At the Pearl City Peninsula, a section would be placed underground to minimize impacts on the Waiawa Unit of the Pearl Harbor Wildlife Refuge, which is located makai of the alignment. A watercress farm is immediately mauka of the wildlife refuge; Leeward Community College is farther mauka of the farm. East of the refuge area, the transmission lines would go overhead to Lehua Avenue, where the double-circuit alignment would split into two single-circuit alignments. One alignment would go underground along an existing 46 kV easement to a point east of Lehua Elementary School. The second alignment would be overhead and turn mauka at Lehua Avenue, then turn east along First Street to a point east of the school.

The lines were split into an above-ground and an underground line so that at least one smaller, but more cost-effective, above-ground structure could be used along the edge of the narrow roadways in this area, minimizing potential impacts on the adjacent commercial uses and school facilities. East of Lehua School, the alignments would continue their double-circuit overhead configuration.

As with the H-1 Overhead and the Farrington Overhead alternatives, this alternative includes a bike path option that would begin east of Lehua Elementary School on the makai edge of H-1 freeway and end at a point east of Waimano Stream on HECO property, where it would follow the same alignment as the H-1 Overhead and Farrington Overhead alternatives into the Waiau Power Plant site. Land use impacts for this optional route would be identical to the land use impacts for this segment of the H-1 Overhead and Farrington Overhead alternatives described earlier.

The transmission lines would be adjacent to Chevron underground oil pipelines. East of the wildlife refuge to Lehua Avenue, the lines would be adjacent to commercial and single-family uses mauka of the lines, and to undeveloped lands to the makai side of the lines. East of Lehua Avenue, an underground segment of the line would pass Lehua Elementary School. Beyond the school the lines would pass over the state's Energy Corridor and through areas in agricultural use.

The OR&L Overhead/Underground alternative would have short-term construction impacts. Adverse impacts on existing land uses, demographics, and employment areas are not anticipated.

No Action Alternative

No impacts to land use, demographics, or existing employment areas are anticipated in the Ewa section, Waipahu section, or Pearl City section by continuing the status quo with the No Action alternative.

Mitigation

Long-term land use impacts to proposed residential development can be avoided by appropriate setbacks of residential areas from overhead transmission lines.

To minimize any conflicts, HECO will coordinate its plans for the proposed transmission lines with the State Department of Transportation Highways Division on the Paiwa Road/H-1 Interchange. HECO is also coordinating with RTS representatives to minimize conflicts with the proposed rapid transit corridor, rapid transit station, park-and-ride facilities, and maintenance and vehicle storage facility. Because little is known about the actual alignment or design of the future rapid transit system, the meetings HECO has had to date with RTS officials have been general in nature and have not covered any specific engineering requirements. Possible measures to resolve potential conflicts include increasing pole heights to provide adequate safety clearance between transit facilities and transmission lines; undergrounding conductors (i.e., for existing 46 kV lines that may be underbuilt on new poles); undergrounding all lines that would otherwise cross over a transit facility; or spacing poles so they span transit facilities.

B. Visual Resources

Environmental Setting

The *Coastal View Study* (City and County of Honolulu, Department of Land Utilization, 1987) describes the visual resources in the Ewa District and Pearl Harbor area of the South Shore of the Primary Urban Center District. For the Ewa District, the study states:

> 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.

With respect to the Ewa section that contains the alignments, the *Coastal View Study* states:

> 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.

For the Pearl Harbor area, the *Coastal View Study* notes that:

> The Pearl Harbor section consists of the area surrounding Pearl Harbor, including Waipahu, Pearl City and Aliamanu. The flat terrain and the built up military facilities surrounding Pearl Harbor provide very little public viewing opportunities into this bay. The best views of the bay are from the upper residential areas of Pearl City and Waipio where an overview of the harbor can be seen.

With respect to the Pearl City section that contains the alignments, the *Coastal View Study* states:

> Even within its urban context, the development on the coastal roadways (Farrington Highway and Kamehameha Highway) are fairly jumbled, representing low visual unity and urban intactness.

No significant stationary coastal viewing areas were identified within the Ewa District near the alignments. The significant stationary coastal viewing areas identified in the Pearl Harbor area are located at Waipahu Intermediate School, Waipahu High School, and Leeward Community College.

The City and County of Honolulu's General Plan (1988) lists the following two general objectives for public views (these identify no specific view, dominant feature, or particular characteristic for the area):

- 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 mountain and sea shall be preserved and enhanced whenever possible.

A field evaluation of visual resources within the project area was conducted during the corridor evaluation stage. The field evaluation of existing conditions described below was used as the basis for the evaluation of the visual impacts of the transmission line alternatives.

Ewa Section

Views from Fort Weaver Road. Perhaps one of the more central viewing locations of the study area, New Fort Weaver Road (just south of its intersection with Farrington Highway) offers a panoramic view. As the viewer looks north with Village Park along the horizon, transmission lines parallel Kunia Road as it continues into the background. The middleground and the area west of Kunia Road are dominated by the green canefields as they give way to the foothills area in the distance. The foreground reveals the red roofs of Kahi Mohala to the north and the rooftops of Honouliuli to the west. As the viewer looks west, existing transmission lines break the skyline just beyond Honouliuli as they lead to the south toward Ewa Beach. Beyond Honouliuli and across the canefields, Puu Makakilo and some of the residential development are evident. Transmission lines and a microwave reflector are visible along the ridge behind Makakilo. Transmission lines parallel Old Fort Weaver Road as it continues south into the horizon.

Toward the east, downtown views and Diamond Head are visible in the distance. Across Fort Weaver Road, Pearl Harbor's West Loch is in the middleground, and the West Loch Estates residential area and Golf Course in the foreground are highlighted by the white forms of the light industrial/warehouse area (Waipahu Industrial Park) just makai of Farrington Highway. Mauka of Farrington Highway, Pearl City is visible behind Waipahu, with the sugar mill framed by a mountain backdrop.

Waipahu Section

Views from Village Park. From the mauka side of Village Park, the ocean meets the horizon line in the distance. West Loch lies in the far middleground and the H-1 freeway and Farrington Highway lie in the near middleground. The existing Village Park development and relatively barren hillside occupy the foreground. To the east, the mountains form a backdrop for the twin towers at Pearl City and the Waipahu Sugar Mill; the Waiau Power Plant is visible near the water. The sugar mill, power plant, and military presence near Pearl Harbor create a somewhat industrial image, although the distance removes much of the detail.

Village Park at the H-1 freeway affords a coastal view, with Pearl Harbor's West Loch in the background, Waipahu in the middleground, and the H-1 freeway dominating the foreground. A transmission line parallels the freeway at this point along the mauka side. Old Fort Weaver Road is visible to the southwest, dotted with transmission line poles.

Views from the H-1 Freeway. The major visual components from the H-1 freeway include the freeway itself and a single-family housing development. Along the highway, the nearness of the foothills creates an awareness of the mountain ridge as a backdrop to most development.

The natural topographic conditions tend to orient casual views to the makai side, although the ridgeline and hills provide interesting visual elements. The Waiawa Interchange offers an imposing pattern of urban development and activity featuring the sweeping curves of the interchange ramps as major elements.

Views Along Farrington Highway. Farrington Highway is lined with commercial development, overhead utility lines, and some housing through Waipahu. Most housing is situated between the H-1 freeway and Farrington Highway in Waipahu, although pockets of residential areas are makai of Farrington Highway to Pearl Harbor. These areas makai of the H-1 freeway are isolated, cul-de-sac type developments separated by occasional drainages to Pearl Harbor. There are numerous overhead utility lines, warehouse spaces, and other light industries. The Waipahu Sugar Mill highlights the otherwise residential development in Waipahu.

Coastal Views. The *Coastal View Study* identified the coastal views from Waipahu Intermediate School and Waipahu High School as significant stationary views.

Pearl City Section

Views from Kamehameha Highway. The area along Kamehameha Highway features a tremendous mix of high-density land uses. These include housing developments, retail shops and shopping centers, restaurants, schools, Naval facilities, and community parks. As such, the visual character as viewed from Kamehameha Highway is one of a rich fabric of high-density urban development with a few high-rise structures. The visual character of this area is distinctly urban, with substantial activity in terms of pedestrian and vehicular traffic.

Views from the H-1 Freeway. The H-1 freeway is elevated in this section, raising the viewer above the generally low-rise urban landscape at street level.

As with the H-1 freeway section in Waipahu, the casual viewer would be aware of the adjacent commercial and residential areas on the mauka side, but would tend toward makai views of Pearl Harbor.

Coastal Views. The *Coastal View Study* identified the coastal view from Leeward Community College as a significant stationary view.

Probable Impacts

In keeping with the objectives of the City and County of Honolulu, views from public streets and thoroughfares were analyzed for possible visual impact, as discussed below.

H-1 Overhead Alternative

Ewa Section. The extent of overhead transmission lines' visual impact depends largely on the capability of the natural landforms to absorb introduced features. The relatively flat terrain and absence of predominant land features in the Ewa section provide views with no particular focus. These circumstances make overhead transmission lines visible from a distance.

As the area's planned and proposed development occurs, the visual impact of the Ewa portion of the transmission line is expected to lessen. Placement of the alignment along the H-1 freeway at the extreme mauka edges of planned and proposed urban areas or along Kunia Road lessens the visual impact the transmission lines would have. The transmission lines will eventually be within a developed area, and distant views of the lines will be mixed in with views of other urban development.

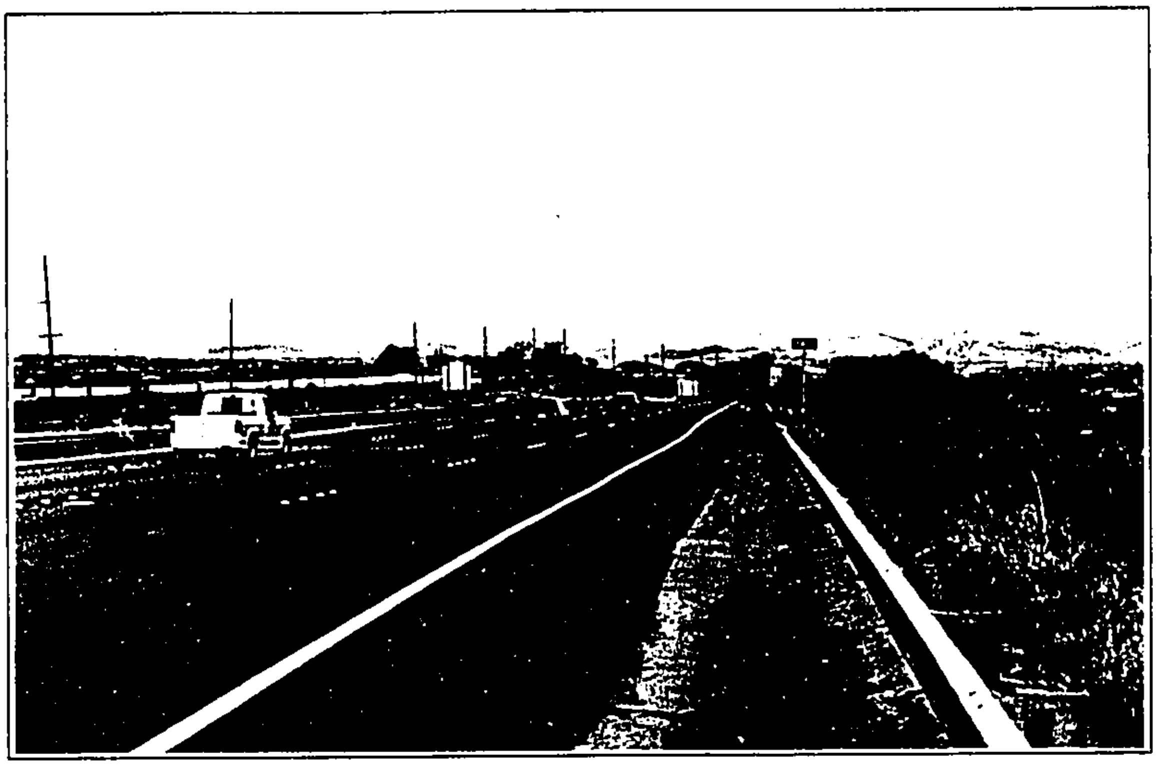
Distant viewers of the Ewa District will be able to see the transmission lines from elevated areas. In the short term, the lines will be visible against the flat terrain. In the long term, when the area is developed, the transmission lines will appear among other manmade improvements and will have minimal visual impact.

Because no significant stationary coastal viewing areas were identified within the Ewa District in the vicinity of the proposed line, there are none that can be affected.

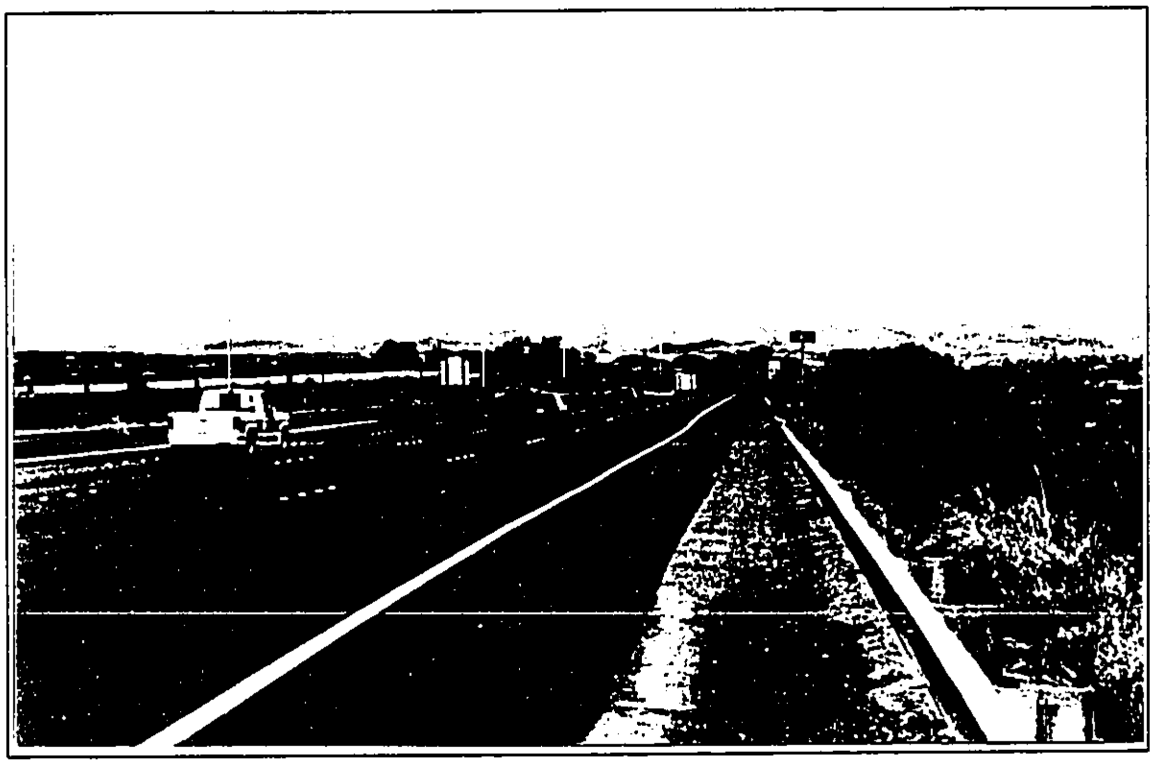
Waipahu Section. The overhead transmission lines' visual impact is a function of the natural and manmade environment's ability to absorb introduced features.

Figure 5-4 simulates the visual impact of the project looking mauka from H-1 near Village Park. Figure 5-5 simulates the project from within Village Park looking in a makai direction. Figure 5-5 can be generalized to show how makai views would be affected in the Waikele area after residential construction.

Mauka views from H-1 near Village Park show a relatively flat terrain without any predominant land features, which would make the overhead transmission lines visible from



Existing Conditions

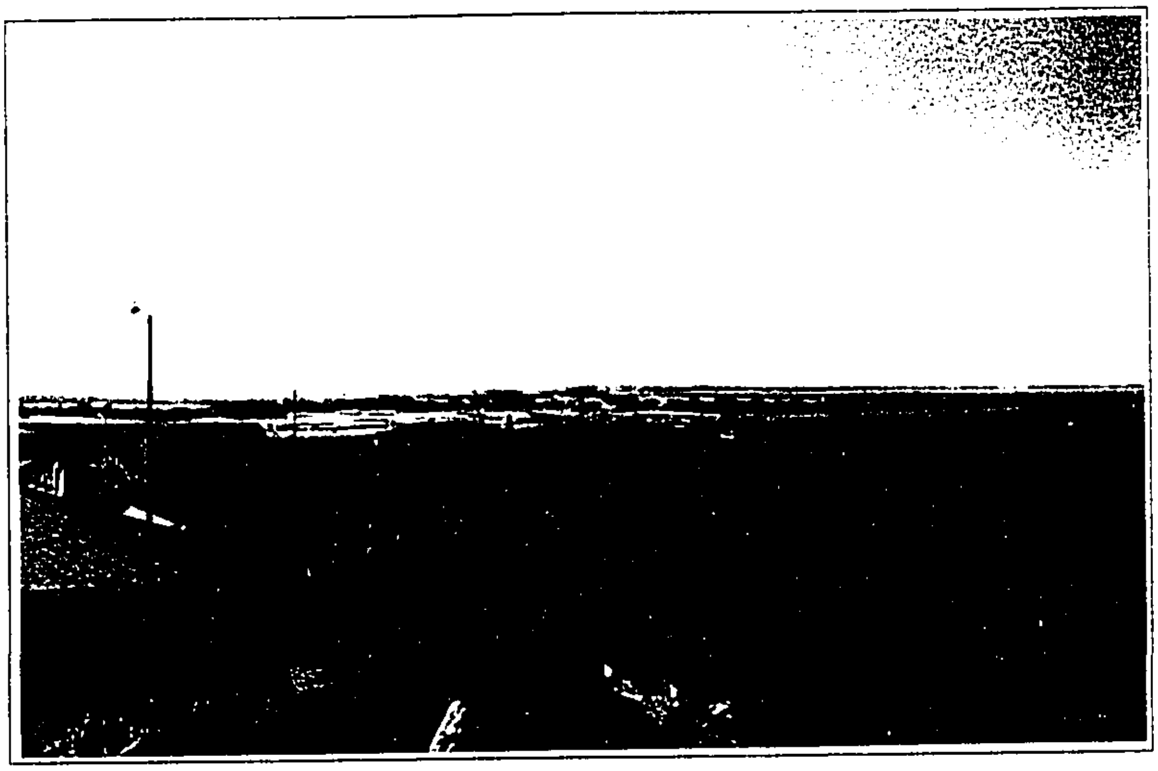


Simulation of Proposed Project

FIGURE 5-4

FROM H-1 NEAR VILLAGE PARK
LOOKING MAUKA

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



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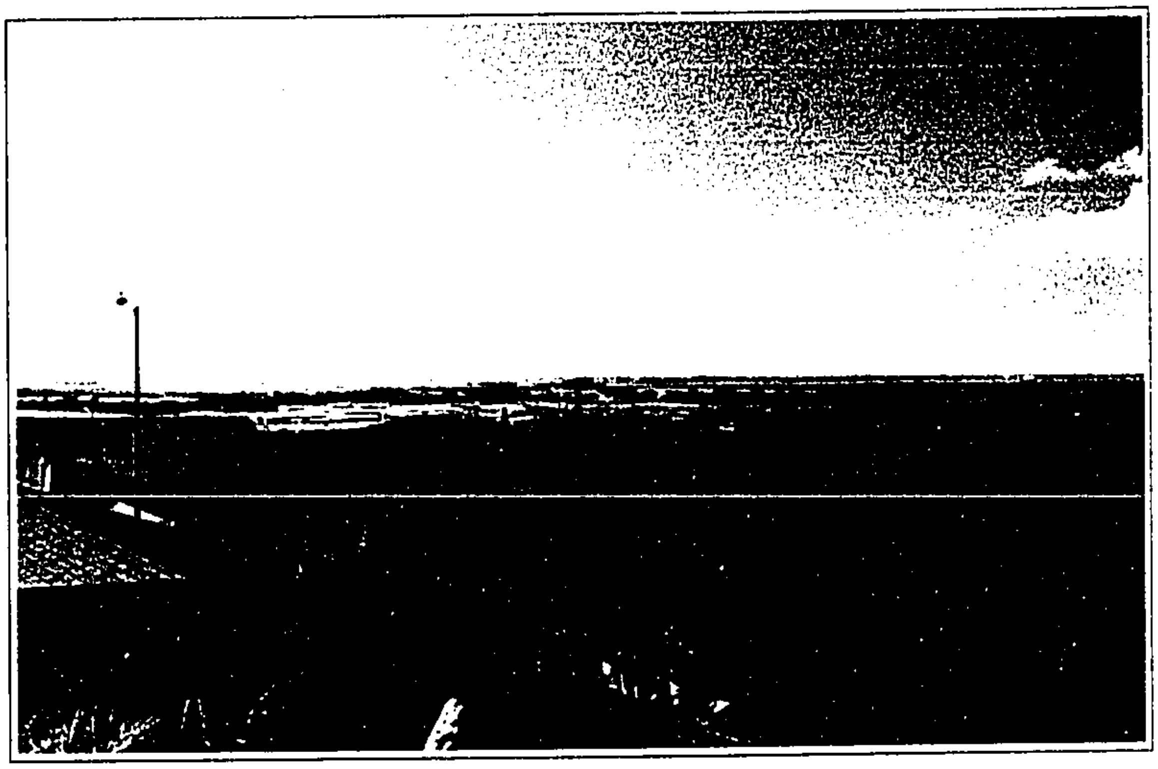


Simulation of Proposed Project

FIGURE 5-5

FROM VILLAGE PARK
LOOKING MAKAI

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

this vantage point. However, as planned and proposed development occurs mauka of the H-1 freeway, the visual impact of the Waipahu section of this line is expected to lessen.

Placement of the alignment along H-1 at the extreme mauka edges of planned and proposed urban areas lessens the visual impact the transmission line will have.

Makai views from Village Park show that the transmission line's visual impact is lessened considerably because of distance, and because it visually merges into the Waipahu urban landscape of residential areas and roadways in the near middleground. Distant makai views to Pearl Harbor are not appreciably affected. Makai views from Waikele after full development of the land would be similar.

The *Coastal View Study* identified two coastal views as significant stationary views in the Waipahu section. These two significant coastal viewing areas at Waipahu Intermediate School and Waipahu High School are both makai of the proposed line, and will not be adversely affected.

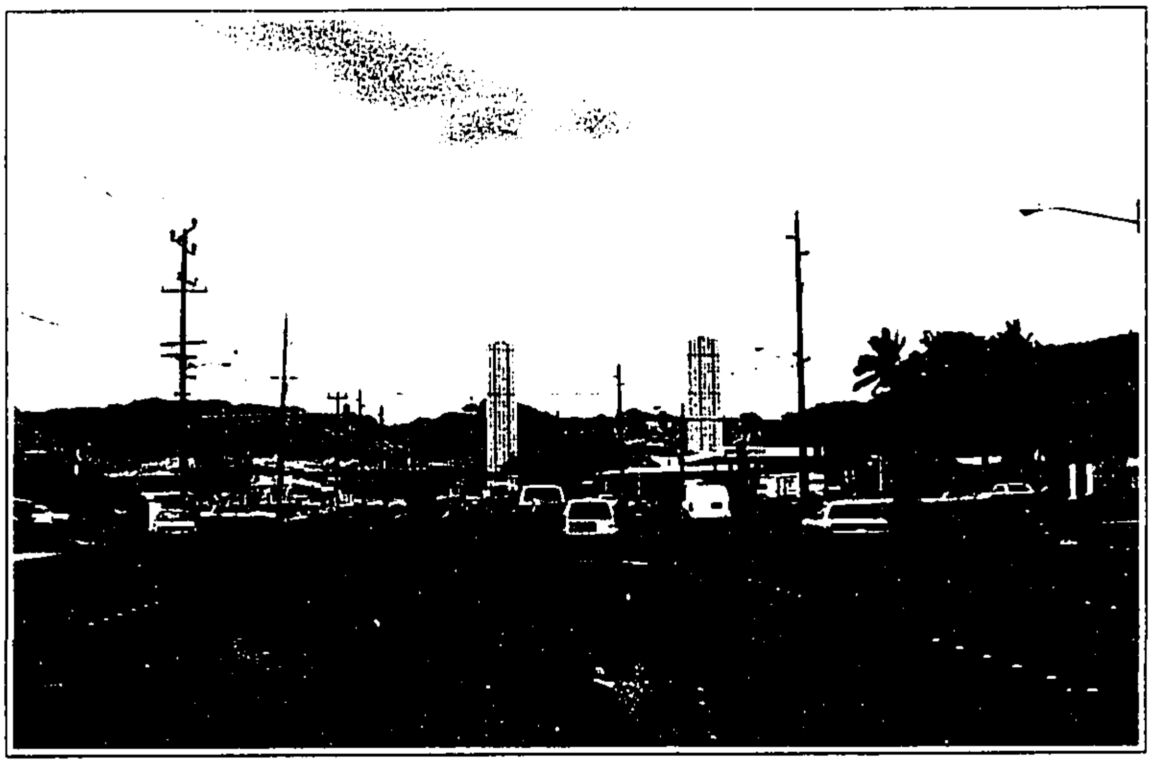
Pearl City Section. Figure 5-6 simulates this alternative as viewed from Kamehameha Highway at Lehua Avenue looking Ewa (west).

The area along Kamehameha Highway contains numerous high-density urban uses including housing developments, retail commercial areas, restaurants, schools, Naval facilities, and industrial areas. The twin residential towers can be seen in the distance. The visual character is distinctly urban, with substantial pedestrian and vehicular traffic. The visual impact of the proposed line is–to a large extent–absorbed into this diverse urban landscape, which already contains numerous utility poles and transmission lines on both sides of Kamehameha Highway.

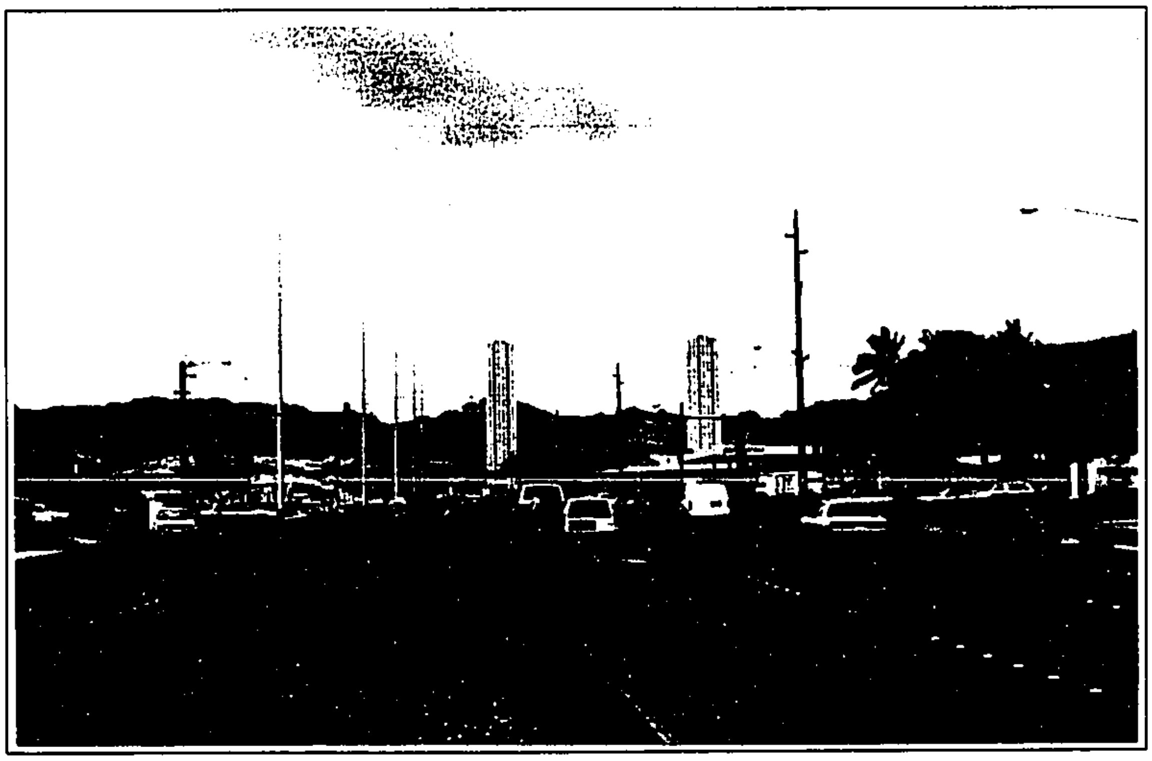
From the H-1 freeway, which is elevated in the Pearl City section, the portion of the line along Kamehameha Highway would not be noticeable to the casual observer.

The portion adjacent to the H-1 freeway itself would be noticeable, but would be following an existing transmission line. The visual impact of an additional transmission line into a corridor that already contains a transmission line would be largely absorbed into the texture of this urban landscape.

The bike path option would require installation of poles and transmission lines along the makai edge of H-1 freeway just east of Lehua Elementary School to a point east of Waimano Stream, where 46 kV lines do not currently exist. However, 46 kV lines do exist farther makai of the bike path. The visual impact of an additional transmission line near a corridor that already contains a transmission line would be largely absorbed into the texture of the urban landscape. Views makai toward Pearl Harbor from H-1 freeway generally would not be interrupted because viewers will look beneath the conductors and between the widely spaced poles to the shoreline.



Existing Conditions



Simulation of Proposed Project

FIGURE 5-6

FROM KAMEHAMEHA HIGHWAY AT LEHUA AVENUE LOOKING EWA

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

The *Coastal View Study* identified one coastal view as a significant stationary view in the Pearl City section. This significant coastal viewing area, Leeward Community College, is located makai of this alternative, and will not be adversely affected.

H-1 Overhead/Underground Alternative

Ewa Section. The visual impacts of this alternative are identical to those of the H-1 Overhead alternative.

Waipahu Section. The H-1 Overhead/Underground alternative is overhead in the Waipahu section, and follows the same route as the H-1 Overhead alternative. The visual impacts of this alternative are identical to those of the H-1 Overhead alternative.

Pearl City Section. From the Waiawa Interchange to the Waiau Power Plant, this alternative is underground and will have no adverse visual impacts.

Farrington Overhead Alternative

Ewa Section. Visual impacts are essentially identical to those of the H-1 Overhead alternative, Kunia option.

Waipahu Section. Makai views of the line from the Village Park area are further diminished compared with the H-1 Overhead alternative because of the increased distance from the viewer. A casual observer on the H-1 freeway would not be able to see the line because of the intervening urban landscape.

Visual impacts are most noticeable along Farrington Highway, where the line would be intermingled with numerous other existing overhead utility lines, and near two- and three-story warehouses, industrial buildings, and commercial areas. The visual impact of this line is lessened because it is largely absorbed into the fairly dense urban landscape surrounding Farrington Highway.

The two significant coastal viewing areas at Waipahu Intermediate School and Waipahu High School are makai of this alternative and will not be adversely affected.

Pearl City Section. From the Waiawa Interchange to the Waiau Power Plant, this alternative is identical to the H-1 Overhead alternative. As with the H-1 Overhead alternative, this section of the alternative includes a bike path option that would begin east of Lehua Elementary School on the makai edge of H-1 freeway and end at a point east of Waimano Stream on HECO property. The visual impacts of this alternative, including its optional route, are identical to those of the H-1 Overhead alternative.

Farrington Underground Alternative

Ewa Section. The underground alternative will have no adverse visual impacts.

Waipahu Section. The underground alternative will have no adverse visual impacts.

Pearl City Section. The underground alternative will have no adverse visual impacts.

OR&L Overhead/Underground Alternative

Ewa Section. The visual impacts of this alternative are essentially identical to those of the H-1 Overhead alternative, Kunia option.

Waipahu Section. Makai views of the line from Village Park are nearly nonexistent because of the distance from the viewer. Views from H-1 and Farrington Highway are nonexistent because of the intervening urban landscape. The overhead portions of this alternative will interfere with the coastal views from Waipahu Intermediate School and Waipahu High School, which are significant stationary coastal views identified in the *Coastal View Study*.

Pearl City Section. Makai views of this line from Kamehameha Highway are nonexistent because of the distance and the intervening urban landscape. Makai views of this alternative would not be noticeable to a casual observer on the H-1 freeway, because this section of the highway is elevated in the Pearl City section, with the alternative mostly below the line of sight. As with the H-1 Overhead and the Farrington Overhead alternatives, this alternative includes a bike path option that would begin east of Lehua Elementary School on the makai edge of H-1 freeway and end at a point east of Waimano Stream in the Waiau Power Plant site. The visual impacts of this optional route are identical to those of the H-1 Overhead and Farrington Overhead optional route alternatives described earlier. Overhead portions of this alternative will interfere with the coastal views from Leeward Community College, which is a significant coastal view identified in the *Coastal View Study*.

No Action Alternative

No visual impacts are anticipated in the Ewa section, Waipahu section, or Pearl City section by continuing the status quo with the No Action alternative.

Mitigation

To soften the visual impact of the transmission line poles, the poles will be a neutral color to blend into the landscape.

To reduce the visual clutter of transmission lines and poles, where possible, existing lower voltage transmission lines that occupy the same alignment will be suspended (underbuilt) on the same pole. Distribution lines that also occupy the same alignment may be placed underground. With this arrangement fewer poles would be needed for the same distance, because longer spans between poles are possible with the high-voltage transmission line. Overall, this will reduce visual clutter at the pedestrian level.

C. Electric and Magnetic Field Effects

This discussion of electric and magnetic fields is based on a report, *Technical Information Paper on Transmission Line Electrical Effects* by Enertech Consultants, January 1992. The report was prepared for the Waiau-CIP Transmission Line Part 2 Project. It appears as Appendix D in the project's Routing Report issued in February 1992.

Environmental Setting

High-voltage transmission or bulk power lines form the backbone of the electric energy distribution system. A network of about 338,000 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 2 lines will be operated at 138 kV, the highest voltage classification used in Hawaii. The 138 kV voltage is, however, 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 compared with 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 kilovolts per meter (kV/m). The electric field is stronger near a charged object and decreases rapidly with distance from an object.

Electric fields are a 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 5-1.

Table 5-1 Typical Electric Field Values for Household Appliances (at 12 inches)	
Appliance	Electric Field (kilovolts/meter)
Electric blanket	0.25[a]
Broiler	0.13
Stereo	0.09
Refrigerator	0.06
Iron	0.06
Hand mixer	0.05
Phonograph	0.04
Coffee pot	0.03

[a]1 to 10 kV/m next to blanket wires (Enertech Consultants, 1985).
Source: Carstensen, 1985.

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

The magnetic field under transmission lines is relatively low compared with measurements near many household appliances and other equipment. The magnetic fields of a large number of typical household appliances were recently measured by the Illinois Institute of Technology Research Institute (IITRI) for the U.S. Navy (Gauger, 1985) and by Enertech Consultants (Silva, 1988) for the Electric Power Research Institute (EPRI). Typical values of magnetic fields associated with household appliances are shown in Table 5-2.

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 using 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 5-3.

Table 5-2
Typical Magnetic Field Values for Household Appliances

Appliance	Magnetic Field (mG) At 12 Inches	Magnetic Field (mG) 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
Coffeemaker	0.8-1	15-250
Toaster	0.6-8	70-150
Crockpot	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
Hairdryer	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 saw	10-250	2,000-10,000
Electric drill	25-35	4,000-8,000

Source: Gauger, 1985.

Table 5-3
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:	McDonald's 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 Highway No. 130	0.2-7

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.

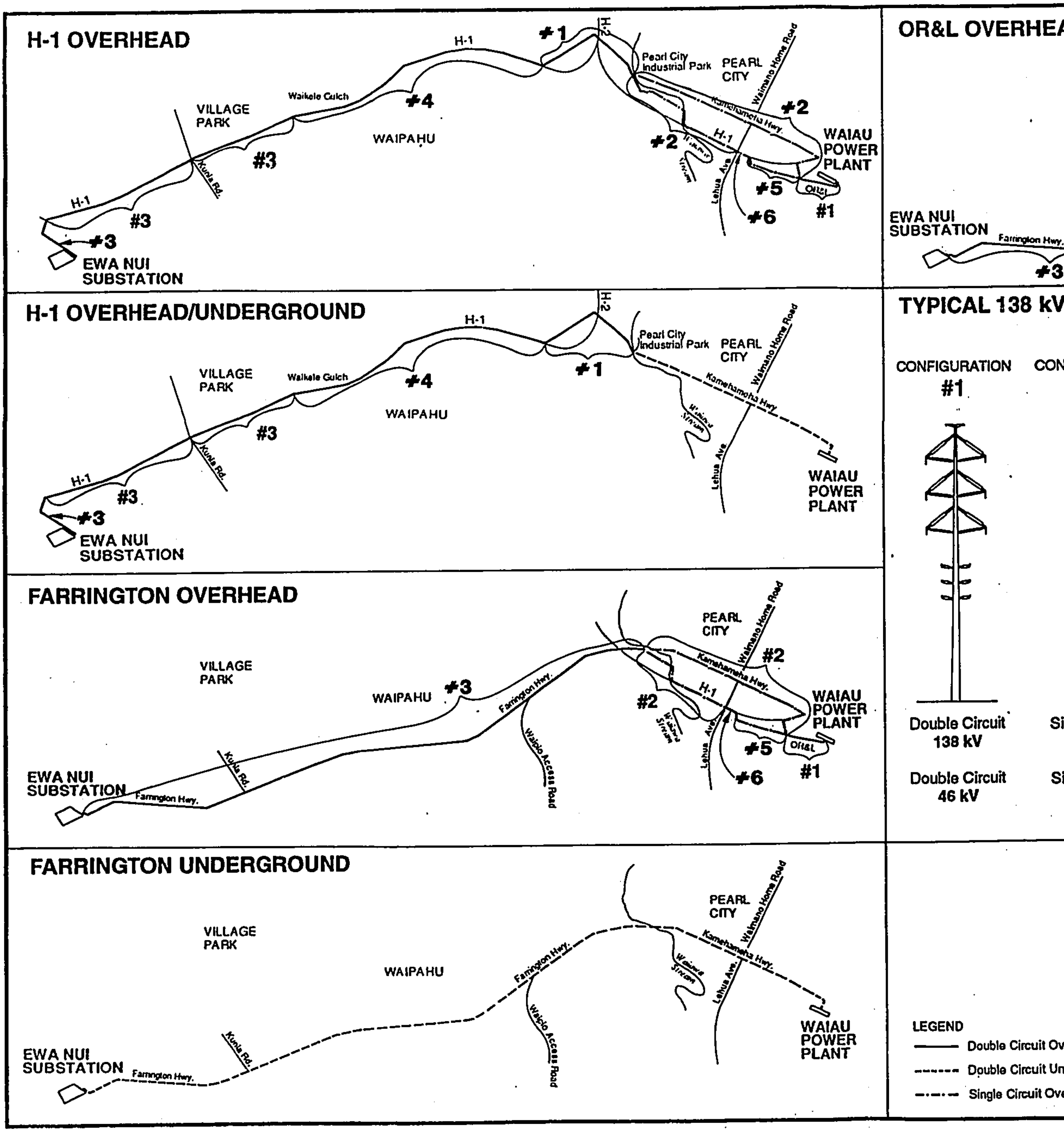
Probable Impacts

HECO supplied a set of load currents, line design details (pole configurations), and phasing to prepare the electric and magnetic field calculations (see Appendix B, Figures B-1 through B-3) of the alternative alignments. The numerical values 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) and in the same direction. Conditions differing from these assumptions (e.g., unequal loading of the circuits and/or opposite directions of power flow) would result in less cancellation from unlike phasing and, hence, higher fields. A system load flow study would be necessary to validate these general assumptions and finalize the optimum phasing for reduced field levels. HECO proposes to conduct such a study to determine optimum phasing and to make magnetic field measurements at locations selected in consultation with community representatives, before and after the lines are operating, to compare calculated levels with actual magnetic field levels.

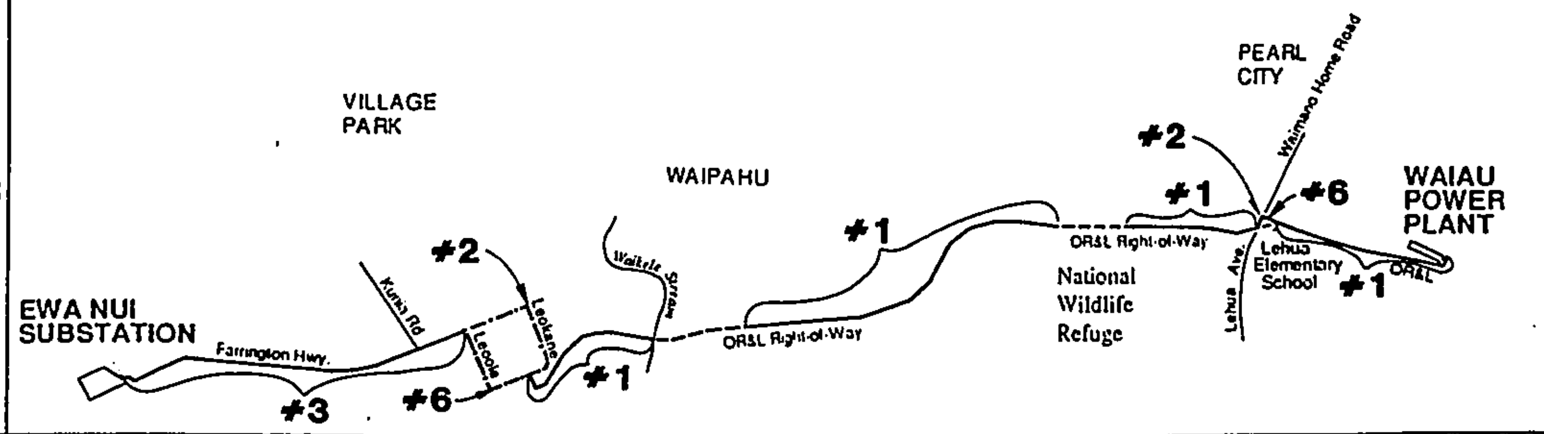
Electric field values were calculated for six possible pole configurations because the configuration of poles would differ somewhat along each of the alternative alignments and between alternatives. Figure 5-7 illustrates the typical pole configurations and their locations for the alternative alignments.

The calculated electric field values for the six configurations are shown in Table 5-4. The results are presented as electric field levels as a function of distance away from the lines on either side at midspan (i.e., the point at which the lines are nearest to the ground). The typical right-of-way (ROW) widths for a double-circuit alignment (75 feet) and a single-circuit alignment (40 feet) are noted on the table to indicate the electric field values at the edge of an alignment's right-of-way (Figures B-4 through B-9 in Appendix B graphically illustrate the electric field levels).

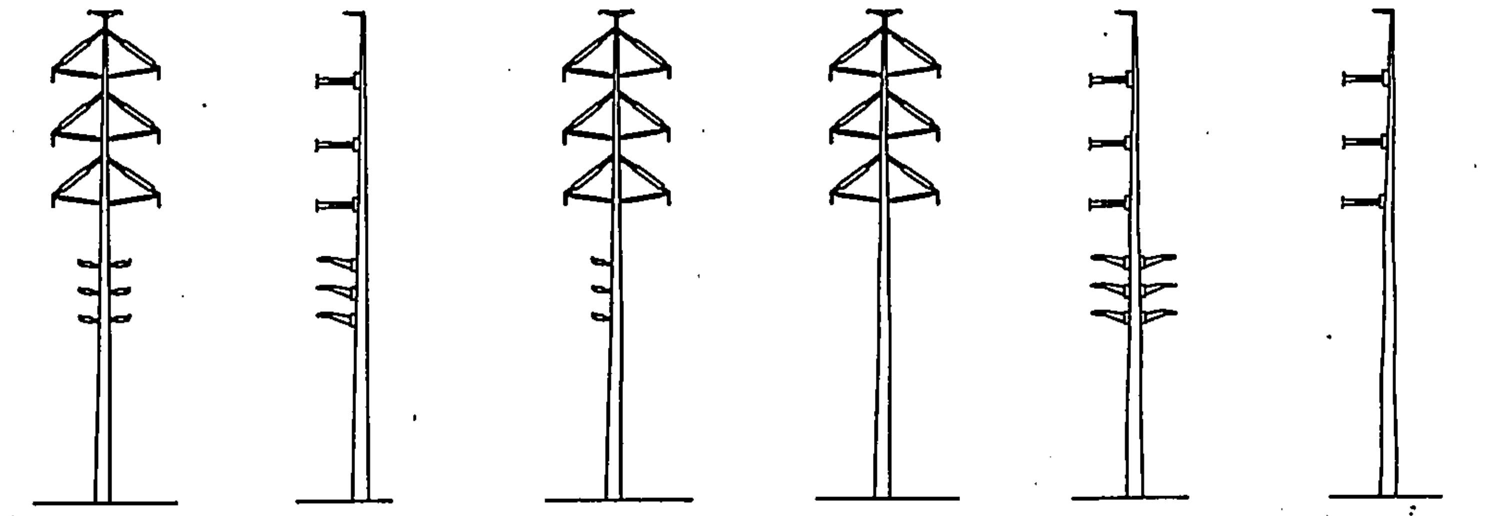
Where 138 kV lines are installed on the same pole as lower-voltage lines, some arrangements of conductors ("low-reactance phasing") can reduce electric field strengths because the interaction of the different opposite (or "unlike") phases can reduce electric field strengths. Table 5-4 illustrates estimated electric field values for the power lines using low-reactance phasing. HECO proposes using low-reactance phasing in locations where the 138 kV lines will share poles with lower-voltage conductors (see Figure 5-7 for these locations).


H-1 OVERHEAD
H-1
H-2
#1
Pearl City Industrial Park
PEARL CITY
Waimano Home Road
Kamehameha Hwy.
#2
VILLAGE PARK
Waikele Gulch
#4
WAIPAHU
#2
H-1
WAIAU POWER PLANT
#3
Kunia Rd.
Lehua Ave.
#5
OR&L
#1
#6
H-1
#3
#3
EWA NUI SUBSTATION
H-1 OVERHEAD/UNDERGROUND
H-1
H-2
Pearl City Industrial Park
PEARL CITY
Waimano Home Road
VILLAGE PARK
Waikele Gulch
#4
#1
Kamehameha Hwy.
WAIPAHU
#3
Kunia Rd.
Lehua Ave.
H-1
#3
WAIAU POWER PLANT
#3
EWA NUI SUBSTATION
FARRINGTON OVERHEAD
PEARL CITY
Waimano Home Road
#2
Kamehameha Hwy.
VILLAGE PARK
WAIPAHU
#3
Farrington Hwy.
#2
H-1
WAIAU POWER PLANT
Kunia Rd.
Lehua Ave.
#5
OR&L
Waipio Access Road
#1
#6
EWA NUI SUBSTATION
Farrington Hwy.
FARRINGTON UNDERGROUND
PEARL CITY
Waimano Home Road
VILLAGE PARK
Kamehameha Hwy.
WAIPAHU
Farrington Hwy.
Lehua Ave.
Waipio Access Road
Kunia Rd.
WAIAU POWER PLANT
EWA NUI SUBSTATION
Farrington Hwy.
OR&L OVERHEA
EWA NUI SUBSTATION
Farrington Hwy.
#3
TYPICAL 138 kV
CONFIGURATION
#1
CON
Double Circuit 138 kV
Si
Double Circuit 46 kV
Si
LEGEND
Double Circuit Ov
Double Circuit Un
Single Circuit Ove

OR&L OVERHEAD/UNDERGROUND



TYPICAL 138 kV POLE CONFIGURATIONS



CONFIGURATION #1	CONFIGURATION #2	CONFIGURATION #3	CONFIGURATION #4	CONFIGURATION #5	CONFIGURATION #6
Double Circuit 138 kV	Single Circuit 138 kV	Double Circuit 138 kV	Double Circuit 138 kV	Single Circuit 138 kV	Single Circuit 138 kV
Double Circuit 46 kV	Single Circuit 46 kV	Single Circuit 46 kV	No 46 kV	Double Circuit 46 kV	No 46 kV

LEGEND
- Double Circuit Overhead Lines
- Double Circuit Underground Lines
- Single Circuit Overhead Line

LOCATIONS OF TYPICAL POLE CONFIGURATIONS

FIGURE 5-7

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

Table 5-4
Estimated Electric Field Levels for Typical Pole Configurations
(Normal and Emergency Loadings)

Typical Pole Configuration	Electric Field (kilovolts/meter) Distance From Centerline (feet): 0	10	20	30	40	50	60
#1 Double-circuit 138 kV, Double-circuit 46 kV underbuild	0.22	0.22	0.21	0.19	0.15	0.11	0.08
#2 Single-circuit 138 kV, Single-circuit 46 kV underbuild	0.13	0.12- 0.13	0.11-0.12	0.09-0.10	0.07	0.04	0.03
#3 Double-circuit 138 kV, Single-circuit 46 kV underbuild	0.34	0.24-0.38	0.17-0.37	0.15-0.30	0.12-0.22	0.10-0.16	0.07-0.11
#4 Double-circuit 138 kV, No underbuild	0.36	0.35	0.33	0.28	0.22	0.16	0.12
#5 Single-circuit 138 kV, Double-circuit 46 kV underbuild	0.18	0.15-0.19	0.13-0.17	0.10-0.11	0.04	0.06	0.04-0.05
#6 Single-circuit 138 kV, No underbuild	0.64	0.60	0.49	0.36	0.25	0.16	0.10

Note: Edge of typical right-of-way from centerline of double-circuit alignment (configurations 1, 3, and 4) is 37.5 feet.
Edge of typical right-of-way from centerline of single-circuit alignment (configurations 2, 5, and 6) is 20 feet.

Source: Enertech Consultants

The electric field for the proposed transmission lines will be about 0.12 to 0.49 kV/m at the ROW edge to about 0.64 kV/m (for the assumed phasing) directly under the conductors near midspan. The maximum electric field occurs in a relatively small area of the ROW (about 5 percent of total area) near midspan, and near where the conductors sag closest to the ground.

The magnetic field was also calculated for the six different configurations (see Figure 5-7). The results are presented as magnetic field levels on both sides of the lines, as a function of distance from the line center, in Table 5-5 for normal loads and Table 5-6 for emergency loads.

For normal loading, the calculated magnetic field would be about 6 to 22 mG at the ROW edge and 9 to 23 mG directly under the conductors (for the assumed loads and phasings).

For unusual situations, the proposed 138 kV lines and 46 kV underbuilds could operate under a maximum heavy or emergency loading situation that would temporarily increase magnetic field values at the ROW edge to a range of about 13 to 55 mG, depending on line configuration, for the assumed loads and phasings. It should be noted that these conditions would be rare and of short duration (e.g., a few hours). (Figures B-10 through B-15 in Appendix B graphically illustrate magnetic field levels.)

Magnetic Field Levels of Underground Cables

Underground transmission lines, using the high-pressure fluid-filled (HPFF) system, would be used for two of the alternative alignments: H-1 Overhead/Underground and Farrington Underground.

Underground line placement effectively shields electric fields, so only magnetic field levels were calculated.

Estimating magnetic field levels for underground cables is difficult because pipe-type designs actually provide shielding for the magnetic flux (some of the flux is contained in the relatively high-permeability steel pipe). This effect is nonlinear with distance away from the pipe. Also, there can be some cancellation effects from return or ground currents flowing in the pipe, which in turn are affected by how the pipe is grounded at each end. Other matters, such as longitudinal current induced in the steel pipe and conductor spacing and placement in the pipe, can also make it difficult to estimate these levels. The latter is problematic because the conductors "move around" in HPFF systems.

Table 5-5
Estimated Magnetic Field Levels for Typical Pole Configurations
(Normal Loadings)

Typical Pole Configuration		Magnetic Field (milliGauss) Distance From Centerline (feet)						
		0	10	20	30	40	50	60
#1	Double-circuit 138 kV Double-circuit 46 kV underbuild	9.2	9.0	8.2	6.9	5.6	4.4	3.4
#2	Single-circuit 138 kV Single-circuit 46 kV underbuild	18.0	17.8-17.9	16.9-17.1	15.4-15.5	13.5-13.6	11.6-11.7	9.9
#3	Double-circuit 138 kV Single-circuit 46 kV underbuild	11.4	10.7-11.2	9.4-9.8	7.9	6.1-6.5	4.5-5.2	3.4-4.2
#4	Double-circuit 138 kV No underbuild	10.6	10.1	8.9	7.4	5.9	4.6	3.5
#5	Single-circuit 138 kV Double-circuit 46 kV underbuild	22.1	20.8-22.8	19.2-22.0	17.1-19.6	14.9-16.7	12.7-14.0	10.8-11.7
#6	Single-circuit 138 kV No underbuild	23.3	22.6	20.7	18.2	15.6	13.2	11.1

Note: Edge of typical right-of-way from centerline of double-circuit alignment (configurations 1, 3, and 4) is 37.5 feet.
Edge of typical right-of-way from centerline of single-circuit alignment (configurations 2, 5, and 6) is 20 feet.

Source: Enertech Consultants

Table 5-6
Estimated Magnetic Field Levels for Typical Pole Configurations
(Emergency Loadings)

Typical Pole Configuration		Magnetic Field (milliGauss)						
		Distance From Centerline (feet)						
		0	10	20	30	40	50	60
#1	Double-circuit 138 kV Double-circuit 46 kV underbuild	18.5	18.6	17.7	15.4	12.4	9.9	7.7
#2	Single-circuit 138 kV Single-circuit 46 kV underbuild	29.6	30.2-31.0	31.0-31.8	29.8-30.4	27.0-24.4	23.6-23.9	20.3-20.5
#3	Double-circuit 138 kV Single-circuit 46 kV underbuild	34.4	31.3-33.7	26.8-29.2	22.3-23.0	17.2-18.3	12.6-14.8	9.2-12.0
#4	Double-circuit 138 kV No underbuild	24.9	23.8	21.0	17.4	13.8	10.8	8.3
#5	Single-circuit 138 kV Double-circuit 46 kV underbuild	50.0	44.9-55.3	41.3-55.4	37.6-49.8	33.1-42.1	28.6-34.9	24.4-28.7
#6	Single-circuit 138 kV No underbuild	54.9	53.2	48.8	42.9	36.7	31.1	26.1

Note: Edge of typical right-of-way from centerline of double-circuit alignment (configurations 1, 3, and 4) is 37.5 feet.
Edge of typical right-of-way from centerline of single-circuit alignment (configurations 2, 5, and 6) is 20 feet.

Source: Enertech Consultants

The magnetic field levels presented in Table 5-7 were calculated as follows:

1. Assume normal loading and all circuits energized with balanced (positive sequence) phase currents, as follows:

   - Configuration No. 1 Double-circuit (unlike phase) 138 kV at 765A
     Double-circuit (unlike phase) 46 kV at 150A

   - Configuration No. 2 Single-circuit 138 kV at 765A
     Single-circuit 46 kV at 150A

   - Underground configuration Triple-circuit pipe-type cables (with 3-inch triangular phase spacing), all energized at 510A

2. Calculate the maximum magnetic field (semi-major axis of the field ellipse) at 1 meter above ground at midspan for overhead lines (typical configuration Nos. 1 and 2) and 1 meter above the ground for the underground circuits (cables are approximately 5 feet below the surface).

3. Use overhead line field values, as calculated.

4. Apply correction to peak calculated underground values at centerline to adjust for pipe shielding. Develop average attenuation factors for up to 60 feet away using EPRI report data averaged for the two grounding conditions. Apply these attenuation factors to calculated values to produce estimates of magnetic field due to HPFF underground cable system.

Table 5-7
Comparison of Magnetic Field Levels for Underground Cables and Overhead Lines

	Magnetic Field (mG)		
Location (Distance from Centerline) (ft)	Overhead Configuration No. 1 Double-Circuit 138/46 kV	Overhead Configuration No. 2 Single-Circuit 138/46 kV	Underground Triple-Circuit 138 kV
0	9.2	18.0	19.0
10	8.9	17.7	8.7
20	8.2	16.9	4.2
30	6.7	15.4	2.2
40	5.6	13.5	1.1
50	4.4	11.6	0.8
60	3.4	9.9	0.6

Qualitatively, the results demonstrate that, although underground cables produce higher fields directly above them, the field attenuation is such that a few feet away, the level is below that for either of the typical overhead configurations shown. This finding is consistent with other information available on underground cables and with measurements made in other states. These data are plotted as lateral comparison profiles for the underground alternatives versus two typical overhead configurations in Figures B-16 and B-17 in Appendix B.

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 by field measurements and by 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).

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 right-of-way widths, line heights, or the location of lines near homes.

The Los Angeles Study. A new residential epidemiology study funded by EPRI 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 a replication of 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 wiring code) is associated with a positive finding, while direct field measurements are not. This is even more perplexing because this Los Angeles study had the most sophisticated direct measurements of magnetic fields to date. Possible explanations for these apparently contradictory research findings are:

- 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.

EPA Preliminary Draft Report. (This report has been under review by the EPA Science Advisory Board. It will be rewritten and submitted for further scientific review before it is published again.) The U.S. Environmental Protection Agency (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 EM 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 in order 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 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 (SAB) Subcommittee concluded that "... there is insufficient information to designate specific values of magnetic-field strength that may be hazardous to human health." The SAB 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., powerline 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 Hz) 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, while recognizing 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 converse 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 Panel 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 in this section, 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 Public Utilities Commission General Order No. 6 (Rules for Overhead Electric Line Construction) and the National Electrical Safety Code (NESC). The Waiau-CIP Part 2 transmission lines will be designed to comply with these codes and standards. These documents do not currently 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 electromagnetic 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 were compiled and are summarized in Table 5-8. 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 2 transmission lines' field values are far below any of the levels in this table.

Table 5-8
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).

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 by the Council 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/day	5	1,000
Few hours/day	10	10,000

As with the state standards, the Waiau-CIP Part 2 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 uneconomical, corona has been studied since the early part of this century. Consequently, it is well understood by engineers and steps to minimize 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.

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 right-of-way.

The same is true of television interference and audible noise. The engineering design of the proposed Waiau-CIP Part 2 transmission lines will produce very low conductor surface gradients (because of the lower 138 kV line voltage and the use of bundled conductors). 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 lines at 138 kV. 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 (this will be especially true for the Waiau-CIP project because the 138 kV design will use bundled conductors). Audible noise levels for the proposed Waiau-CIP Part 2 transmission lines, calculated for the edge of the ROW during foul 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 TV reception. As described earlier, corona discharges can sometimes generate unwanted electrical signals. There are two potential sources of interference: corona and gap discharges. Corona may affect AM radios, while gap discharge can affect television as well as radio reception. Corona activity is lessened 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 right-of-way 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 μv/m reference value). This level will meet the Federal Communications Commission level for satisfactory service. The bundled conductor design of the 138 kV lines is such that TV interference levels will be extremely low, lower than on many 138 kV lines on the mainland where TV 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 can often be found on distribution lines. The discharges act as small "transmitters" at frequencies that may be received on some radio and TV 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 TV signal, the quality of the radio or TV set and antenna system, and the distance between the set and the interference source. It should be obvious that radios and TV 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, fluorescent lights).

Transmission line engineers commonly 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 (O_3) is another possible by-product 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 one 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 2 transmission lines, calculated ozone levels would be about 0.007 ppb. Concentrations below about 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. However, when these pacemakers detect a spurious signal, such as a 60 Hz 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 commonly induced by cardiologists to check pacemaker performance. So, while 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 2 transmission lines (about 0.1 to 0.7 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.

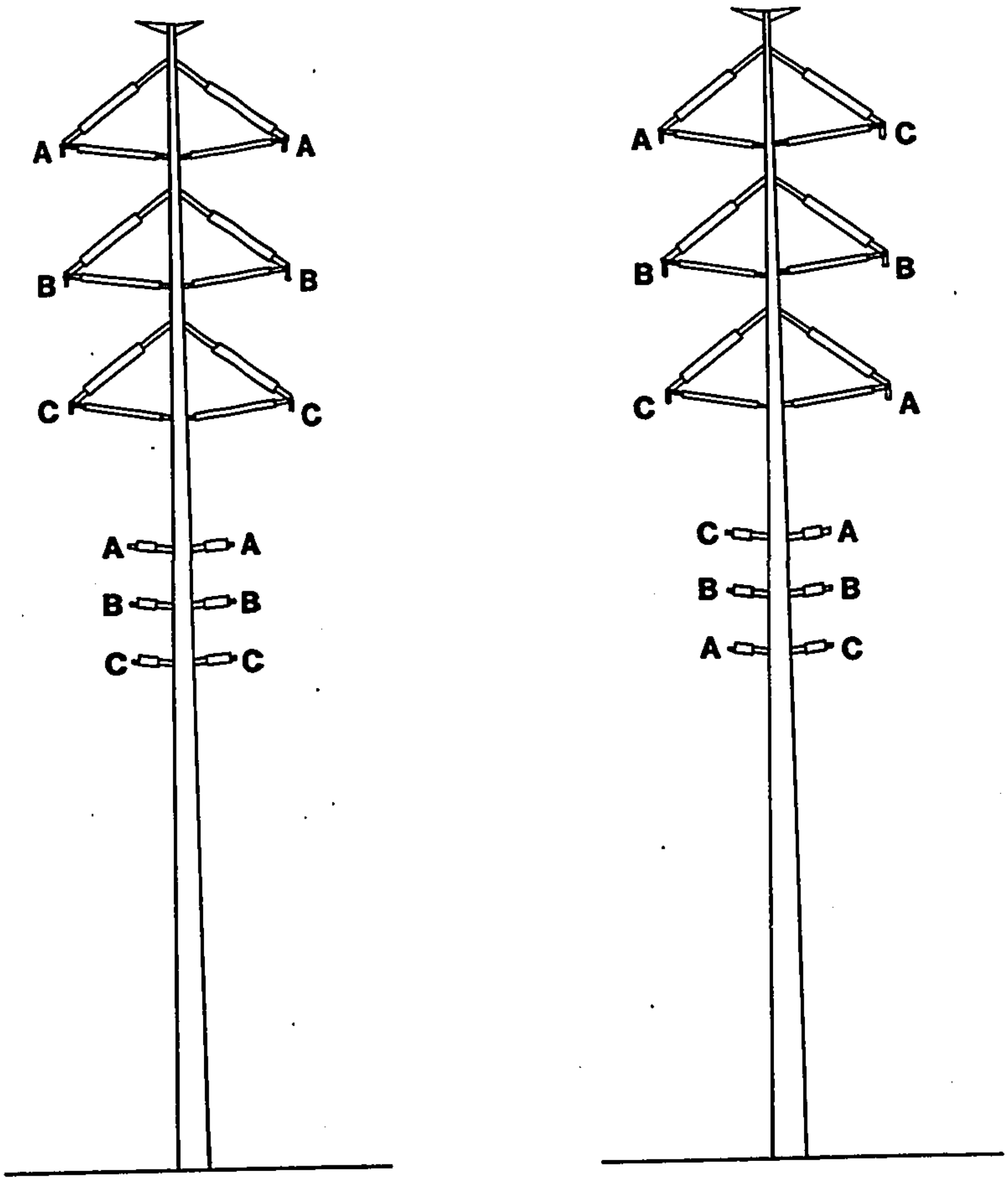
Mitigation

Research to date has not demonstrated conclusive evidence of health hazards from 138 kV transmission lines similar to the Waiau-CIP Transmission Line Part 2 Project. Nevertheless, HECO has adopted strategies consistent with the "prudent avoidance" approach in routing and designing transmission lines.

The evaluation of land use along the alternative alignments and different engineering design options (such as unlike or low-reactance phasing) is consistent with this prudent avoidance approach. The use of unlike phasing (placing opposite phases next to each other) can reduce field levels for the assumed magnitude and direction of current flow in each circuit.

A comparison of pole configurations with like and unlike phasing is provided in Figure 5-8. An example calculation of the difference in magnetic field levels for like and unlike phasing is shown in Figure 5-9. As shown in Figure 5-9, the use of unlike phasing can significantly reduce field levels for the assumed loading conditions. HECO proposes to use such a phasing strategy for this project.

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 design, construct, and operate its transmission lines in a manner that will minimize EMF where technically feasible and economically reasonable.



LIKE PHASING
(Super Bundle)

UNLIKE PHASING
(Low Reactance)

NOTE: Unlike phasing is proposed for this project.

FIGURE 5-8

EXAMPLE OF *LIKE* AND *UNLIKE* PHASING

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

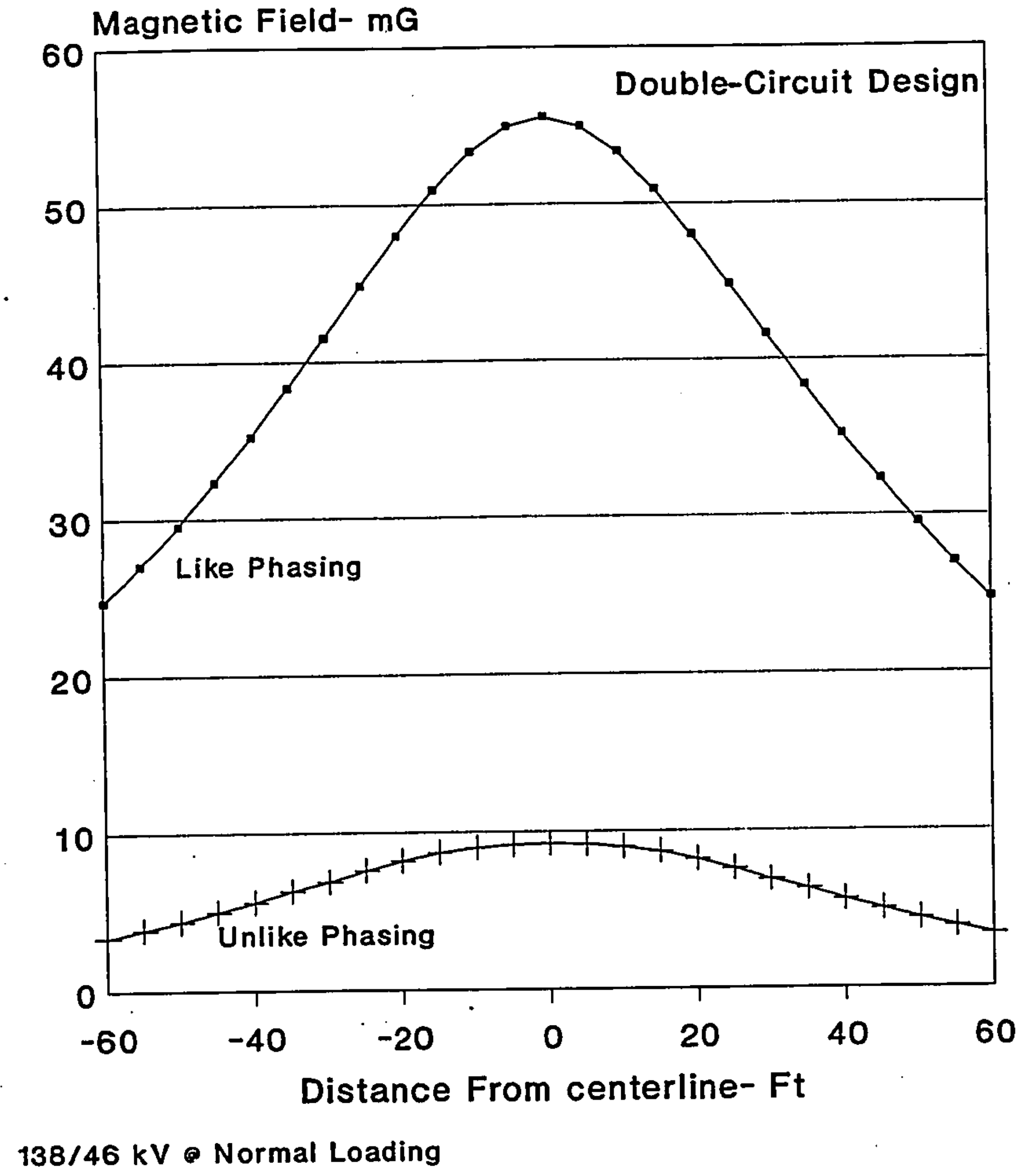


FIGURE 5-9

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 1: TO COMPARE FIELD LEVELS OF LIKE AND UNLIKE PHASING

Waiau-Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2MHILL

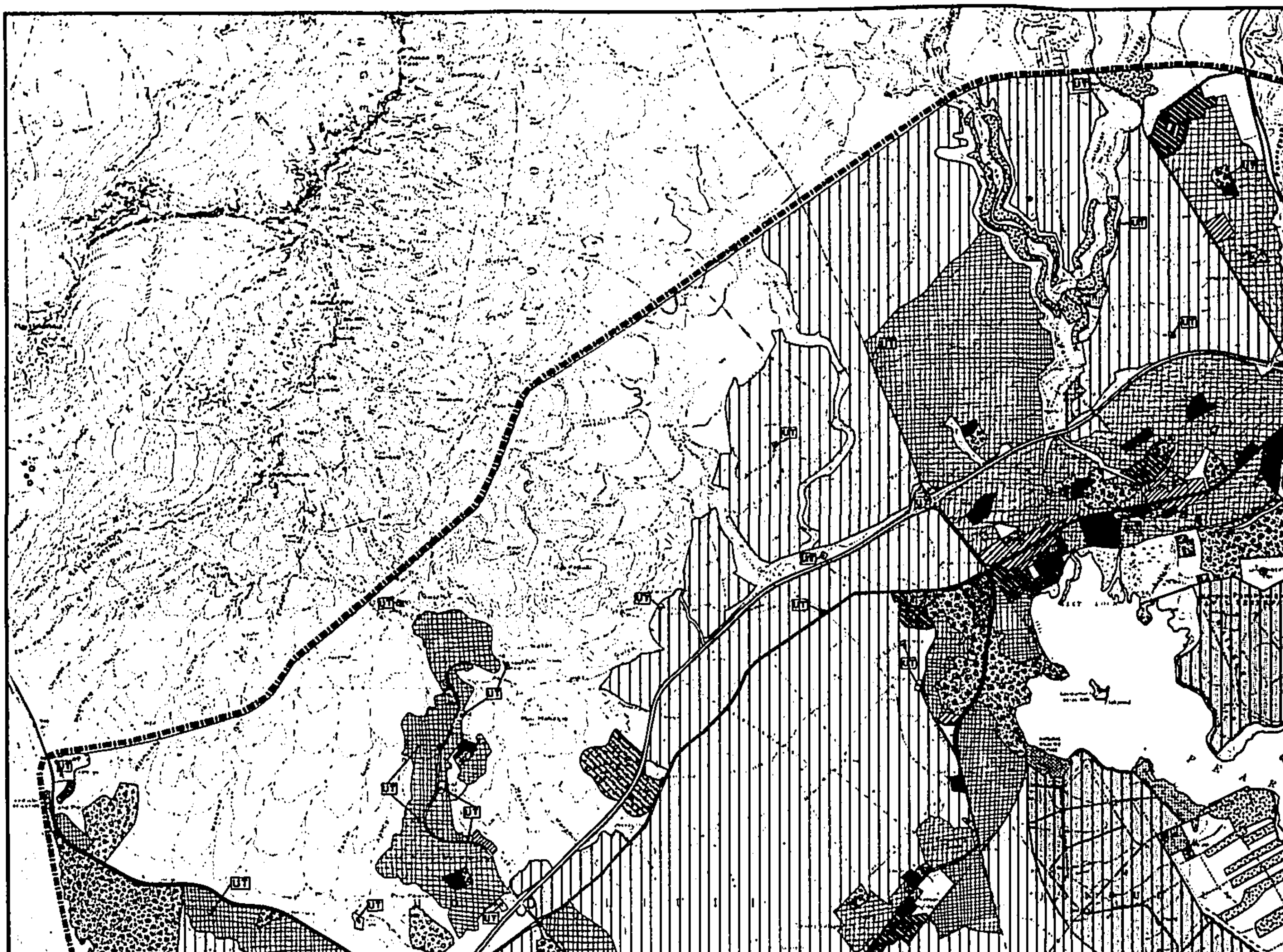
D. Biology, Water, and Earth Resources

Environmental Setting

Biological Resources

Vegetation. The Waipahu and Pearl City sections are mostly urbanized with few undeveloped or agricultural lands (see Figure 5-10). Biological surveys conducted in the study area reveal that plants, animals, and their habitats have been greatly disturbed by human activities over a long period of time (see Figures 5-11 through 5-13a). Ornamental and landscaped species characterize the vegetation around residential and business areas, while less-maintained areas along roadsides and H-1 support an assortment of weedy ruderal species. A Koa-haole (*Leucaena leucocephala*) scrub community is found in less-disturbed areas of the project site, primarily along drainageways, on steeper slopes, and along the OR&L right-of-way, H-1, and other transportation corridors. Actively cultivated fields of sugar cane (*Saccharum officinarum*) characterize the area surrounding the Ewa Nui Substation east to Kunia Road. Weedy species associated with the fields are confined to the margins of the cane fields where they adjoin a network of cane haul roads, irrigation ditches, and drainageways. The limited vegetation that exists in the developed areas of the alignments is composed almost exclusively of introduced species; no native vegetation or significant natural plant communities remain.

The most significant and least disturbed vegetation occurs in the wetlands along the shores of the West, Middle, and East Lochs of Pearl Harbor. The mangrove (*Rhizophora mangle*) forms an almost impenetrable monodominant forest along many shoreline areas adjacent to the OR&L alignment. The nonwoody wetlands community is composed of various members of the sedge family (Cyeraceae), cattails (*Typha latifolia*), and pickleweed (*Batis maritima*). Nonwoody wetlands include several acres between the Waikele Stream and the Kapakahi Stream in an area designated as a Protective Subzone in the State Conservation District; the National Wildlife Refuge and an adjacent area near the Waiawa Spring; and an area adjacent to the Waiau Power Plant. These areas provide important habitat for four endangered species of waterfowl (see Wildlife section, below). A Special Management Area (SMA) designation protects mangrove and nonwoody wetland communities as valuable coastal resources (see Figures 5-14 through 5-16a). Hawaii's Coastal Zone Management Office created SMAs "... to avoid permanent losses of valuable resources and the foreclosure of management options, and to ensure that adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas, and natural reserves is provided." Within the study area, the SMA includes lands mauka and makai of the OR&L alignment along Pearl Harbor, and that portion of all alternative transmission corridors that connects to the Waiau Power Plant. Development of transmission lines within a designated SMA requires an approved SMA Use Permit (issued by the City and County of Honolulu Department of Land Utilization and approved by the City Council).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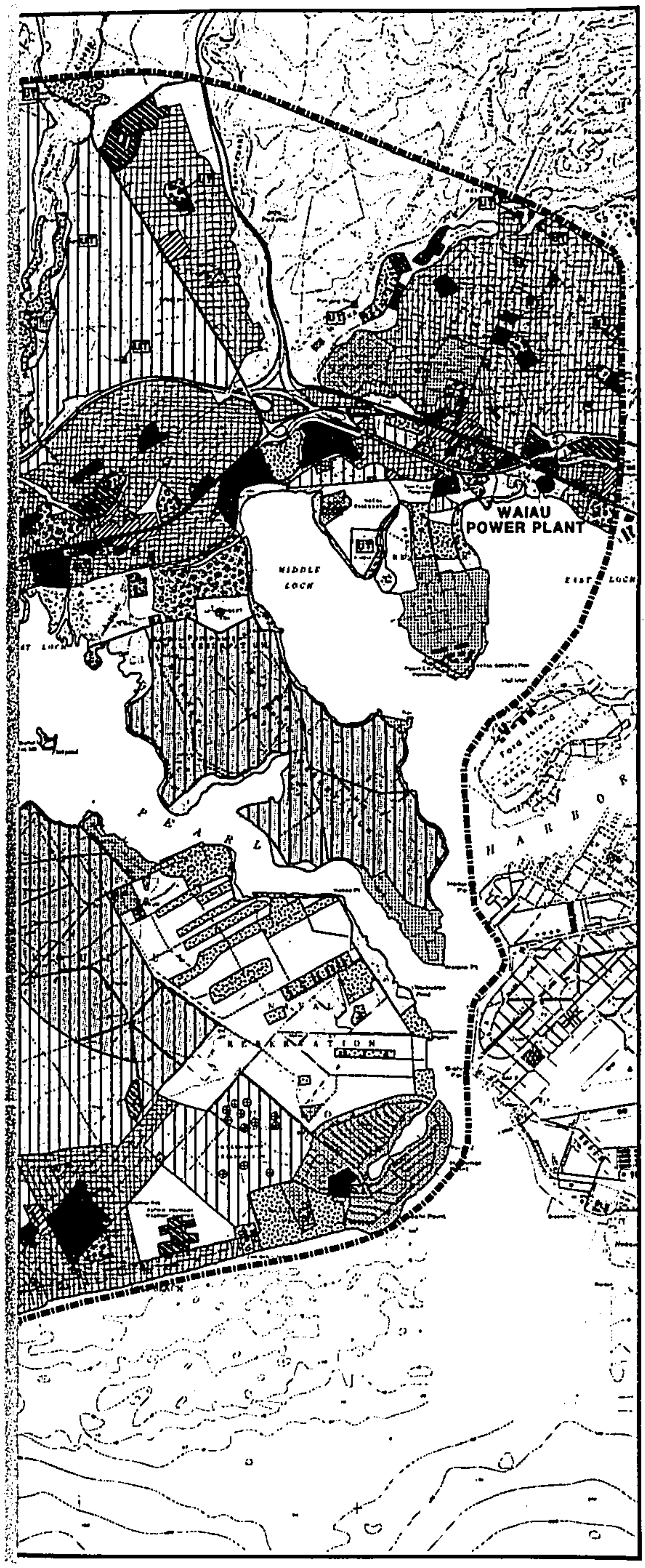


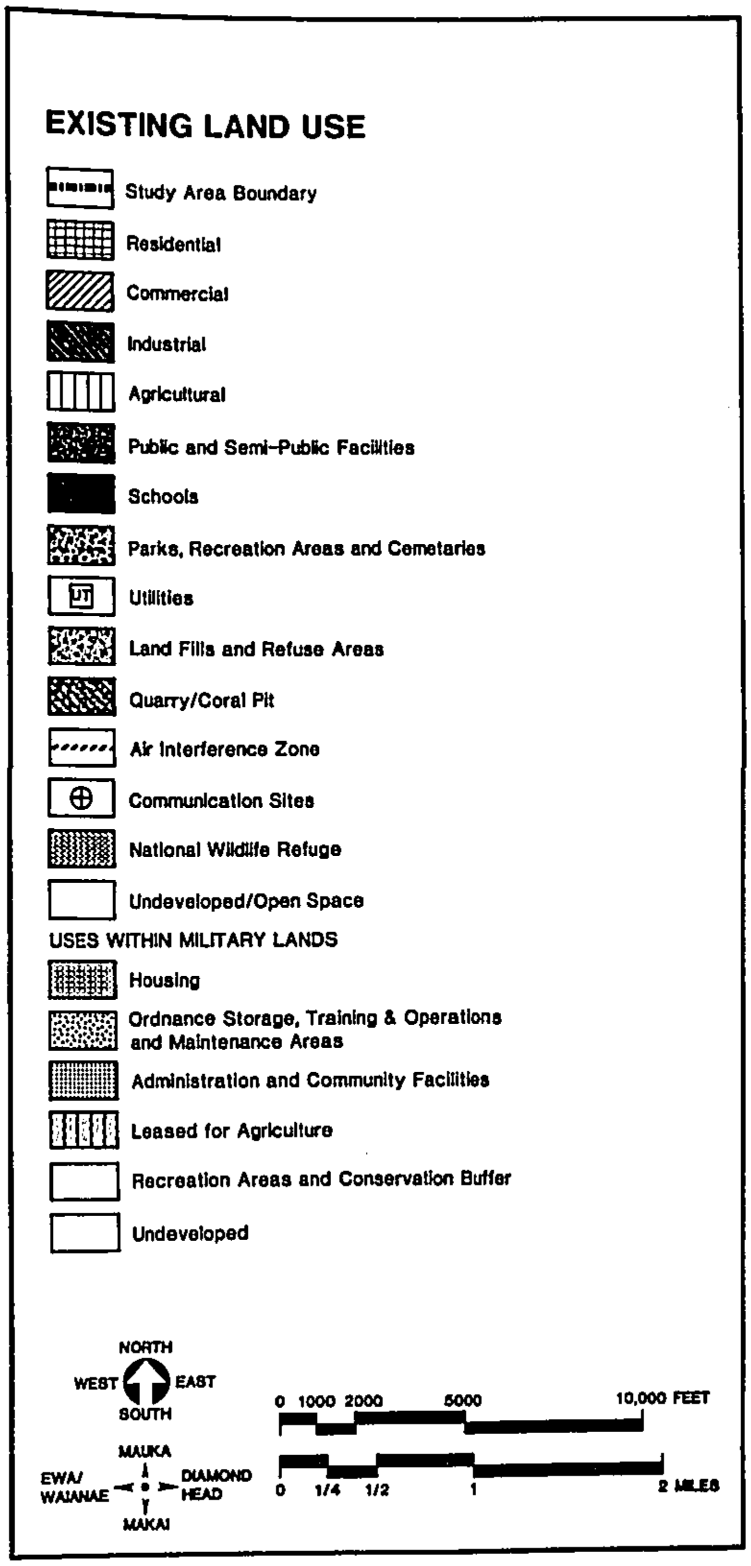
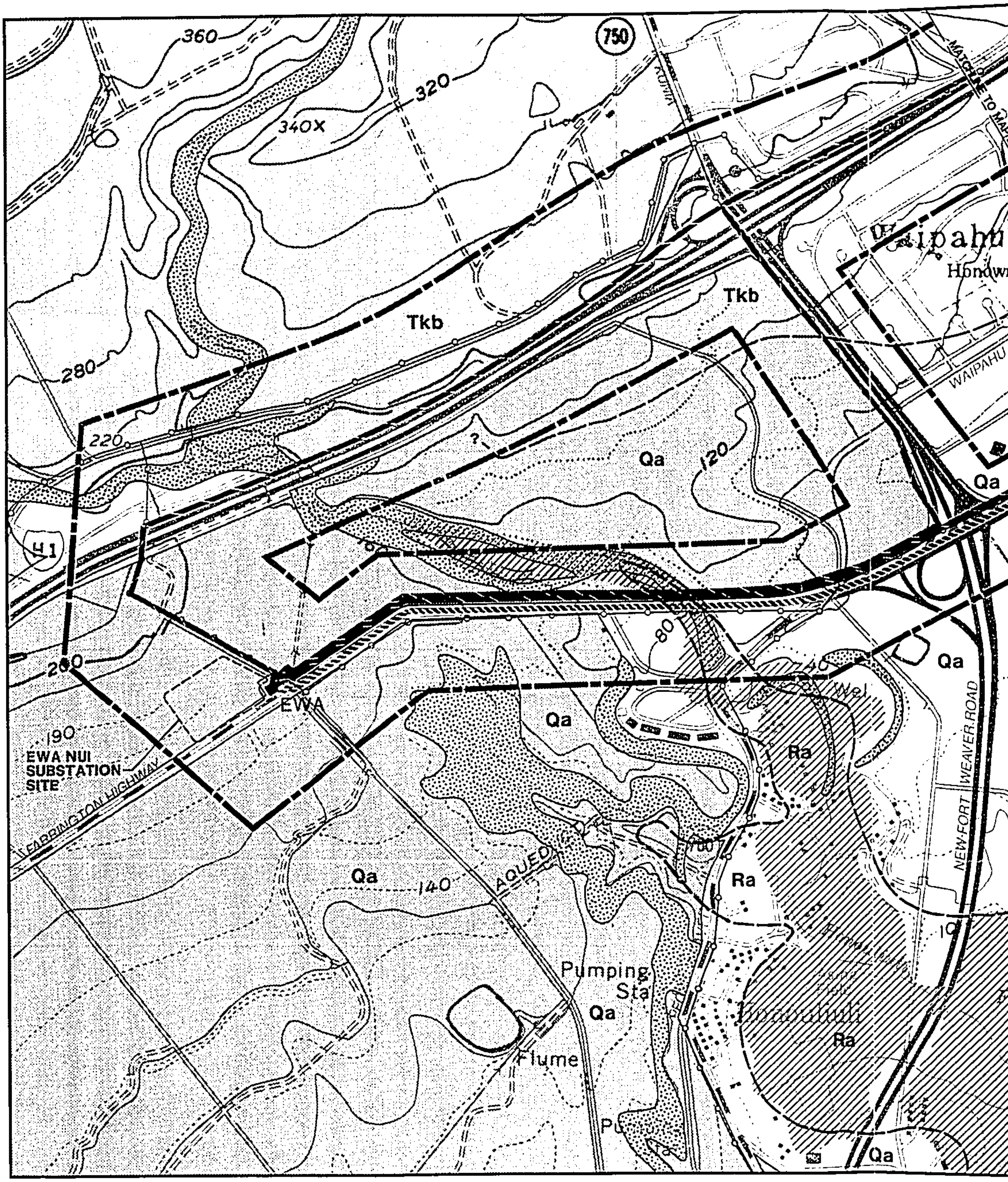
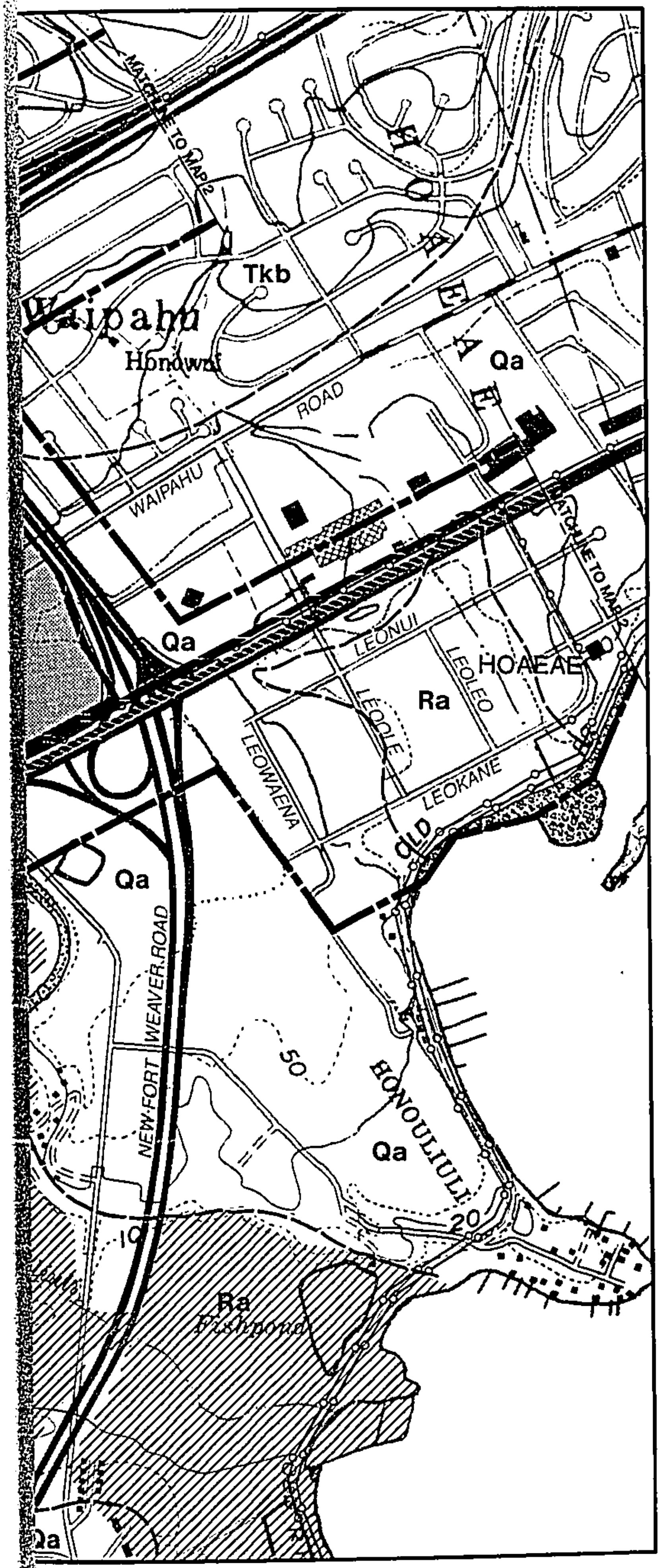


FIGURE 5-10

Waiau –
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company

CH2M HILL


360
750
320
340X
280
220
Tkb
Tkb
Qa
120
Qa
H1
80
200
EWA
190
EWA NUI
SUBSTATION
SITE
FARRINGTON HIGHWAY
Qa
Ra
Qa
NEW FORT WEAVER ROAD
Qa
140
Ra
Pumping
Sta
Qa
Flume
Ra
Qa



ALIGNMENT DATA MAP

GEOPHYSICAL AND BIOLOGICAL

H-1 F.H. OH&L Double-Circuit Overhead Line
Double-Circuit Underground Line
Single-Circuit Overhead Line
Single-Circuit Underground Line
Corridor Boundary
Existing 138 kV Line
Existing 46 kV 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

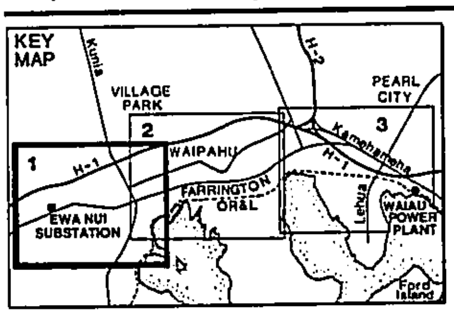
FOREST

- Kiawe Forest
- Koa-Haole Scrub
- Mixed Scrub

WETLANDS

- Mangrove Swamp
- Non-Woody Wetlands
- Cultivated Wetlands

*Subject to inundation by 100-year flood



MAUKA
EWA/ WAIANAE — DIAMOND HEAD
MAKAI

MAP 1

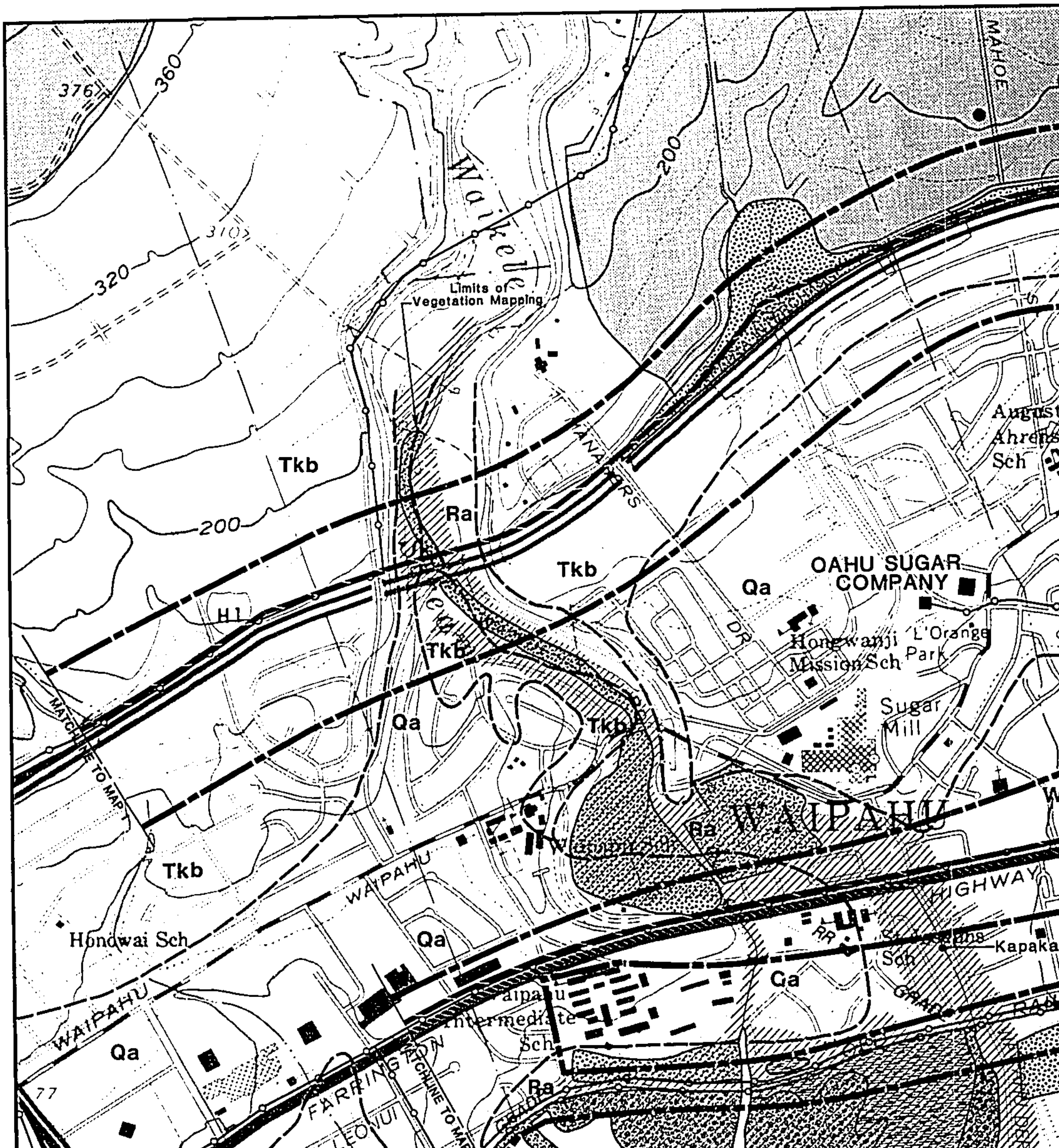
SCALE
0 500 1000 FEET
0 1/8 1/4 MILE

NORTH
WEST EAST
SOUTH

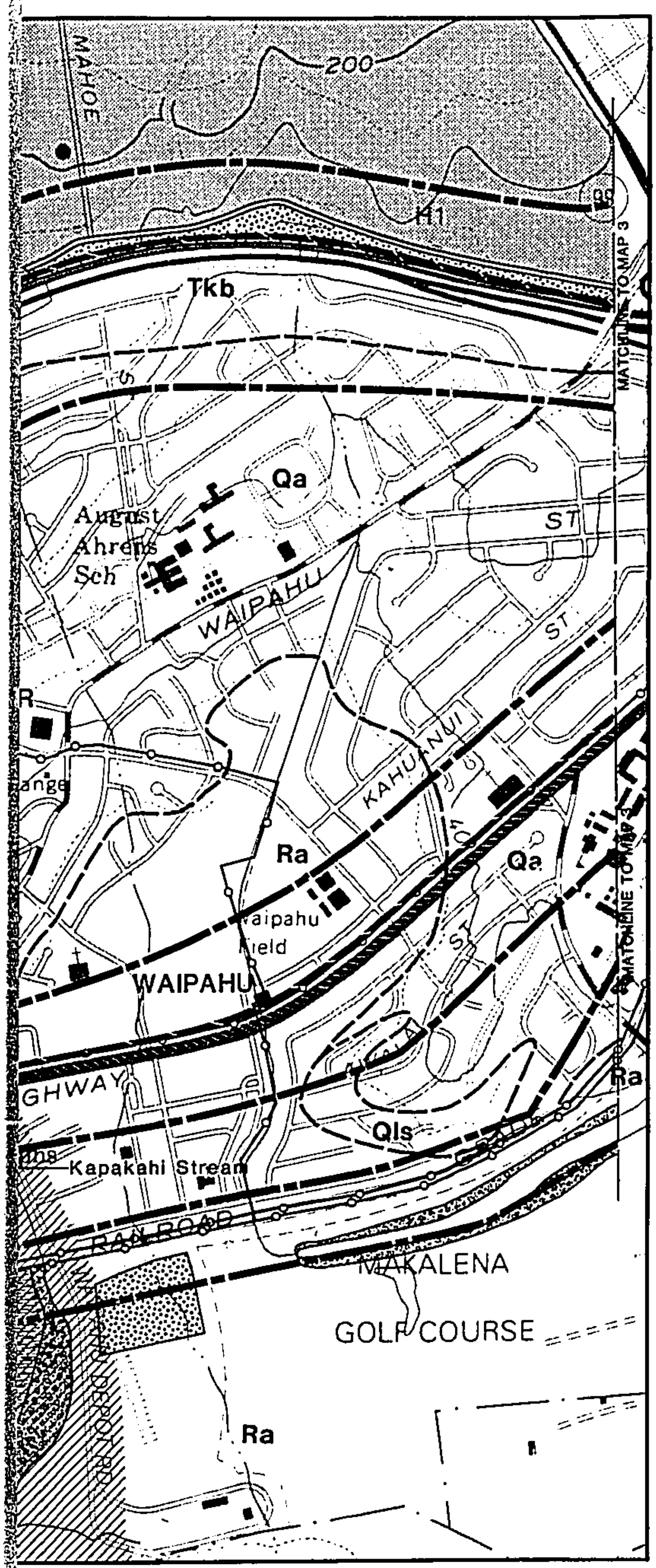
FIGURE 5-11

Waiau –
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company

CH2M HILL



376
360
320
200
Waikele
Limits of Vegetation Mapping
Tkb
Ra
H1
Qa
OAHU SUGAR COMPANY
Hongwanji Mission Sch
L'Orange Park
Sugar Mill
WAIPAHU
HIGHWAY
Honowai Sch
Waipahu Intermediate Sch
FARRINGTON
HOAEAE
LEONUI
LEOLEO
LEOOLE
Waikele Stream
MAHOE



ALIGNMENT DATA MAP

GEOPHYSICAL AND BIOLOGICAL

H-1 F.H. OR&L

- Double-Circuit Overhead Line
- Double-Circuit Underground Line
- Single-Circuit Overhead Line
- Single-Circuit Underground Line
- Corridor Boundary
- Existing 138 kV Line
- Existing 46 kV 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

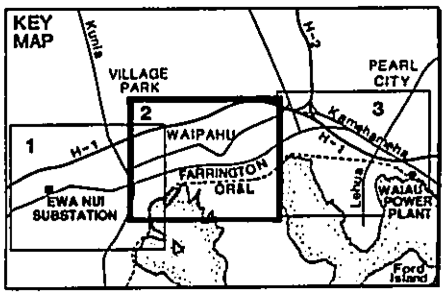
FOREST

- Kiawe Forest
- Koa-Haole Scrub
- Mixed Scrub

WETLANDS

- Mangrove Swamp
- Non-Woody Wetlands
- Cultivated Wetlands

*Subject to inundation by 100-year flood



MAUKA
EWA/ WAIANAE — DIAMOND HEAD
MAKAI

MAP 2

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

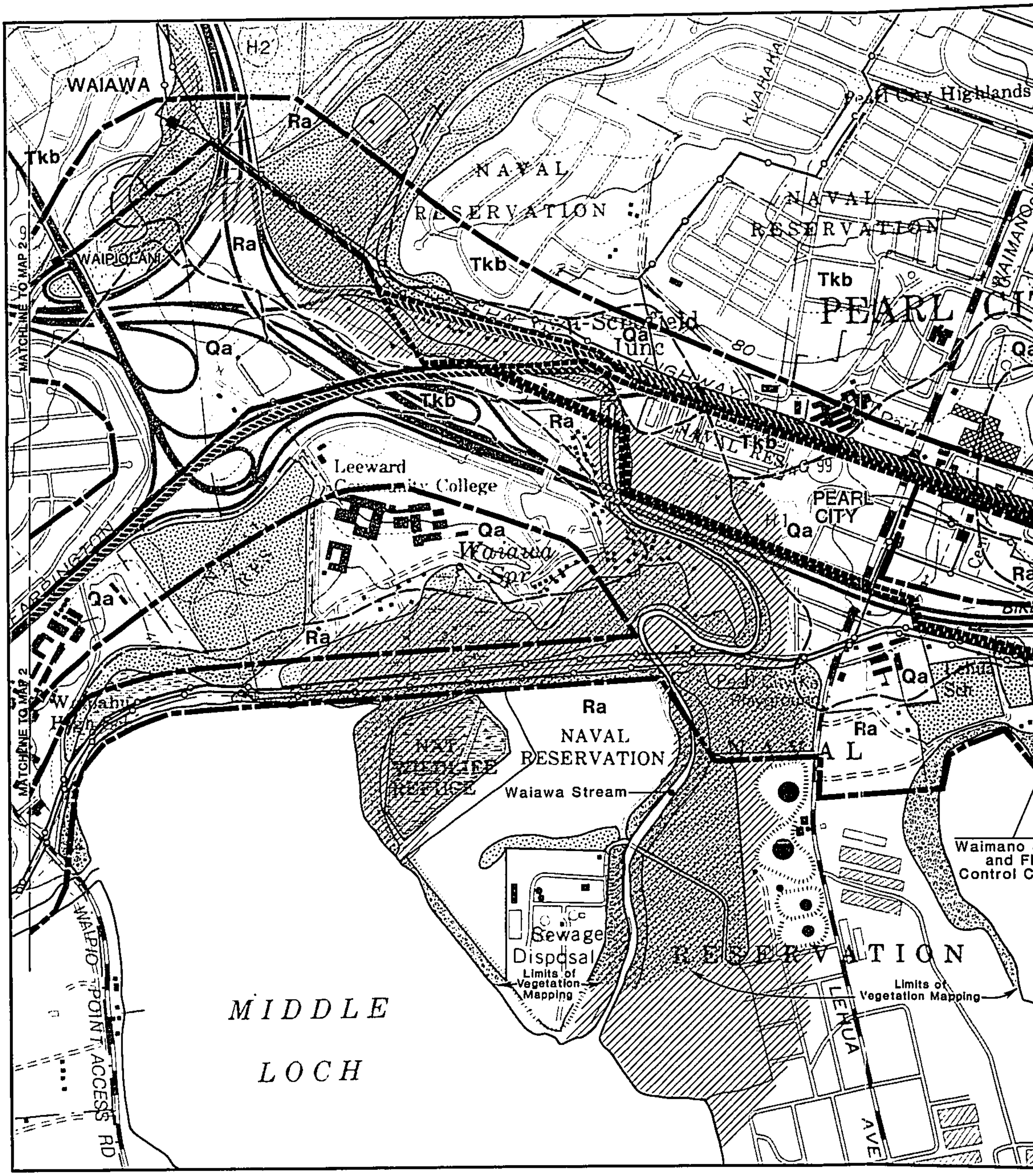
NORTH
WEST EAST
SOUTH

FIGURE 5-12

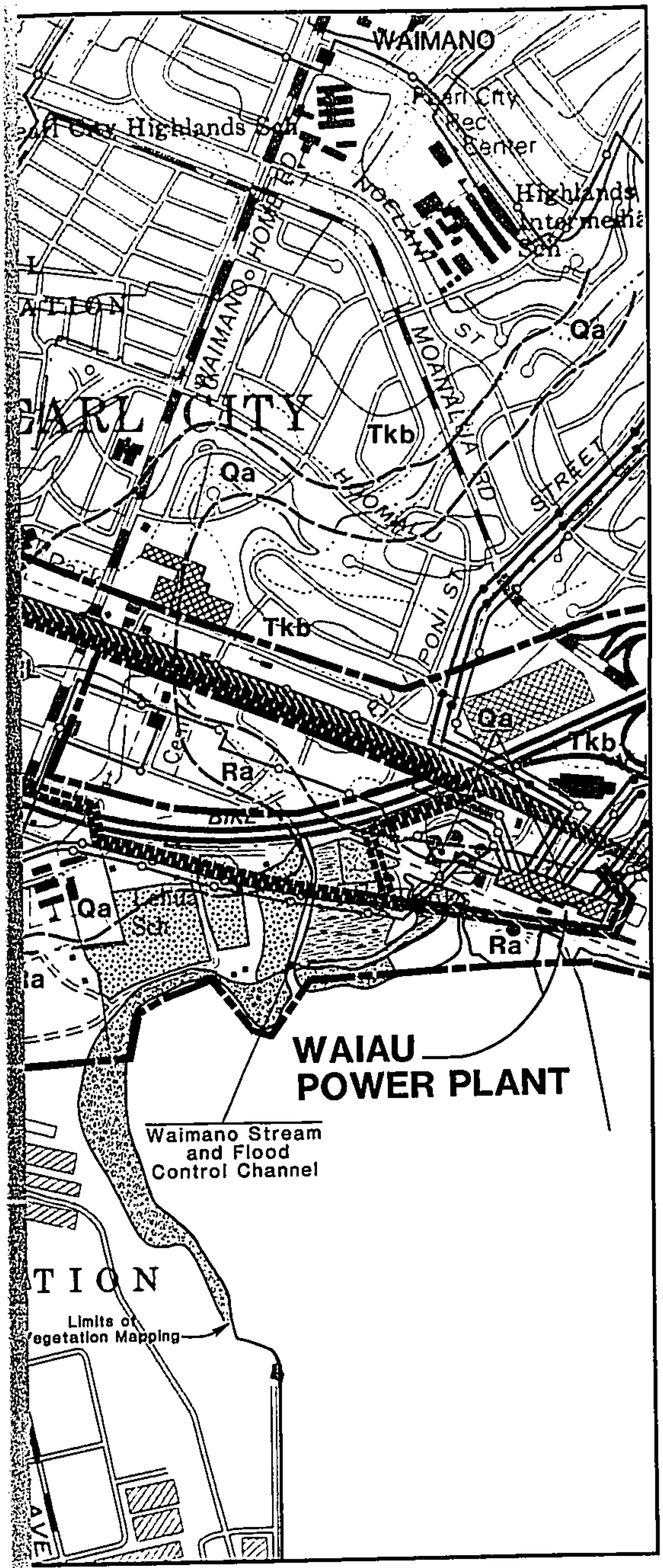
Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL



WAIAWA
H2
Tkb
Ra
NAVAL
RESERVATION
WAIPIOLANI
MATCHLINE TO MAP 2
Qa
Pearl City Highlands
PEARL CITY
Leeward Community College
Waiawa Spr
PEARL CITY
FARRINGTON
NAVAL RESERVATION
Waiawa Stream
Sewage Disposal
Limits of Vegetation Mapping
MIDDLE LOCH
WAIPIO POINT ACCESS RD
LEHUA AVE
Waimano
and Fl
Control C
RESERVATION



ALIGNMENT DATA MAP

GEOPHYSICAL AND BIOLOGICAL

H-1	F.H.	OR&L		
		Double-Circuit Overhead Line	Corridor Boundary	
		Double-Circuit Underground Line	Existing 138 kV Line	
		Single-Circuit Overhead Line	Existing 46 kV Line	
		Single-Circuit Underground 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
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FOREST

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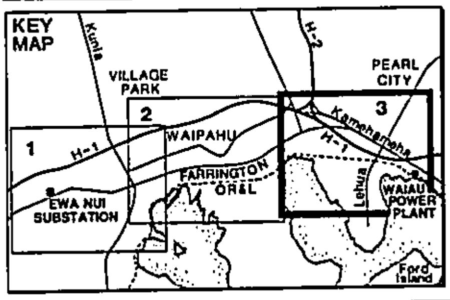
WETLANDS

- Mangrove Swamp
- Non-Woody Wetlands
- Cultivated Wetlands

*Subject to inundation by 100-year flood



MAUKA
EWA/WAIANAE — DIAMOND HEAD
MAKAI

MAP 3

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

NORTH
WEST EAST
SOUTH

FIGURE 5-13

Waiau –
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company

CH2M HILL

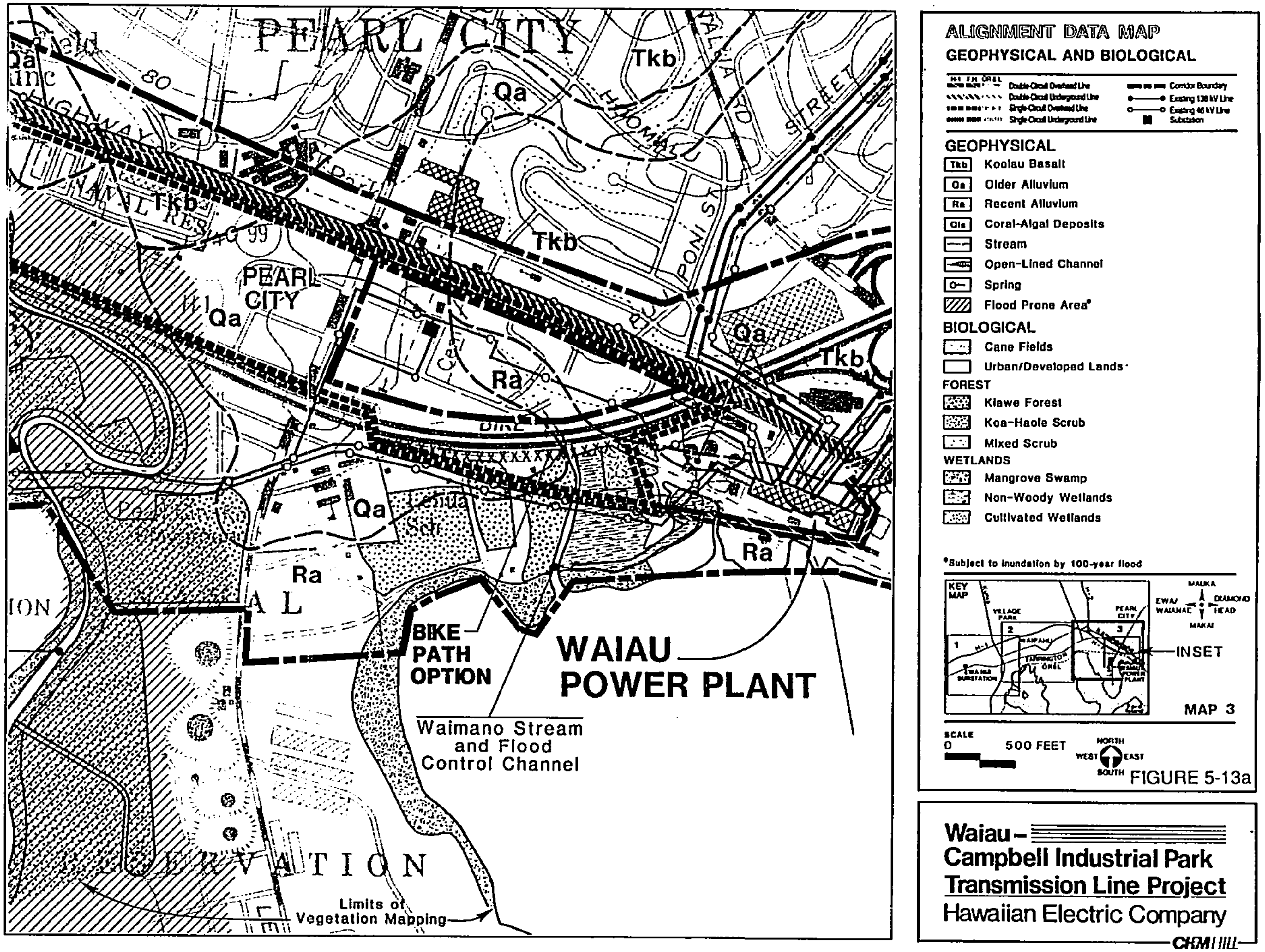
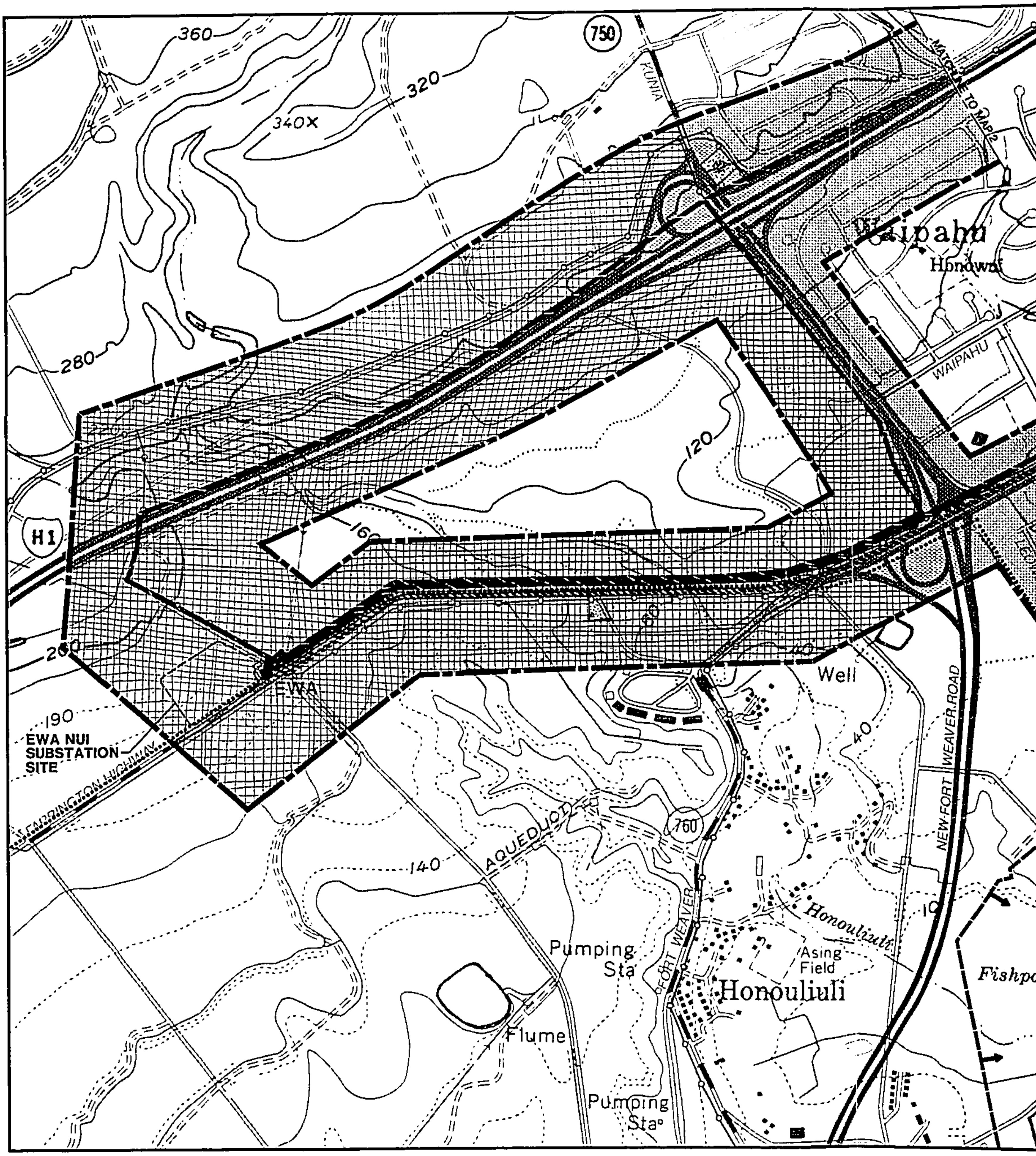
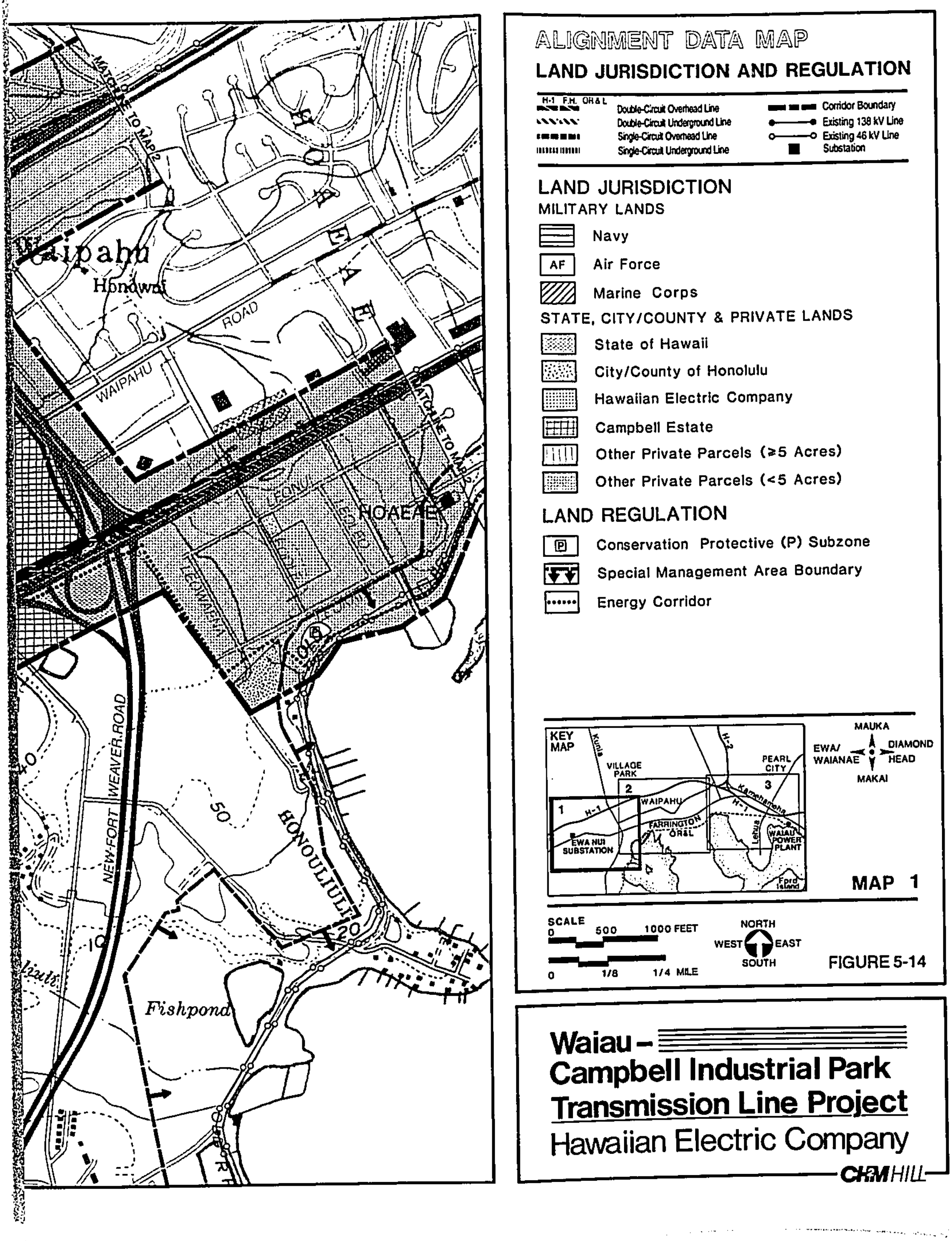


FIGURE 5-13a

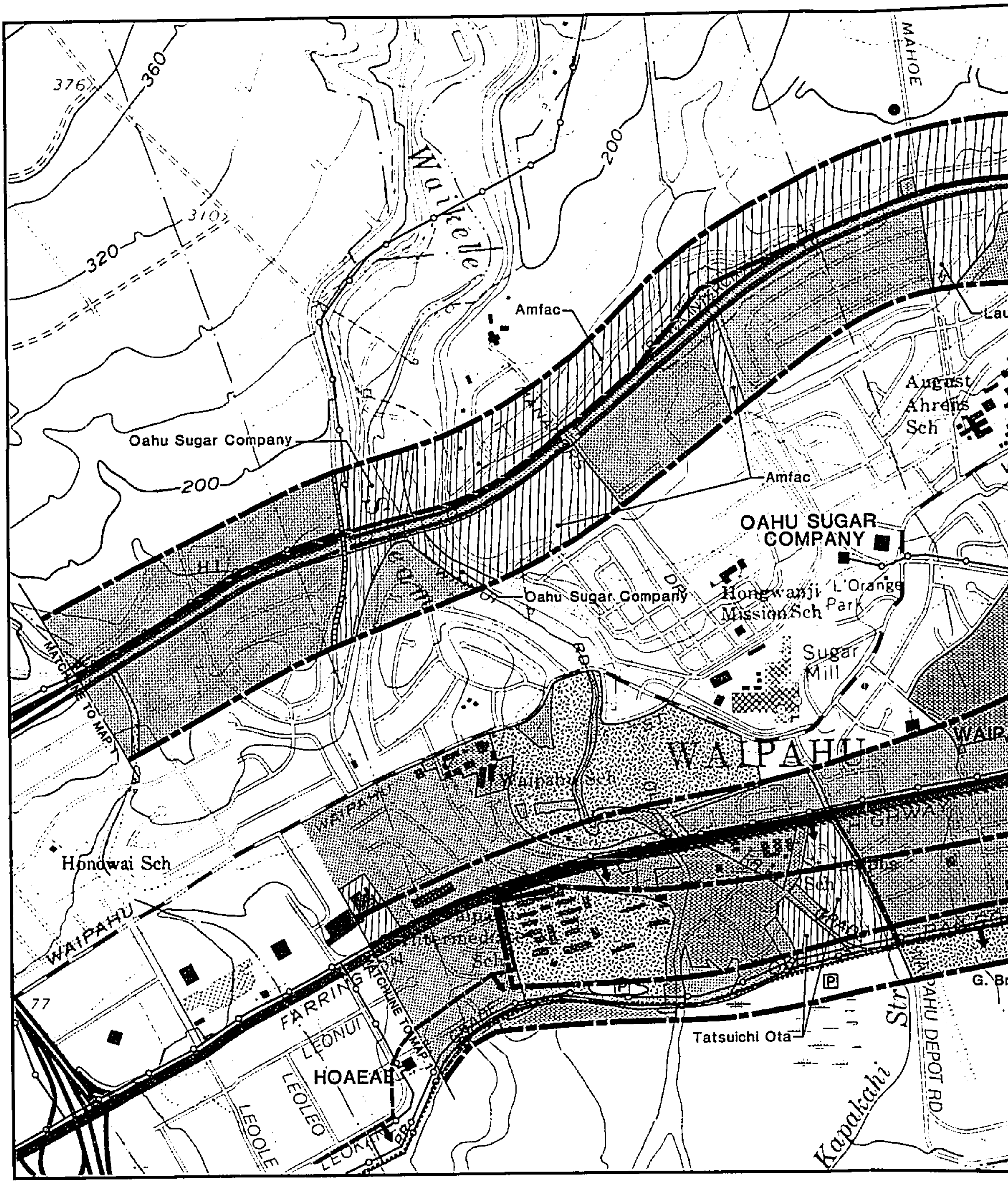
Waiau –
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company
CH2M HILL



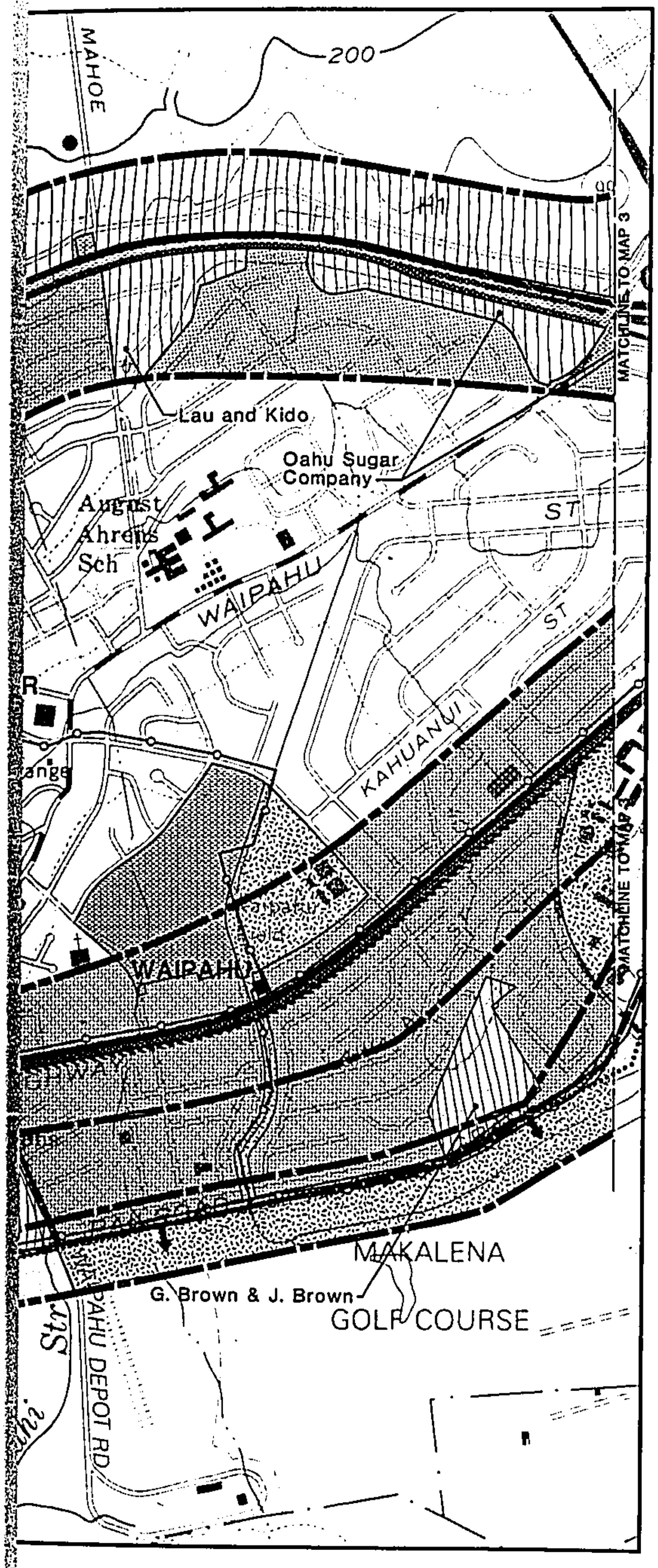
360
320
340X
750
KUNIA
MATCH TO MAP 2
Waipahu
Honowai
WAIPAHU
280
120
160
H1
260
EWA
Well
190
EWA NUI
SUBSTATION
SITE
FARRINGTON HIGHWAY
40
NEW FORT WEAVER ROAD
140
AQUEDUCT
760
FORT WEAVER
Honouliuli
Asing
Field
Pumping
Sta
Flume
Pumping
Sta



ALIGNMENT DATA MAP
LAND JURISDICTION AND REGULATION
Double-Circuit Overhead Line
Double-Circuit Underground Line
Single-Circuit Overhead Line
Single-Circuit Underground Line
Corridor Boundary
Existing 138 kV Line
Existing 46 kV Line
Substation
LAND JURISDICTION
MILITARY LANDS
Navy
Air Force
Marine Corps
STATE, CITY/COUNTY & PRIVATE LANDS
State of Hawaii
City/County of Honolulu
Hawaiian Electric Company
Campbell Estate
Other Private Parcels (≥5 Acres)
Other Private Parcels (<5 Acres)
LAND REGULATION
Conservation Protective (P) Subzone
Special Management Area Boundary
Energy Corridor
KEY MAP
VILLAGE PARK
PEARL CITY
WAIPAHU
FARRINGTON OR&L
EWA NUI SUBSTATION
WAIAU POWER PLANT
Ford Island
MAUKA
EWA/ WAIANAE
DIAMOND HEAD
MAKAI
MAP 1
SCALE
0 500 1000 FEET
0 1/8 1/4 MILE
NORTH
WEST
EAST
SOUTH
FIGURE 5-14
Waipahu
Honowai
WAIPAHU ROAD
HOAEAE
MATCHLINE TO MAP 2
NEW-FORT WEAVER ROAD
HONOULIULI
Fishpond
Waiau – Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company
CH2M HILL



MAHOE
376
360
310
320
200
Waikele
Amfac
Oahu Sugar Company
Amfac
OAHU SUGAR COMPANY
August Ahrens Sch
Hongwanji Mission Sch
L'Orange Park
Oahu Sugar Company
Sugar Mill
WAIPAHU
Waipahu Sch
MATCHLINE TO MAP 1
Honowai Sch
WAIPAHU
77
FARRINGTON
LEONUI
HOAEAE
LEOLEO
LEOOLE
Tatsuichi Ota
Kapakahi
WAIPAHU DEPOT RD



ALIGNMENT DATA MAP

LAND JURISDICTION AND REGULATION

H-1 F.H. OR&L

- Double-Circuit Overhead Line
- Double-Circuit Underground Line
- Single-Circuit Overhead Line
- Single-Circuit Underground Line
- Corridor Boundary
- Existing 138 kV Line
- Existing 46 kV Line
- Substation

LAND JURISDICTION

MILITARY LANDS

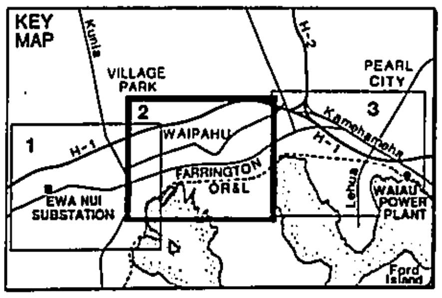
- Navy
- AF Air Force
- Marine Corps

STATE, CITY/COUNTY & PRIVATE LANDS

- State of Hawaii
- City/County of Honolulu
- Hawaiian Electric Company
- Campbell Estate
- Other Private Parcels (≥5 Acres)
- Other Private Parcels (<5 Acres)

LAND REGULATION

- P Conservation Protective (P) Subzone
- Special Management Area Boundary
- Energy Corridor



MAUKA
EWA/WAIANAE — DIAMOND HEAD
MAKAI

MAP 2

SCALE: 0 — 500 — 1000 FEET; 0 — 1/8 — 1/4 MILE

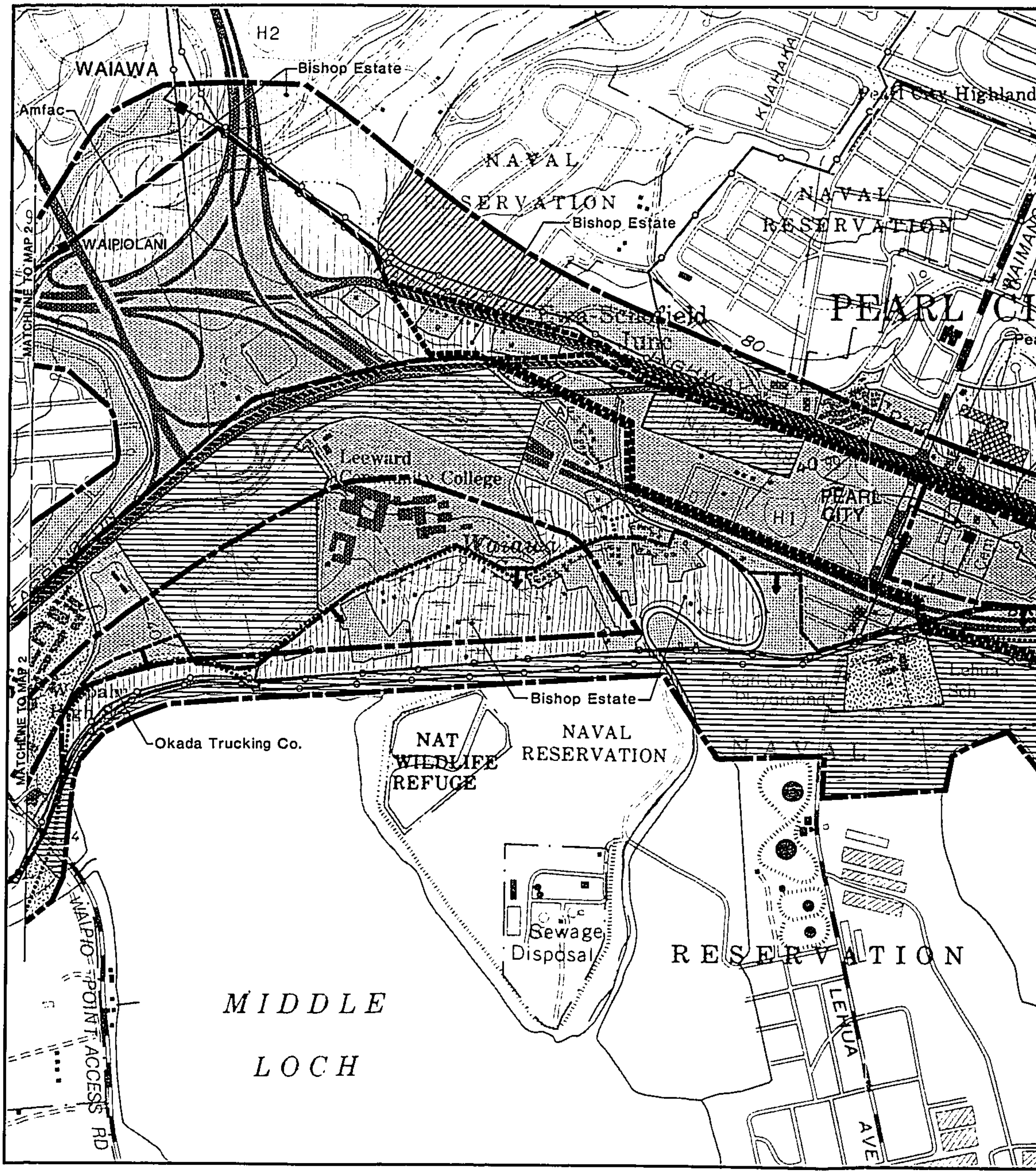
NORTH / WEST / EAST / SOUTH

FIGURE 5-15

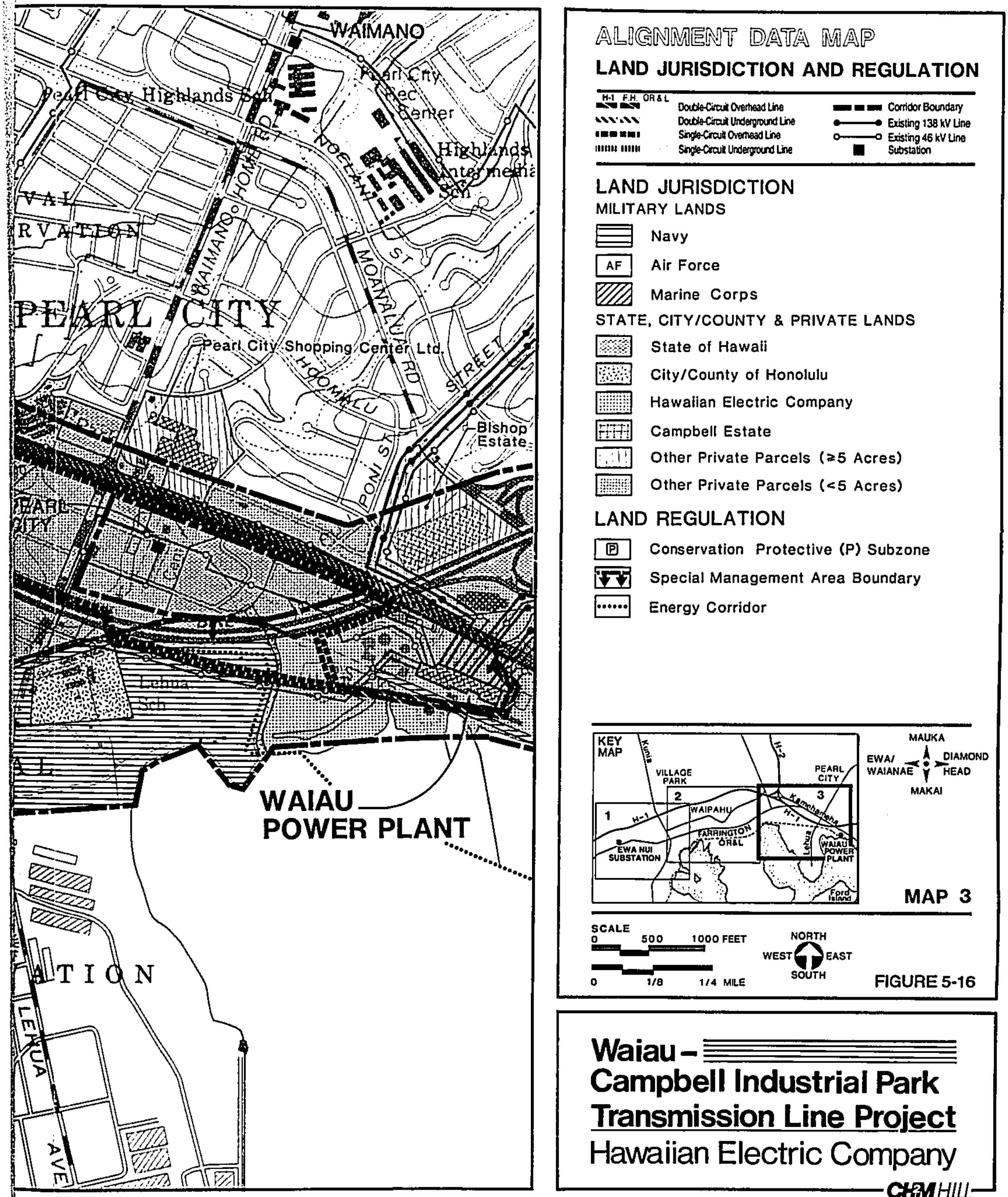
Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

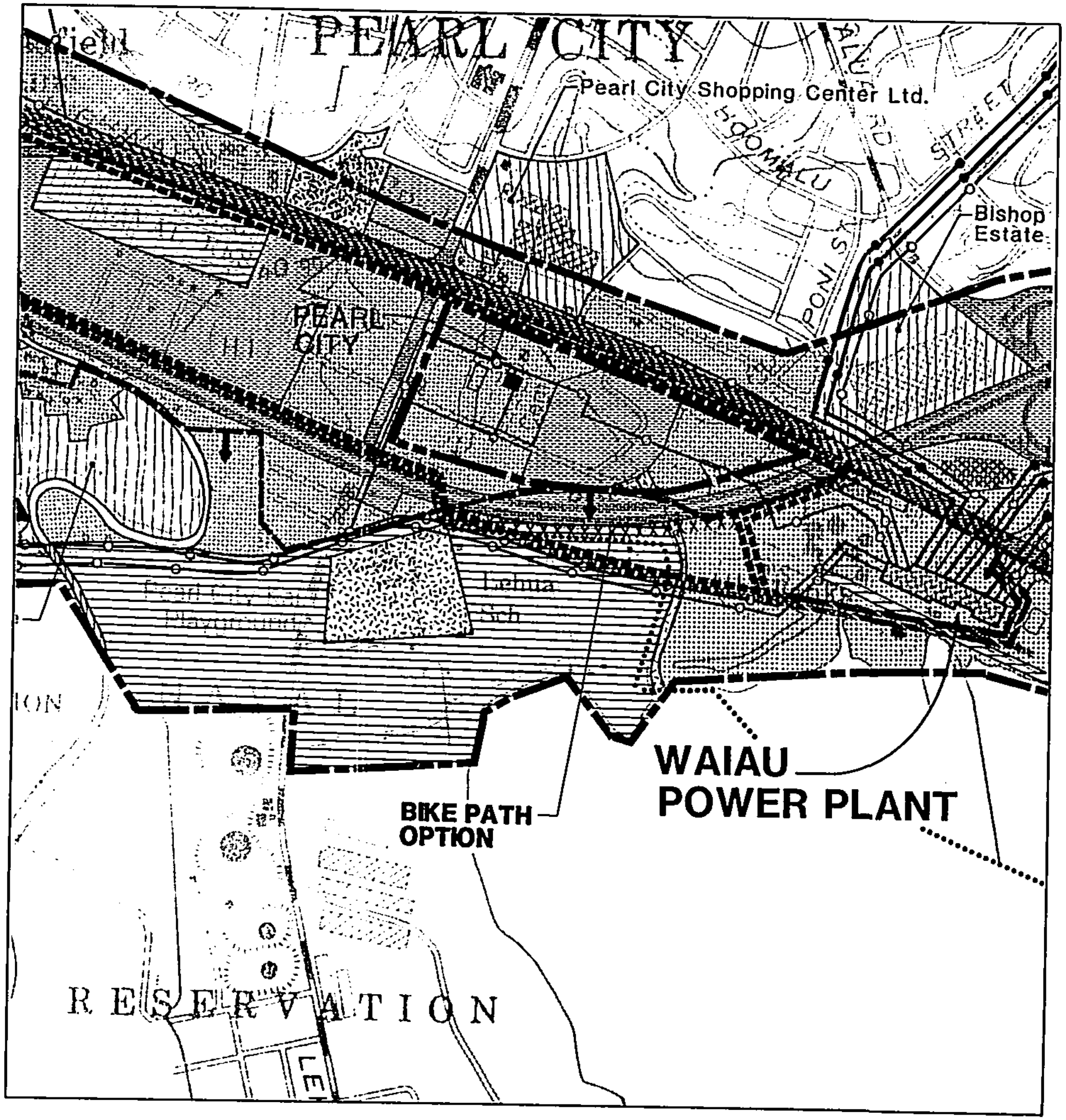
CH2M HILL



H2
WAIAWA
Bishop Estate
Amfac
NAVAL
RESERVATION
Bishop Estate
NAVAL
RESERVATION
WAIPIOLANI
MATCHLINE TO MAP 2
Leeward
College
80
PEARL
CITY
H1
Bishop Estate
Okada Trucking Co.
NAT
WILDLIFE
REFUGE
NAVAL
RESERVATION
NAVAL
Sewage
Disposal
RESERVATION
MIDDLE
LOCH
WAIPIO POINT ACCESS RD
LEHUA
AVE



WAIMANO
Pearl City Highlands Sch
Pearl City Rec Center
Highlands Intermediate Sch
HOOLANI
MOANALUA RD
WAIMANO HOME RD
PEARL CITY
Pearl City Shopping Center Ltd.
HOOMALU
STREET
Bishop Estate
PONI ST
Lehua Sch
WAIAU POWER PLANT
LEHUA AVE
ALIGNMENT DATA MAP
LAND JURISDICTION AND REGULATION
H-1 F.H. OR&L
Double-Circuit Overhead Line
Double-Circuit Underground Line
Single-Circuit Overhead Line
Single-Circuit Underground Line
Corridor Boundary
Existing 138 kV Line
Existing 46 kV Line
Substation
LAND JURISDICTION
MILITARY LANDS
Navy
AF
Air Force
Marine Corps
STATE, CITY/COUNTY & PRIVATE LANDS
State of Hawaii
City/County of Honolulu
Hawaiian Electric Company
Campbell Estate
Other Private Parcels (≥5 Acres)
Other Private Parcels (<5 Acres)
LAND REGULATION
P
Conservation Protective (P) Subzone
Special Management Area Boundary
Energy Corridor
KEY MAP
VILLAGE PARK
PEARL CITY
WAIPAHU
FARRINGTON
OR&L
EWA NUI SUBSTATION
WAIAU POWER PLANT
Ford Island
1
2
3
MAUKA
EWA/ WAIANAE
DIAMOND HEAD
MAKAI
MAP 3
SCALE
0 500 1000 FEET
0 1/8 1/4 MILE
NORTH
WEST
EAST
SOUTH
FIGURE 5-16
Waiau –
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company
CH2M HILL



ALIGNMENT DATA MAP

LAND JURISDICTION AND REGULATION

- Double-Circuit Overhead Line
- Double-Circuit Underground Line
- Single-Circuit Overhead Line
- Single-Circuit Underground Line
- Corridor Boundary
- Existing 138 kV Line
- Existing 46 kV Line
- Substation

LAND JURISDICTION

MILITARY LANDS

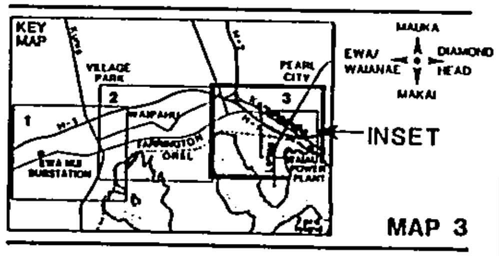
- Navy
- AF Air Force
- Marine Corps

STATE, CITY/COUNTY & PRIVATE LANDS

- State of Hawaii
- City/County of Honolulu
- Hawaiian Electric Company
- Campbell Estate
- Other Private Parcels (≥5 Acres)
- Other Private Parcels (<5 Acres)

LAND REGULATION

- P Conservation Protective (P) Subzone
- Special Management Area Boundary
- Energy Corridor



MAP 3

SCALE 0 500 FEET

NORTH WEST EAST SOUTH

FIGURE 5-16a

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

Within the SMA, no building or development is allowed within a 40-foot setback from the shoreline, except through the granting of a variance from the City and County of Honolulu Department of Land Utilization, and approval by the City Council. Utilities are eligible for receiving variances to build in the 40-foot setback. Shoreline areas of the OR&L alignment are within the 40-foot setback and will require a variance to conduct project activities.

Other, less significant cultivated wetlands occur inland of the Farrington Highway, in the vicinity of Waikele Stream, mauka of the National Wildlife Refuge in the vicinity of Waiawa Springs, and in a small area inside the Waiau Power Plant SMA. Cultivated wetland crops include watercress (*Nasturtium microphyllum*), taro (*Colocasia esculenta*), and ung-choi (*Ipomoea aquatica*) (see Figures 5-12 and 5-13).

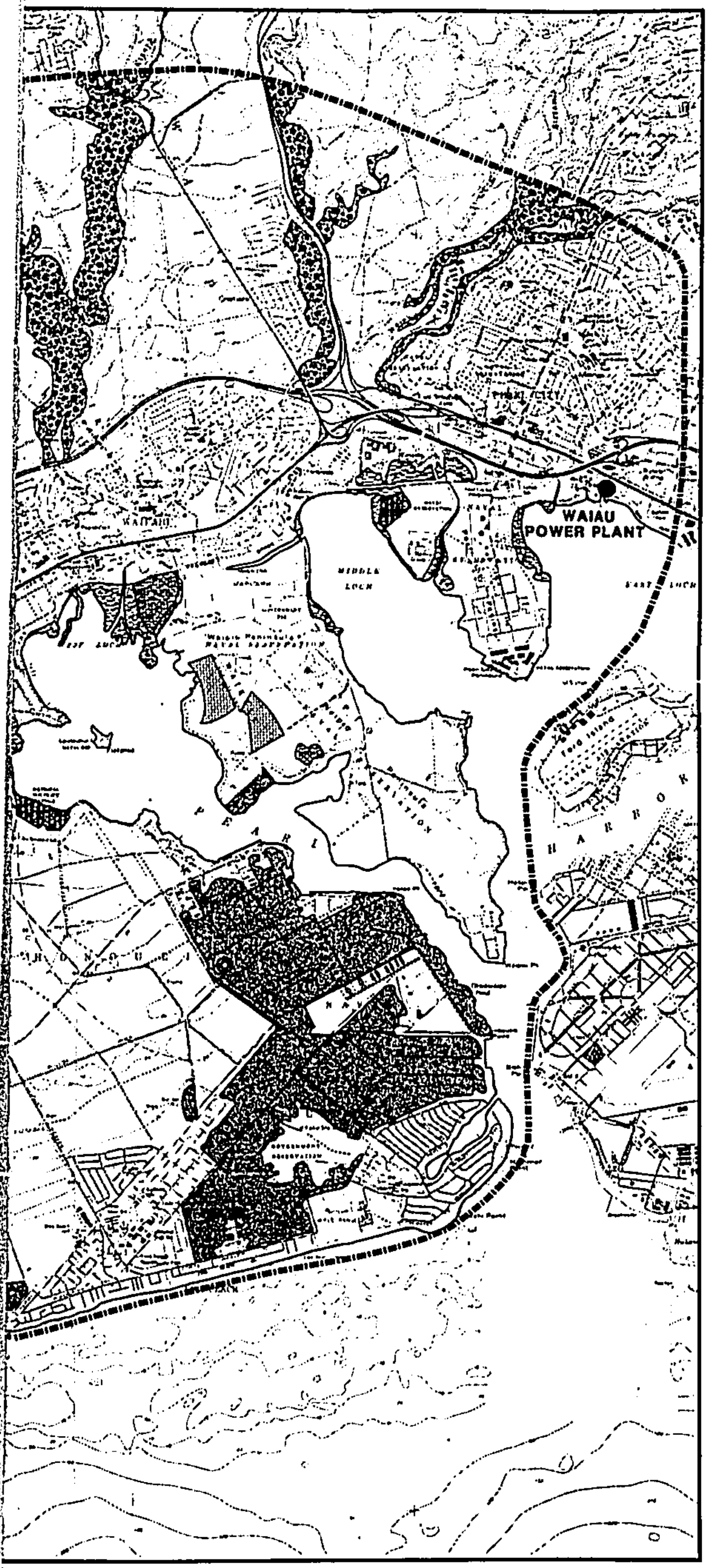
No plant species identified in the study area have been listed by the U.S. Fish and Wildlife Service (USFWS) as threatened or endangered. Similarly, no special-status plant species or sensitive plant communities have been identified by the State of Hawaii.

Wildlife. The wildlife occurring in the urbanized areas of the project are primarily introduced species. Of the few undeveloped lands remaining, only the wetlands provide habitat for any significant populations of native wildlife. The Waiawa Unit of the Pearl Harbor National Wildlife Refuge is designated by the USFWS as an "Essential Habitat" for the survival of endangered Hawaiian waterfowl. Other native waterfowl concentration areas set aside by the USFWS are located between the Waikele Stream and the Kapakahi Stream, makai of the OR&L alignment and on the Waipio Peninsula. The wildlife refuge and the waterfowl concentration areas provide habitat for four endemic species of waterfowl, all of which are on the federal and state endangered lists. These species are the Black-necked (Hawaiian) Stilt or Ae'o (*Himantopus mexicanus knudsenni*), the Common (Hawaiian) Moorhen or 'Alae-'Ula (*Gallinula chloropus sandvicensis*), the American (Hawaiian) Coot or 'Alae-Ke'oke'o (*Fulica americana alai*), and the Hawaiian Duck or Koloa (*Anas wyvilliana*). Other wetlands as well as riparian areas, irrigation ditches, and ponds are also used by these species, but to a lesser degree. A bird that occurs sporadically throughout the project area in undeveloped and agricultural lands is the Hawaiian Owl (or Pueo). It is on the state endangered list for the Island of Oahu only (see Figure 5-17).

The mouths of the Waikele, Kapakahi, and Waiawa Streams and Pearl Harbor generally are habitats for the Nehu fish (*Stolephorus purpureus*), a commercial bait fish used in the local tuna fishery. Important food fish that live in the Pearl Harbor estuary include the awa (milk fish), mullet species, and various species of ulua/papio (jacks). Native gobi species migrate through these streams throughout their life cycle. Sediment loading impacts these streams during the rainy season (personal communication, John Naughton, February 6, 1992).

No endangered, threatened, or sensitive marine or freshwater fish species are known to exist in the project area.

C.I.P.
SUBSTATION



BIOLOGICAL RESOURCES

Study Area Boundary

VEGETATION TYPES

Strand

Mixed Forest

Koa–Haole Scrub

Kiawe/Koa–Haole Forest

Wetlands

Urban–Agricultural Complex

ENDANGERED, THREATENED AND SENSITIVE PLANT SPECIES HABITAT

Achyranthes rotundata

Euphorbia skottsbergii var. kalaeloana

WILDLIFE

National Wildlife Refuges

ENDANGERED, THREATENED AND SENSITIVE WILDLIFE SPECIES HABITAT

Waterbird Concentration Areas

- Hawaiian Coot (Alae ke'o ke'o) [FE,SE]
- Hawaiian Duck (Koloa) [FE,SE]
- Hawaiian Gallinule (Alae ula) [FE,SE]
- Hawaiian Stilt (Ae'o) [FE,SE]

Hawaiian Owl (Pueo) [SEO]

STATUS CODE

FE – Federal Endangered
SE – State Endangered
SEO – State Endangered, Oahu Only

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 5-17

Waiau –
Campbell Industrial Park
Transmission Line Project
Hawaiian Electric Company

CH2M HILL

Water Resources

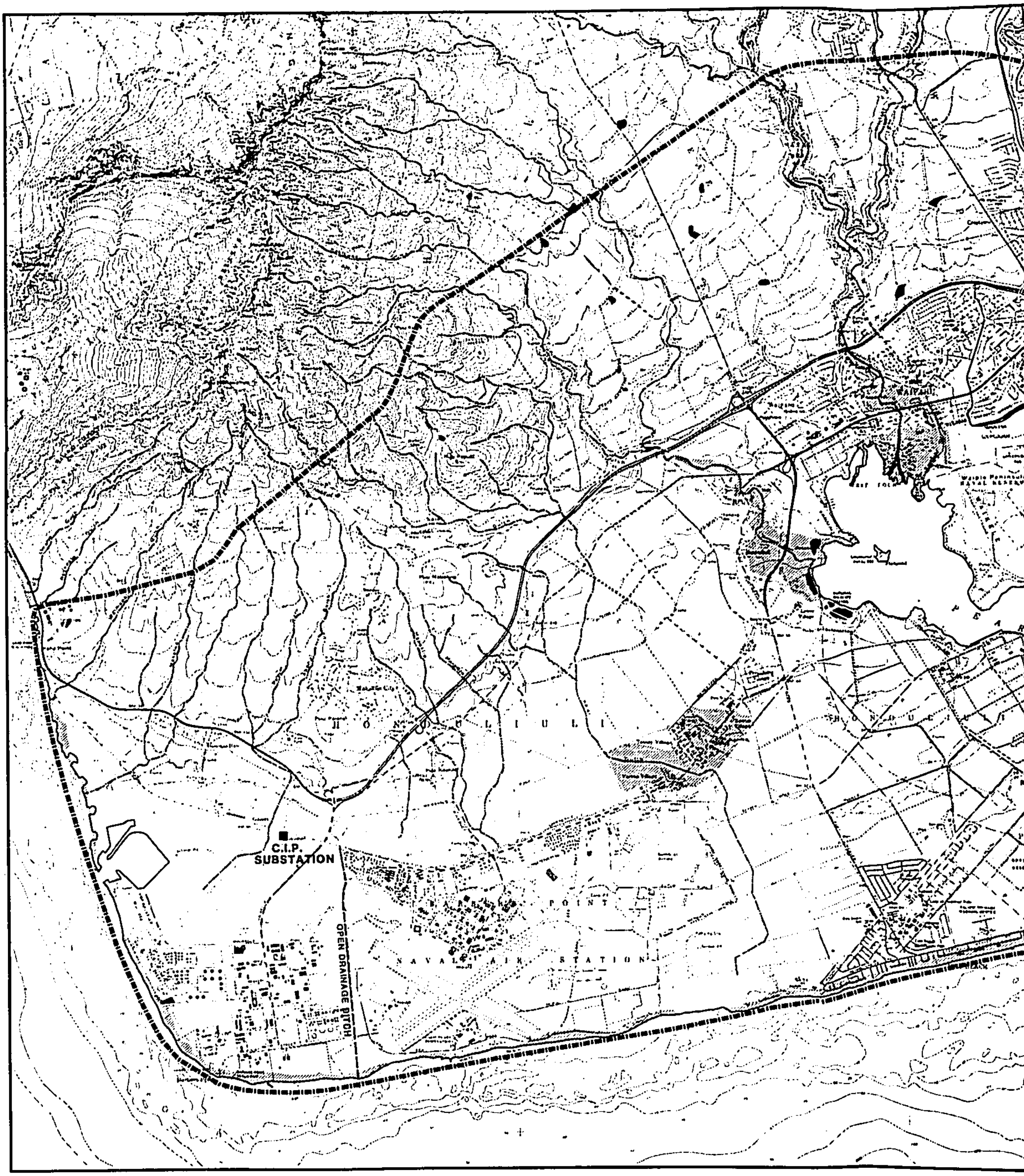
Surface Waters. There are no lakes or rivers in the study area. Several ponds, marshes, swamps, and salt flats occur in the Waipahu and Pearl City sections along the areas bordering Pearl Harbor. The Waiawa, Kapakahi, and Waikele Streams are perennial in their lower reaches near Pearl Harbor. Many intermittent stream channels drain the slopes of the Waianae and Koolau Mountains (see Figure 5-18).

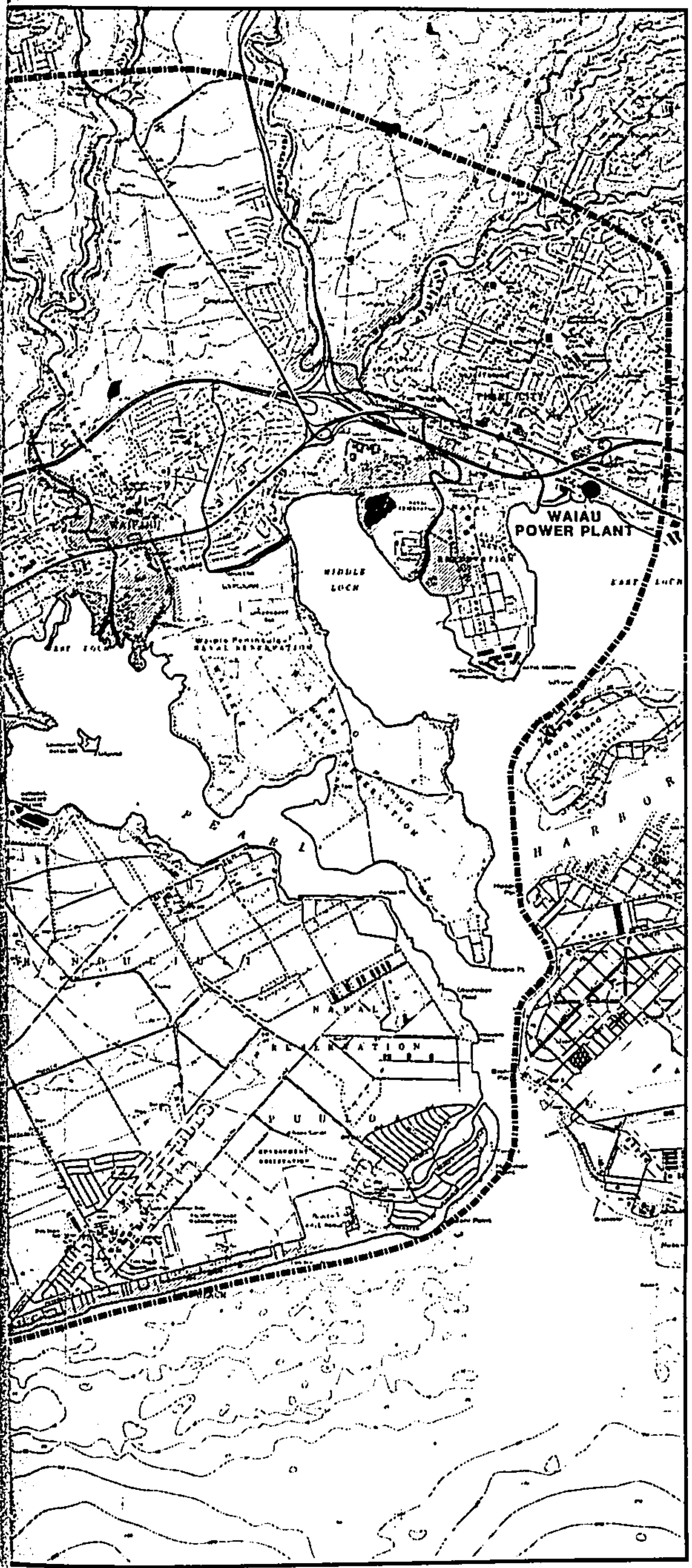
Several sections of the proposed alignments are within the 100-year floodplain and are likely to be flooded an average of once every 100 years. These areas include an area between Honouliuli and West Loch, land surrounding Wailele Stream from just mauka of H-1 to the mouth of the stream, the mouth of Kapakahi Stream, the Waiawa Stream from just mauka of H-1 to its mouth, and the mauka end of Pearl City peninsula makai of Leeward Community College (see Figure 5-18).

Groundwater. The entire study area displays similar groundwater characteristics. In general, the groundwater lies within the basalt aquifer below an impervious layer of caprock, which prevents the groundwater from rising to the surface and holds it under artesian pressure. The groundwater level throughout the study area is typically several feet above sea level. Generally, there is a good chance of encountering artesian groundwater at any location where pole foundations encounter Koolau basalt at an elevation of less than 20 feet. Where fractures exist in the caprock, groundwater may leak out as springs. A single area of springs and moist soils exists just makai of Leeward Community College near the Waiawa Stream (see Soils section, below).

Earth

Geology. The study area lies approximately at sea level and is gentle and rolling in its topography; it has only a few sharp changes in relief. Seismic and related ground movement activities are rare or unusual in the study area. U.S. Coast and Geodetic Survey data show that all of Oahu is in Zone 1 of the seismic risk maps (the next-to-lowest risk category). No faults have been identified in the study area. Areas of steep slopes (greater than 20 percent) are located primarily in the slopes above the Waikele and Waiawa Streams. These slopes are very unstable and subject to landslides (see Figure 5-19). Four geologic formations exist in the study area: Koolau basalt (TKb), older alluvium (Qa), coral-algal deposits (OIS), and recent alluvium (Ra) (see Figures 5-11 through 5-13). Koolau basalt, the oldest of the formations, is the aquifer material of the Pearl Harbor Artesian Basin. Older alluvium, the second-oldest formation, frequently shows a moderate to high shrink/swell potential. The Koolau basalt, older alluvium, and coral-algal deposits are the most suitable of the four formations for standard drilled pier foundations. Recent alluvium formations have moderate to fair suitability for foundation support and pile-type foundations may be necessary in some locations.


C.I.P.
SUBSTATION
OPEN DRAINAGE DITCH
HONOULIULI
POINT
NAVAL AIR STATION
WAIPAHU



WATER RESOURCES

- Study Area Boundary
- Flood Prone Areas (Subject to inundation by-100 year flood)
- Ponds
- Perennial Streams
- Intermittent Steams

NORTH
WEST EAST
SOUTH

MAUKA
EWA/ WAIANAE DIAMOND HEAD
MAKAI

0 1000 2000 5000 10,000 FEET

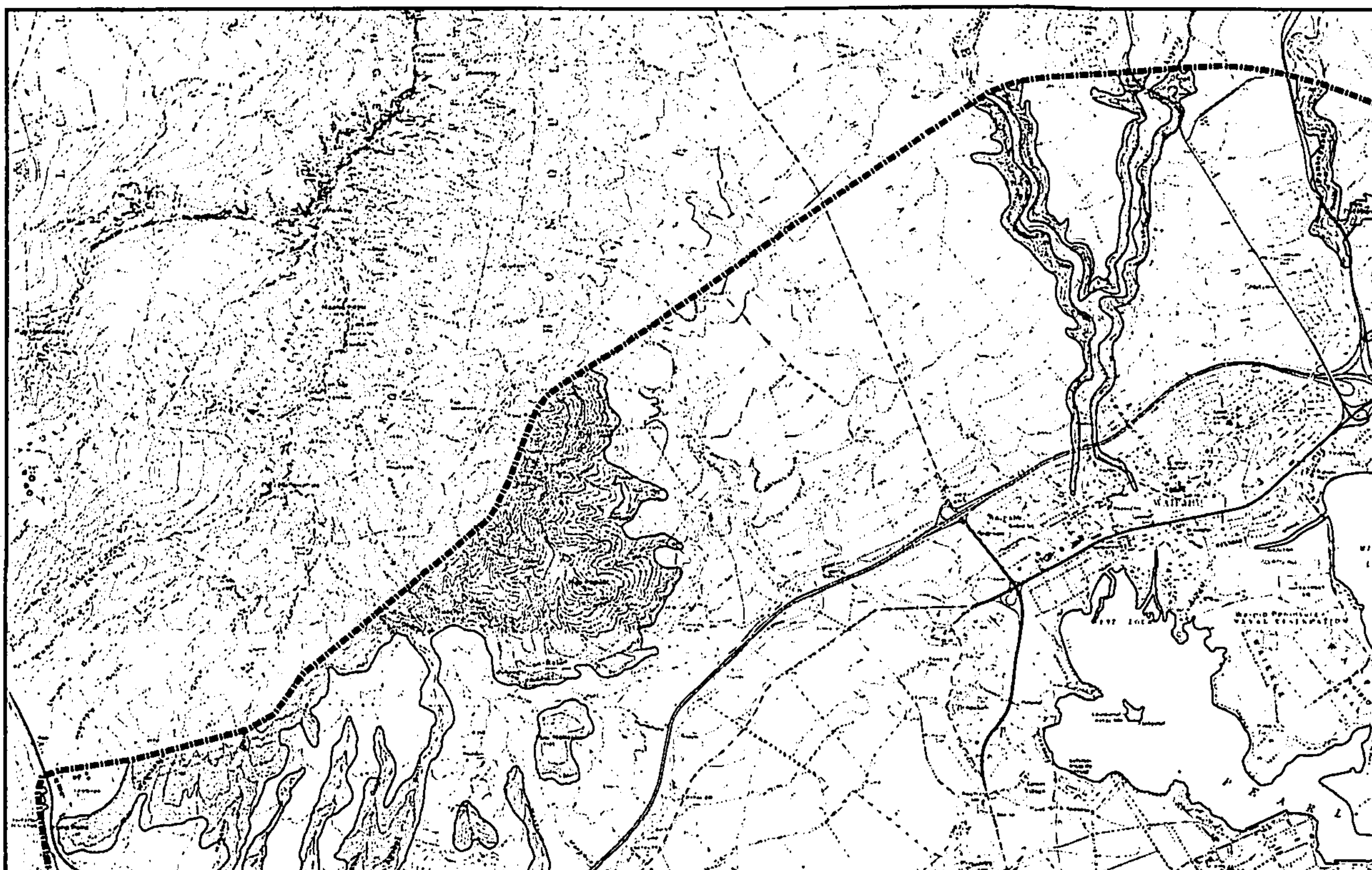
0 1/4 1/2 1 2 MILES

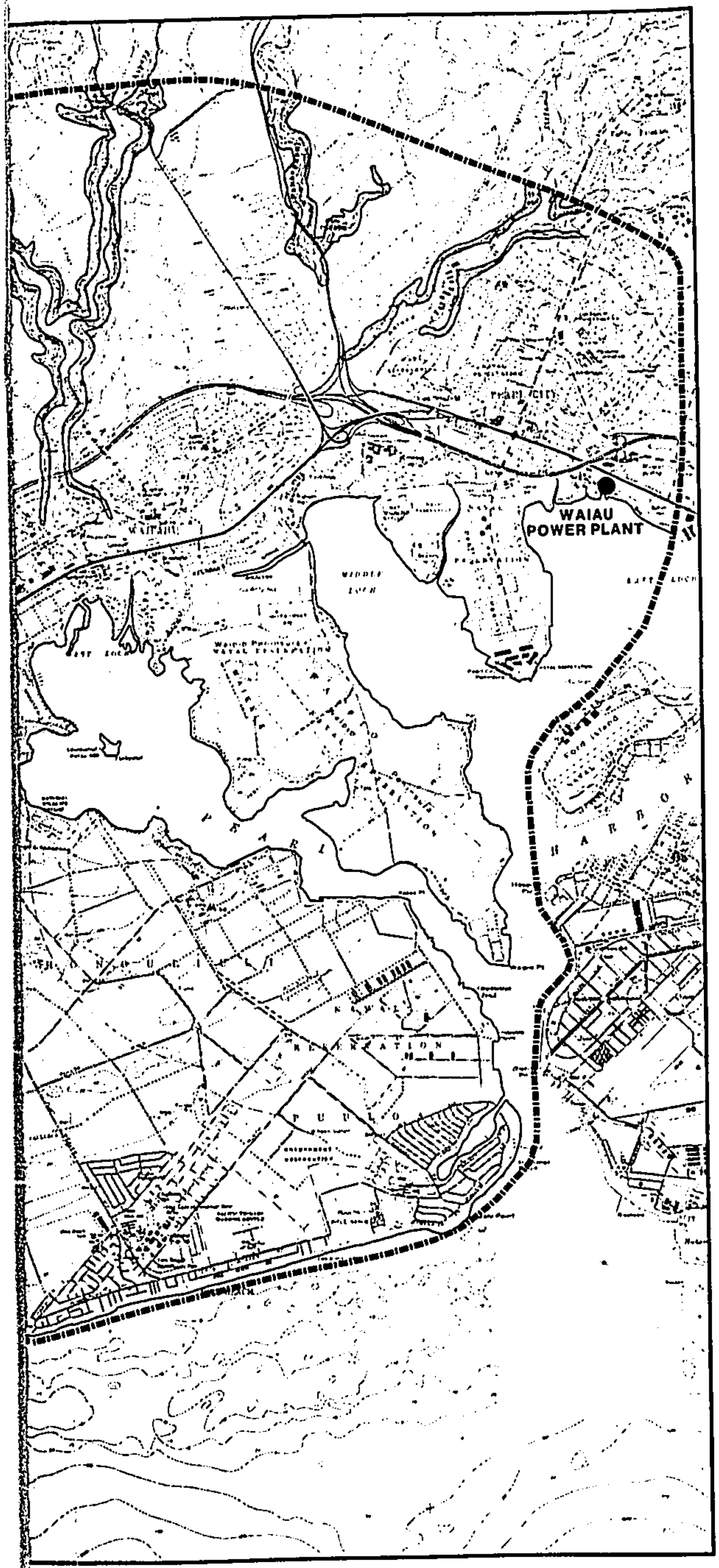
FIGURE 5-18

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL


C.I.P.
SUBSTATION
H O N O U L I U L I
N A V A L   A I R   S T A T I O N



SLOPE

Study Area Boundary

Slopes greater than 20 percent

FIGURE 5-19

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

Soils. Older alluvium and/or recent alluvium deposits make up the majority of the soils in the alignments. Relatively impermeable alluvial and lagoonal deposits make up the caprock, which overlies the basalt aquifer. Older alluvium deposits consist mainly of very stiff to hard clayey silts that were deposited by stream action. Recent alluvium consists mainly of very soft to medium stiff clayey silt, often submerged underwater. These wet soils are located primarily in the low-lying areas near Pearl Harbor (see Figure 5-20). The portion of the alignment along the OR&L right-of-way through Waipahu, Pearl City, and Waiau is believed to be underlain by thick deposits of very soft soils. Areas of wet soils are located in Honouliuli adjacent to West Loch and along the alignment of the OR&L north of West Loch and the Waipio and Pearl City peninsulas, and along Middle Loch. A single area of springs and moist soils exists just makai of Leeward Community College near the Waiawa Stream (see Figure 5-13). These soils are generally considered to be poorly to very poorly suited for use as support for foundation loads. Soils with high shrink-swell potential (which are generally also recent alluvium soils) are located between Waiawa Stream and the Waiau Power Plant (see Figure 5-20).

Several underground petroleum lines are known to be within and adjacent to the OR&L right-of-way (see Figures 5-1 through 5-3). The condition of these lines may have deteriorated since their installation several years ago. It is highly likely that the soils in this area are contaminated from leaking petroleum lines.

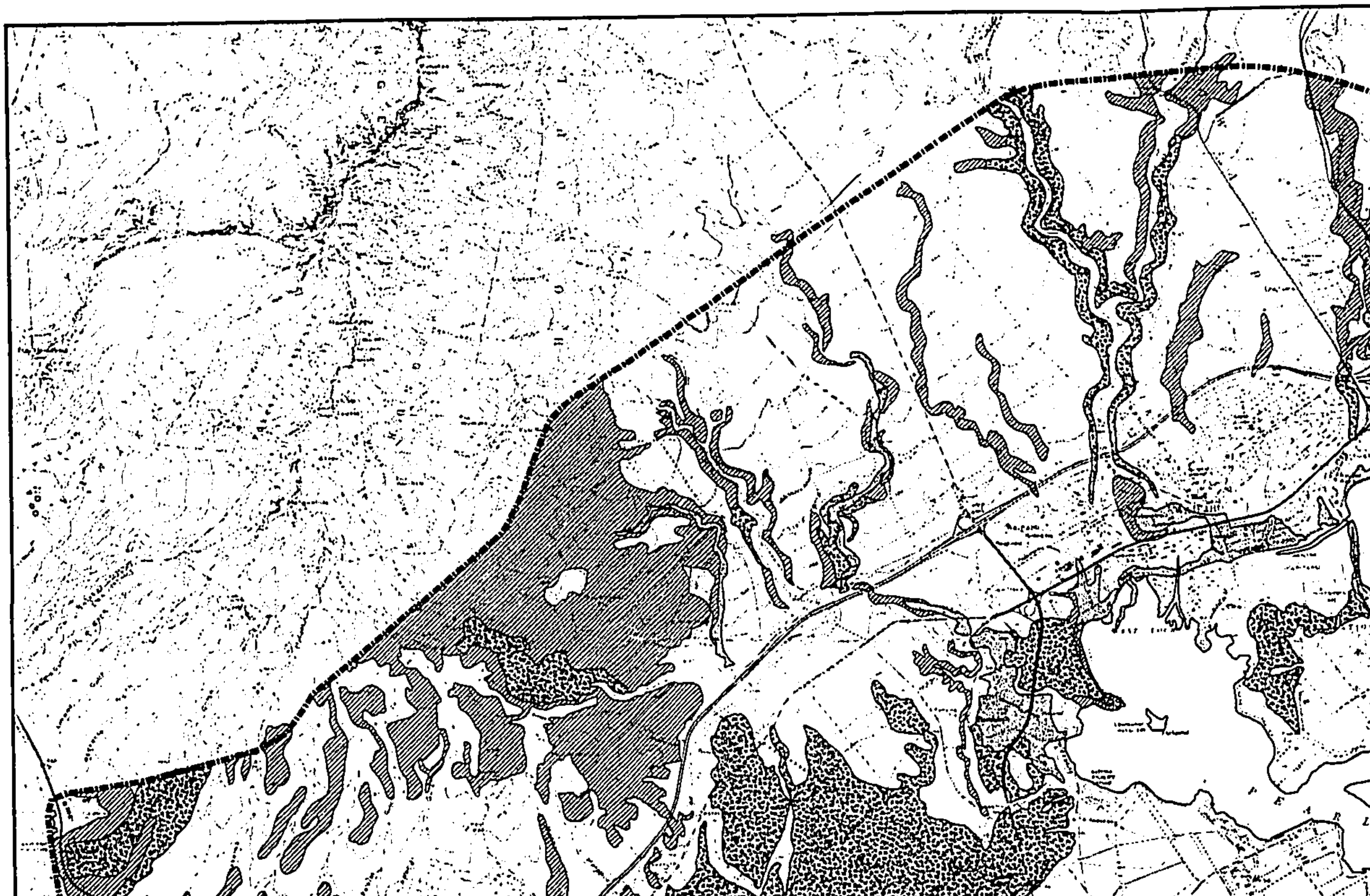
Probable Impacts

H-1 Overhead Alternative

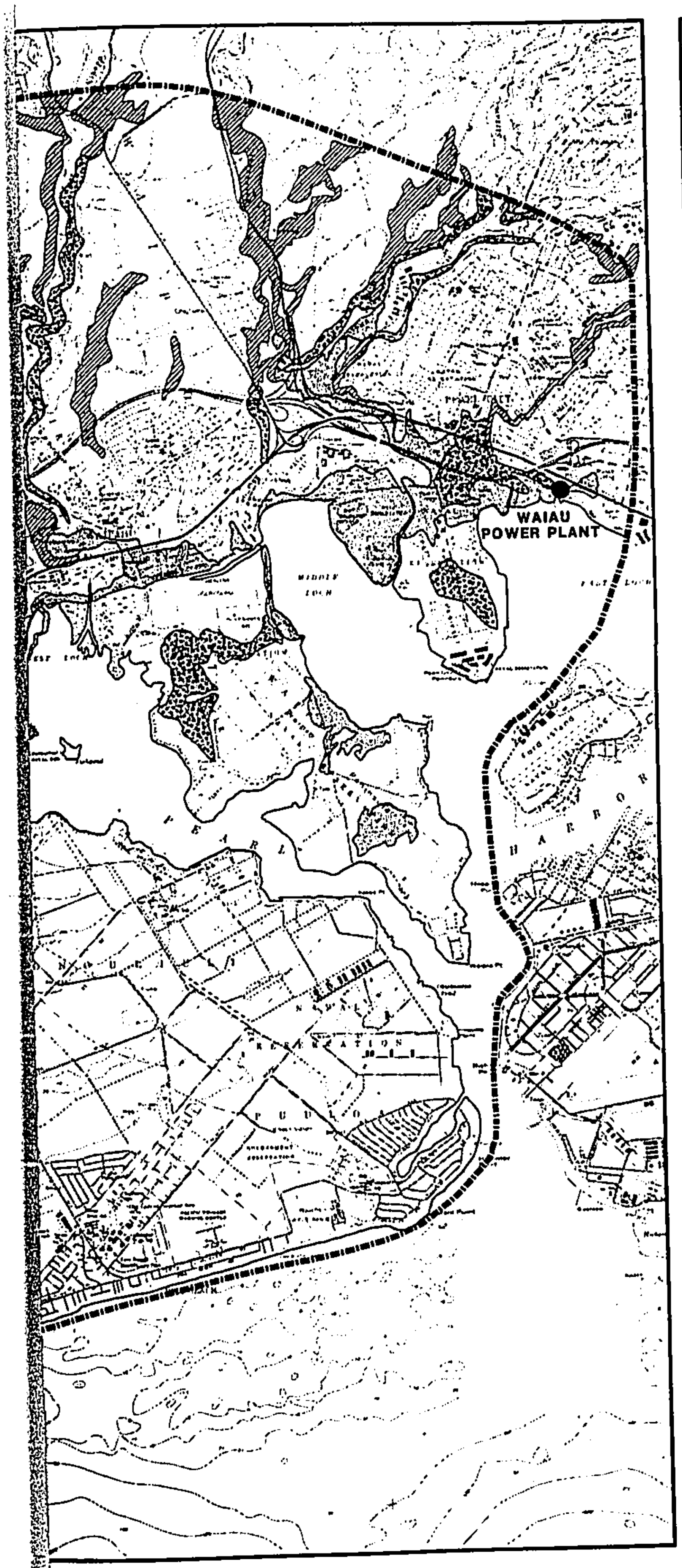
Biological Resources. There should be no substantial impacts on biological resources from either construction or operation of the proposed transmission lines. No undisturbed biological resources exist along the proposed transmission line route. No threatened, endangered, or sensitive species or habitat occur in this alignment.

Nonwoody and cultivated wetlands located in an SMA near and in the Waiau Power Plant site can be avoided during construction associated with the alignments in that area (see Figure 5-13). For both alternate routings being considered in that section of the alignment, poles can be sited to span wetlands, and can be accessed through nonwetland areas for maintenance. An SMA Use Permit will guide environmental review of construction and operations activities associated with the project.

About half the land along the H-1 alignment is or has been used for agriculture, and the remaining portion of land is within urbanized areas. Two alternative routings are being considered for the beginning section of this alignment: the H-1 and the Kunia options (see Figure 5-11). The H-1 option follows an existing 46 kV line easement mauka of the Ewa Nui Substation along a cane haul road for approximately one-half mile, and then crosses to the mauka side of H-1. The Kunia option runs along the mauka edge of Farrington Highway east to the Kunia Road overpass, where it turns mauka and follows the west side of Kunia Road along an existing 46 kV line easement to the Kunia/H-1



C.I.P.
SUBSTATION
NAVAL AIR STATION



SOILS

- Study Area Boundary
- Soils with High Erosion Potential
- Wet Soils (Peat/Muck Substratum)
- Soils with High Shrink-Swell Potential

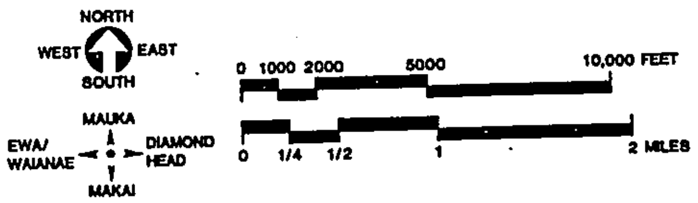


FIGURE 5-20

Waiau – Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company

CH2M HILL

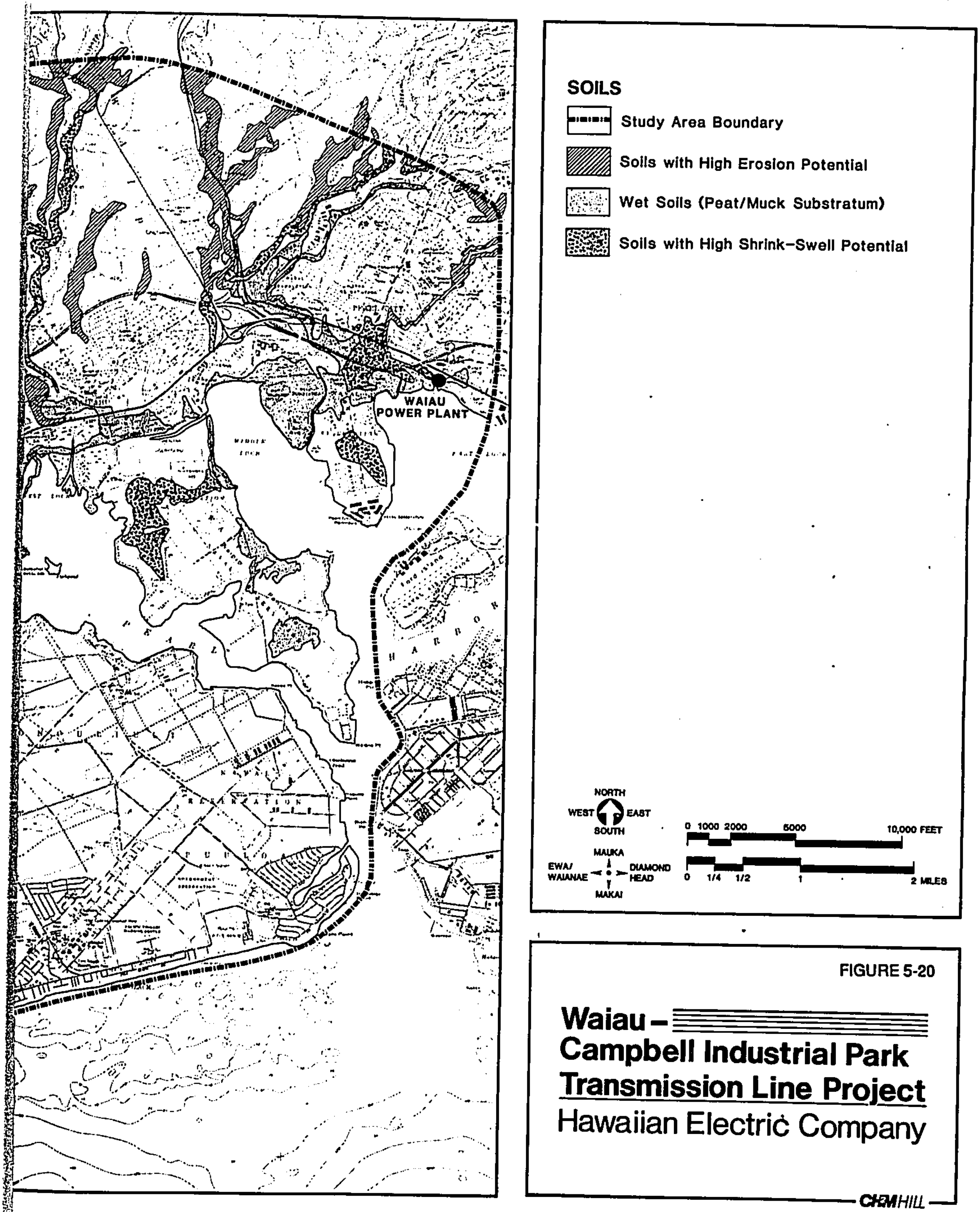


FIGURE 5-20

Waiau – Campbell Industrial Park Transmission Line Project
Hawaiian Electric Company

CH2M HILL

Interchange. Construction impacts would displace a greater area of crops and compact more land along the Kunia option. Because fewer crops would be disturbed along the H-1 option, fewer impacts would be associated with it. Construction activities usually require selective clearing and/or removal of vegetation from construction pads and pole sites. In a few locations throughout the alignment, 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 positions of conductors in high winds.

Water Resources. There should be no substantial impacts on water resources from either construction or operation of the proposed transmission lines. Along Waikele and Waiawa Streams, all poles will be sited outside the stream channels and no alteration will be made to the channels. Where possible, new poles will replace existing 46 kV poles, minimizing areas of new disturbance. No dredging or filling should be required, and there should be no discharges into surface waters or any violations of federal, state, or county water quality standards. This alignment includes Federal Emergency Management Act (FEMA)-designated flood-prone areas adjacent to Waikele and Waiawa Streams (see Figure 5-18). Flooding could erode the soils surrounding the poles and cause sedimentation in the streams. Proper design of the pole foundations and appropriate span length can reduce the risk of soil erosion and scouring around poles during flooding.

Proper care must be taken when drilling pole foundations to avoid penetrating the caprock that overlies the aquifer. Caution will be exercised in preparing foundations to provide sufficient support for the pole and to control water leakage from the aquifer. There are no groundwater-fed springs in the alignment area. There should be no impacts on groundwater quantity or quality if proper care is taken.

Earth Resources. Most of this alignment is underlain by Koolau basalt and older alluvium formations that have a relatively high bearing capacity and can support relatively large loads with proper design (see Figures 5-11 through 5-13). In these formations, conventional drilled pier foundations would probably be practical for supporting the transmission poles. Recent alluvium soils are less suitable for supporting the pole foundation loads because of their low in situ strength characteristics and the tendency for structures overlying this type of soil to settle. Pile foundations may be required to support the transmission poles in the areas surrounding the Waiawa Stream and the Waiau Power Plant, where there are wet soils, soils with high shrink-swell potential, and recent alluvium. Areas of the alignment along the banks of the Waikele and Waiawa Streams with slopes greater than 20 percent can be fairly easily avoided when selecting sites for transmission poles (see Figure 5-19). Similarly, the few isolated areas along H-1 where soils exhibit high erosion potential can be avoided (see Figure 5-20). Surface disturbance from siting transmission poles 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.

H-1 Overhead/Underground Alternative

The potential impacts of the overhead section of this alternative would be identical to those described for the H-1 Overhead alternative from the Ewa Nui Substation to the Pearl City Industrial Park. A transition station would be constructed at the point where the overhead lines go underground. The potential impacts of the underground section are described below.

Biological Resources. Construction impacts would be minimal because the area was disturbed previously by the siting of the existing 46 kV lines. This area is developed and consists of a mix of residential, commercial, and industrial uses. There appear to be no sensitive biological resources along the underground section; therefore, there should be no substantial impacts from construction or operation.

Water Resources. At the point where the line goes underground to a point approximately one-half mile to the east, the ground is subject to 100-year flood inundation (see Figure 5-13). Should the area be flooded, that section of the pipe and the transition station would be submerged. Under nonflood conditions there would be no impact to water resources. Should flood conditions exist, construction and maintenance operations could cause soil erosion and siltation. Also, the transition station could be damaged from floodwaters.

Earth Resources. Recent alluvium soils occur at the point where the line goes underground and continue along the proposed alignment for approximately one-half mile to the east (see Figure 5-13). These soils are generally considered to be poorly to very poorly suited for use as support for foundation loads because of their tendency to settle under their own weight or the weight of a minimal overburden. Uneven settling could stress the underground pipe to its breaking point, causing release of dielectric fluid into adjacent soils.

Farrington Overhead Alternative

The potential impacts of the single-circuit section of this alignment would be identical to those described for the single-circuit section of the H-1 alignment, including the bike path option, from just east of the H-2 on-ramp to its termination in the Waiau Power Plant. The potential impacts of the double-circuit section of the alignment are described below.

Biological Resources. Commencing at the Ewa Nui Substation, approximately one-fifth of the alignment runs adjacent to cane fields to a point just west of the Kunia Road overpass. The impacts to cane plants would be identical to those described for the H-1 Overhead alternative, Kunia option. The remainder of the alignment is located in a highly developed area consisting of commercial, office, apartment, and public facilities uses. This alignment follows existing transmission lines, easements, or roadways for almost its entire length. No threatened, endangered, or sensitive species or habitats occur in this alignment. In general, this section of the alignment has relatively few potential biological impacts.

Water Resources. Areas of the alignment susceptible to 100-year flood events include the Waikele and Waiawa Streams (see Figure 5-13). Improper siting of pole foundations in these areas could result in erosion and scouring during floods.

Earth Resources. Recent alluvium soils with high shrink-swell potential are located in the areas adjacent to the Waikele and Waiawa Streams (see Figure 5-13). These wet, soft soils require deep pile foundation systems to support the transmission line poles. There is the potential danger of puncturing the caprock and encountering groundwater while attempting to site deep enough bearings for the piles. Soils with high erosion potential are located on the mauka side of Farrington Highway in the vicinity of the Waikele Stream. The stability of poles can be undermined by erosion or stressed by accumulations of soil deposited by erosion at the pole bases.

Farrington Underground Alternative

Because this alignment would be placed in an existing right-of-way that is already extensively disturbed, minor construction impacts are likely, but long-term impacts are not expected. Trenching may cause temporary soil erosion; however, proper mitigation can effectively reduce those impacts. There are no significant biological resources within the existing right-of-way for this proposed alignment. Construction activities associated with the Waikele Stream and Waiawa Stream crossings may require U.S. Army Corps of Engineers 404 permits. If so, the permit process will require environmental review of proposed construction methods and require necessary mitigation for stream channel protection if the streams are disturbed. The impacts for the section from Kamehameha Highway to the Waiau Power Plant would be identical to those described for the H-1 Overhead/Underground alternative.

OR&L Alternative

Biological Resources. Commencing at the Ewa Nui Substation, this proposed alignment follows the mauka edge of Farrington Highway adjacent to cultivated cane fields to a point just west of the Kunia Road overpass. The impacts to cane plants would be identical to those described for the respective section of the H-1 Overhead alternative, Kunia option. The double-circuit alignment becomes two single-circuit alignments in the vicinity of a residential area makai of Farrington Highway. No sensitive biological species occur in this area, but landscaped residential areas could be impacted from construction and maintenance activities.

An existing Energy Corridor containing oil and gas pipelines occupies the majority of this proposed alignment (see Figures 5-1 through 5-3). Because these utilities were installed several years ago, it is likely that they have deteriorated. There is a high potential that contamination already exists in those soils and that construction activities could result in additional petroleum releases through accidental pipe rupture. For this reason, this alignment poses a strong threat to the sensitive wetland areas that provide habitat for threatened, endangered, and sensitive waterfowl. Oil and fuel spills onto environmentally sensitive wetland areas and inadvertently into the National Wildlife Refuge would be detrimental to the long-term survival of the endangered species. The birds are especially vulnerable when nesting.

Portions of the alignment are near or adjacent to several acres of a Protective Subzone in the State Conservation District and the National Wildlife Refuge (see Figures 5-15 and 5-16). Nonwoody wetlands, mangrove swamps, and two streams (Waikele and Kapakahi) occur in the Protective Subzone area. Nonwoody wetlands, mangrove swamps, and the Waiawa Stream occur in the National Wildlife Refuge area. Both of these areas provide habitat for four endangered waterfowl species, and the potential for electrocution from overhead lines in these areas is extremely high. To avoid the possibility of electrocution, the lines will be underground in the areas adjacent to habitat for the endangered waterfowl species. Trench excavation in these areas must be carefully planned and executed to avoid disturbance to the wildlife and their habitat. Adverse impacts to the hydrology of neighboring wetlands could severely degrade the habitat used by endangered species of waterfowl. Because the trench will be dug in the existing railbed, the hydrology of the neighboring wetlands should not be impacted. The underground lines would be supported on piles.

This alternative would require reconstruction and/or widening of existing bridges to provide continuous access to the proposed all-weather access road. The bridges and road must be able to support the heavy construction and maintenance equipment and remain passable in wet conditions. The improved bridges would cross Waikele Stream, Kapakahi Stream, Wailani Flood Control Channel, Hoaeae Drainage Channel, Wailani Culvert, and Waiawa Springs (see Figures 5-11 through 5-13). Wherever possible, the underground transmission lines will be built into the structure of the bridges to avoid below-ground stream crossings. Potential construction impacts associated with bridge work include erosion and subsequent sedimentation in adjacent streams (although, in the absence of trenching, there should be minimal sediment release). No adverse biological impacts are expected. Environmental review and approval of these activities will be required from the Corps of Engineers.

Most of the alignment is in the SMA and many sections are within the 40-foot no-build setback (see Figures 5-14 through 5-16a). As with the H-1 Overhead and Farrington Overhead alternatives, this alternative would follow one of two routes in the SMA near its termination at the Waiau Power Plant site. For either route, the potential impacts are identical to those discussed in the H-1 Overhead or Farrington alternatives. Project activities will be reviewed for environmental impacts during the SMA Use Permit process and during the 40-foot setback variance process.

Water Resources. Precautions should be taken during construction of trenches to avoid disturbing the hydrology of adjacent wetlands (see Biological Resources, above). Neighboring wetlands could be drained of all their surface water, thereby severely degrading the habitat used by endangered, threatened, and sensitive waterfowl species.

Within this alignment, the Protective Subzone lands and the National Wildlife Refuge are within the 100-year floodplain and are likely to be inundated with water during 100-year flood events (see Figures 5-12 and 5-13). The alignment would be underground in these areas, and flooding could cause erosion of the unvegetated and disturbed area overlying the pipe. Erosion-borne sediment would most likely be trapped in the adjacent wetlands, causing adverse impacts to those ecosystems. Should maintenance or repairs be necessary during floods, the submerged, underground pipe would be very difficult to access.

Impacts from reconstruction and/or widening of existing bridges are discussed above under Biological Resources. In addition, flooding could cause erosion and scouring around bridge piles, which may weaken the foundation of these bridges.

Construction activities could cause existing oil or gas pipelines to rupture and leak into adjacent water resources. Potential impacts are discussed above under Biological Resources.

The wet soils in this alignment often require deep foundations. This area may contain contamination from existing oil and gas lines, and the potential exists for rupturing those lines again during construction. Therefore, any groundwater in the area would be in danger of contamination.

Earth Resources. The alignment is believed to be underlain by thick deposits of very soft soils. The Protective Subzone area and the National Wildlife Refuge have characteristically wet and marshy soils. These soils tend to settle under their own weight, and there is a high potential for underground pipes to break at connection points. The potential impacts are discussed above under Biological Resources. In addition, the majority of this alignment contains existing gas and oil pipelines. There is high potential for accidental rupture and oil/gas spill during construction of the new alignment, causing contamination to soils. These impacts are also discussed under Biological Resources.

No Action Alternative

Under the No Action alternative, there would be no construction, operation, or maintenance impacts to the biological, water, and earth resources currently existing within the proposed alignments. In particular, there would be no new impacts to threatened, endangered, or sensitive bird species or to their associated habitats. Similarly, there would be no new impacts to the streams and springs in the proposed alignments. There would be no need to apply for environmental permits and approvals for activities within SMAs, the 40-foot coastal zone setback, stream crossings, and other habitat for endangered, threatened, and sensitive waterfowl species.

Mitigation

Biological Resources

Prior to any construction in the OR&L alignment, HECO should contact owners (identified in Chapter 5, Section F) of existing gas and petroleum lines and determine whether spill contingency plans have been developed to respond to accidental spills. In the absence of a spill contingency plan, HECO should coordinate with the Honolulu Coast Guard Marine Safety Office, USFWS, and NMFS to establish appropriate construction mitigation measures. Possible mitigation measures include field testing for the location of the existing pipelines, having a containment boom onsite, and placing silt screens around edges of any adjacent wetlands.

If a spill occurs, HECO should notify the Honolulu Coast Guard Marine Safety Office and the Hawaii Department of Health. The Coast Guard will implement a local response effort, including contacting USFWS and NMFS for advice on a natural resource damage assessment and restoration methods.

In areas being used for sugar cane cultivation, poles should be sited to avoid existing crops. When poles and equipment displace crops, replanting should occur. In areas being used for wetland cultivation, especially in the Waiau Power Plant SMA, poles should be placed in the same locations as existing 46 kV poles, where possible, to reduce disturbance to plantings. Replanting should occur following construction. Trimming and removal of trees should be kept to a minimum.

In the areas of the OR&L alignment where construction activities include trenching adjacent to habitat for endangered waterfowl species, those activities should be carefully reviewed by appropriate agencies and designed to avoid interference with hydrology of neighboring wetlands.

Water Resources

When required to site within flood-prone areas, proper design of pole foundations and appropriate span length can reduce the risk of soil erosion and scouring around poles during flooding. Transition stations associated with underground alignments should be elevated above flood-prone areas because they contain electronic equipment not suited to moisture.

Poles should span–not be sited in–stream channels, drainage ditches, and flood control channels. For underground sections, lines should be built into the structure of the bridges to avoid below-ground stream crossings.

Earth Resources

A full-scale geotechnical exploration, including borings and field and laboratory testing, should be developed and implemented before the final design stage of the project. Drilled pier construction should be closely monitored by a geotechnical engineer to ensure that foundation support is achieved. Wherever possible, transmission poles should be sited in areas underlain by Koolau basalt and older alluvium, which make excellent bearing formations because of their high-strength characteristics, and which reduce the need for deep siting of the poles. Drilling fluids should be avoided as much as practical, as they may saturate and weaken the subsoil or rock. The holes should be advanced by auger drilling, bit chopping, or cutting.

Prompt placement of concrete in the prepared hole, as soon as it is completed, is recommended to reduce probable caving in of the hole in occasional soft or loose areas. When soft soils conditions require siting of pile foundations, the piles should be spaced apart adequately to minimize reduction in soil strength caused by pile group effect, and a rigid pile cap should be provided to reduce the lateral movement. When siting piles in these soils, care should be taken not to puncture caprock, which could release groundwater into the project area.

Stabilization of the ground surface may be needed in these soft ground areas to allow access for heavy equipment. If so, existing underground utilities should be identified and a determination made as to whether stabilization may have potential impacts on any of these buried utilities.

Short-term impacts from soil erosion can be mitigated through use of silt curtains in the vicinity of streams.

Unforeseen soil conditions, such as perched groundwater, soft deposits, hard layers, or cavities, may occur in localized areas and may require additional probing or corrections in the field to attain properly constructed pole foundations. Therefore, a sufficient contingency fund is recommended to accommodate such possible extra costs.

E. Transportation and Traffic

Environmental Setting

Three major roadways transect the project area: H-1 freeway, Kamehameha Highway, and Farrington Highway.

H-1 freeway is a major arterial that begins at Ewa and goes east through the study area to Waialae. Through the study area, H-1 has been built to U.S. Department of Transportation Interstate Highway standards, with exclusive rights-of-way and controlled accesses and exits. The section of H-1 east of the Waiawa Interchange through Pearl City is elevated. Average daily traffic for the 27-mile H-1 freeway was 114,754 in 1989. About 7 miles of H-1 pass through the project area from the Ewa Nui Substation to the Waiau Power Plant. Traffic volumes for the H-1 freeway within the study area are shown in Table 5-9.

Table 5-9
Peak and 24-Hour Traffic Volumes, H-1 Freeway--1989

	West of Kunia Interchange	Kunia Interchange to Waiawa Interchange (West End)	Waiawa Interchange (East End) to Waiau Interchange
24-Hour Volume	50,068	76,784	178,041
A.M. peak 1-hour	4,006	5,759	12,469
Eastbound	2,003	3,167	9,352
Westbound	2,003	2,952	3,117
P.M. peak 1-hour	4,256	6,527	13,353
Eastbound	2,128	2,937	4,673
Westbound	2,128	3,590	8,680

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

Kamehameha Highway (Highway 99) begins at the north shore of Oahu at Waialua, goes south to Pearl City, then east to Pearl Harbor at Makalapa. Average daily traffic for this 24-mile segment of Kamehameha Highway was 25,840 in 1989. About 1.7 miles of the busiest portion of Kamehameha Highway is located within the study area, east of Waiawa Interchange in Pearl City. Traffic volumes for this portion of Kamehameha Highway are shown in Table 5-10.

Table 5-10 Peak and 24-Hour Traffic Volumes, Kamehameha Highway West of Waimano Home Road--1989	
24-Hour Volume	61,336
A.M. peak 1-hour Eastbound Westbound	4,293 2,576 1,717
P.M. peak 1-hour Eastbound Westbound	4,293 1,503 2,790
Source: State of Hawaii Department of Transportation, Traffic Summary, Island of Oahu, 1989.	

For statistical purposes, Farrington Highway in the vicinity of the study area was divided into two parts. One part, designated FAU(S) 7110, is 0.6 mile long and is located between the Ewa Nui Substation and Kunia Road. This western part of Farrington Highway had an average daily traffic volume of 6,384 in 1989. The second part, designated FAU(S) 7101, is 3.0 miles long and is located between Kunia Road and the Waiawa Interchange. The eastern part of Farrington Highway through Waipahu had an average daily traffic volume of 38,585 in 1989. Traffic volumes for Farrington Highway within the study area are shown in Table 5-11.

Table 5-11 Peak and 24-Hour Traffic Volumes Farrington Highway--1989			
	West of Kunia Road	West of Waipahu Depot Road	West of Waiawa Interchange
24-Hour Volume	7,146	38,423	39,621
A.M. peak 1-hour Eastbound Westbound	500 250 250	2,690 1,345 1,345	2,575 1,287 1,287
P.M. peak 1-hour Eastbound Westbound	679 272 407	2,690 1,210 1,480	2,773 1,248 1,525
Source: State of Hawaii Department of Transportation, Traffic Summary, Island of Oahu, 1989.			

The State Department of Transportation Highways Division and the City and County of Honolulu have plans to improve transportation facilities in the study area. The State Department of Transportation plans to improve the H-1/Kunia Road Interchange by possibly adding a cloverleaf at the southwest corner of the interchange. The State Department of Transportation also has future plans to improve Farrington Highway through Waipahu. The city is proposing a rapid transit system that would extend from Honolulu to Pearl City. A fixed guideway may be located along Kamehameha Highway through Pearl City and terminate at a maintenance/storage yard west of Leeward Community College. Transit stations are proposed, including one in Kamehameha Highway east of Waimano Home Road (see Figure 5-3). In the future, the city may extend the fixed guideway toward Ewa and central Oahu from the maintenance/storage yard. A possible alternative corridor for the westbound extension is Farrington Highway. A possible alternative corridor northbound is the H-2 freeway.

Probable Impacts

H-1 Overhead Alternative

Because the new lines would principally follow highway and freeway rights-of-way, construction activities would temporarily disrupt traffic in some locations. In one configuration, about 3/4 mile of the lines would be adjacent to Kunia Road. Work on public roads must follow 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 adjacent to a state road or highway, such as the H-1 freeway, Kunia Road, and parts of Kamehameha 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, which includes portions of Kamehameha Highway. Access from H-1 freeway to construct or maintain the lines is not permitted by State Department of Transportation regulations.

According to state highway regulations, only one lane at a time may be closed on a multilane highway; on a two-lane highway, lanes of adequate width in both directions must be provided wherever possible. All lanes must be open to traffic during morning peak hours (generally 6:00 to 8:30 a.m.) and afternoon peak hours (generally 3:00 to 6:00 p.m.). HECO and its construction contractors follow state guidelines for the types of signs, lights, and markers; the position of traffic cones and areas coned off; and the use of flaggers and/or police officers (State of Hawaii Department of Transportation, 1978; U.S. Federal Highway Administration, 1978).

Coning off a lane of traffic is usually required during the drilling of the pier foundation, pole erection, and conductor installation phases of line construction. At any one point along the new route, traffic might have to be interrupted for several days over the course of 3 to 4 months.

Construction may be performed in a staggered manner, meaning that 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, the areas where it is necessary to cone off lanes of traffic can shift among locations along the alignment.

The first activity that may require coning off a lane of traffic would be the drilling of the pier foundation. Typically, several pier foundations are drilled 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 construction hours. The next construction activity, which may occur up to several weeks later, is pole installation. Approximately three poles per day can be installed, which requires coning off a single lane for approximately 700 to 1,300 feet. Conductor installation is done in sections approximately 1/2 to 1 mile long and requires about 1 month per mile to complete. A single lane of traffic may be coned off during construction hours. The entire construction process for the H-1 Overhead alternative is expected to take about 12 months.

Impacts to traffic on roads and highways would occur during construction. Construction crews would use existing roads for access to all segments of the alignment, except for the portions of H-1 that cannot be accessed from adjacent existing roads. Along approximately 3,000 feet of the H-1 freeway where no adjacent road exists (east of Village Park), HECO would probably construct a dirt access road rather than gain access from the H-1 freeway, which is not permitted according to State Department of Transportation highway regulations.

When poles are installed adjacent to roads, part of the road surface (in addition to the shoulder) must sometimes be used to station equipment used in installing foundations, poles, and conductors.

The potential for traffic disruption is higher in Pearl City along Kamehameha Highway than in other areas, because of the heavier traffic volumes along this highway. Traffic disruption would probably be most prolonged along Kamehameha Highway in Pearl City between the Waiawa Interchange and H-1. Construction along the alignment mauka of the elevated section of H-1 should cause little traffic disruption, since construction crews would work from a road that runs along the side of the freeway.

After construction is complete, traffic disruption for routine maintenance would be less frequent and shorter in duration. Semiannual routine maintenance is essentially a "drive-by" inspection. Detailed inspection, performed once every 5 years, requires one day per pole, and, along public roads, might require coning off a lane of traffic for a few hundred yards on either side of the pole being inspected.

The transmission lines would cross over the proposed rapid transit fixed guideway in two locations near Waiawa Stream. A single-circuit line would cross over a proposed transit station in Kamehameha Highway east of Waimano Home Road.

H-1 Overhead/Underground Alternative

Impacts on transportation and traffic are similar to those for the H-1 Overhead alternative, except that a longer period of traffic disruption would occur for trenching and laying of the underground pipes for the transmission lines along Kamehameha Highway and that lines would not cross over the proposed rapid transit system.

Manholes to access the underground line would be placed at varying intervals along the line, with a maximum interval of 2,000 to 4,000 feet. Periodic manhole inspections and maintenance would cause occasional traffic disruptions.

Underground trenching and conductor installation would be done in sections 1/2 to 1 mile long. A single lane of traffic may be coned off during trenching and underground conductor installation. The entire construction process for the H-1 Overhead/Underground alternative, which includes 5 miles of overhead and 2 miles of underground lines, is expected to take about 12 months.

Farrington Overhead Alternative

About 5 miles of the lines would be installed along Farrington Highway, about 2 miles along Kamehameha Highway, and about 3/4 mile along the elevated section of the H-1 freeway.

Impacts on transportation and traffic are similar to those of the H-1 Overhead alternative, except that the impacts would be along Farrington Highway, Kamehameha Highway, and the elevated section of the H-1 freeway. The entire construction process for the Farrington Overhead alternative is expected to take about 12 months.

The potential for traffic disruption is higher in Pearl City along Kamehameha Highway and in Waipahu along Farrington Highway than in other areas, because of the heavier traffic volumes along these highways. As with the H-1 Overhead alternative, traffic disruption would probably be most prolonged along Kamehameha Highway in Pearl City between the Waiawa Interchange and the H-1 freeway. Transmission lines would cross over the proposed rapid transit fixed guideway and a transit station at Kamehameha Highway. Construction along the alignment mauka of the elevated section of H-1 should cause little traffic disruption because construction crews would work from a road that runs along the side of the highway.

This alternative, which would occupy the median of Farrington Highway in Waipahu, could have significant conflicts with the rapid transit system if the city decides to propose an extension of the fixed guide rail from Pearl City toward Ewa.

Farrington Underground Alternative

About 6.5 miles of underground lines would be installed along Farrington Highway and Kamehameha Highway.

Impacts are similar to those of the underground component of the H-1 Overhead/ Underground alternative along Kamehameha Highway, except that the impacts would be along Farrington Highway in addition to Kamehameha Highway.

The entire construction process for the Farrington Underground alternative is expected to take about 18 months.

OR&L Overhead/Underground Alternative

About 1-3/4 miles of the lines would be installed overhead along Farrington Highway from the Ewa Nui Substation to the Waipahu industrial area. The impacts of this alternative on transportation and traffic would include impacts on this segment of Farrington Highway and some short-term, local traffic congestion impacts on Leokane Street and Leoole Street in the industrial area, but would be considerably less than those of the Farrington Overhead alternative.

The entire construction process for the OR&L Overhead/Underground alternative is expected to take about 12 months.

No Action Alternative

No adverse transportation and traffic impacts are anticipated by continuing the status quo with the No Action alternative.

Mitigation

Construction workers and contractors will comply with state laws and City and County of Honolulu regulations regarding vehicle safety (marking, signing, flagging, lighting, and pilot vehicles), and will observe a Traffic Control Plan approved by the State Department of Transportation Highways Division for any work adjacent to state roads.

Work within the right-of-way of a state highway will receive prior approval from the State Department of Transportation Highways Division, through a "Permit to Perform Work on a State Highway." The permit is designed to ensure that safe practices are followed in the design and construction of structures near state highways.

All work that requires lanes of traffic to be coned off or closed will take place during off-peak traffic hours. In addition, work will be scheduled to make maximum use of weekends, holidays, nights, and other periods when construction work will cause the least disruption, provided construction activities at such times do not result in adverse noise impacts to sensitive land uses (e.g., residences and hospitals). See section 5.G for further restrictions on noise. These safety precautions will minimize traffic hazards to motor vehicles, bicyclists, and pedestrians during construction.

HECO will coordinate design of its project with state and city agencies to minimize conflicts with proposed transportation improvements, including rapid transit project improvements. Ongoing discussions between HECO staff and rapid transit project staff have identified several possible measures to resolve potential conflicts between the two projects. These measures include higher poles to provide an adequate safety clearance between the transmission lines and the transit facilities; undergrounding of conductors (such as existing 46 kV lines that may be installed on the new steel poles below the 138 kV conductors); undergrounding of all the lines that cross over a transit facility; or providing sufficient spacing of poles so that lines can span a transit facility.

F. Utilities, Pipelines, and Hazardous Waste

Environmental Setting

The study area contains a network of linear utility rights-of-way that have been used to develop siting alternatives for the proposed transmission lines. Electric utilities and oil and gas pipelines that exist adjacent to and crossing the alternative alignments carried forward in this study are shown in Figure 5-21, and are summarized as follows:

- H-1 alignment: 46 kV overhead lines along H-1, Kamehameha Highway, and Kunia Road
- Farrington Highway alignment: oil and gas pipelines along the section of Farrington Highway from Ewa Nui Substation to Kunia Road, 46 kV overhead lines along the entire length of Farrington Highway
- OR&L alignment: oil and gas pipelines and 46 kV overhead lines in the State Energy Corridor and along the length of the OR&L right-of-way

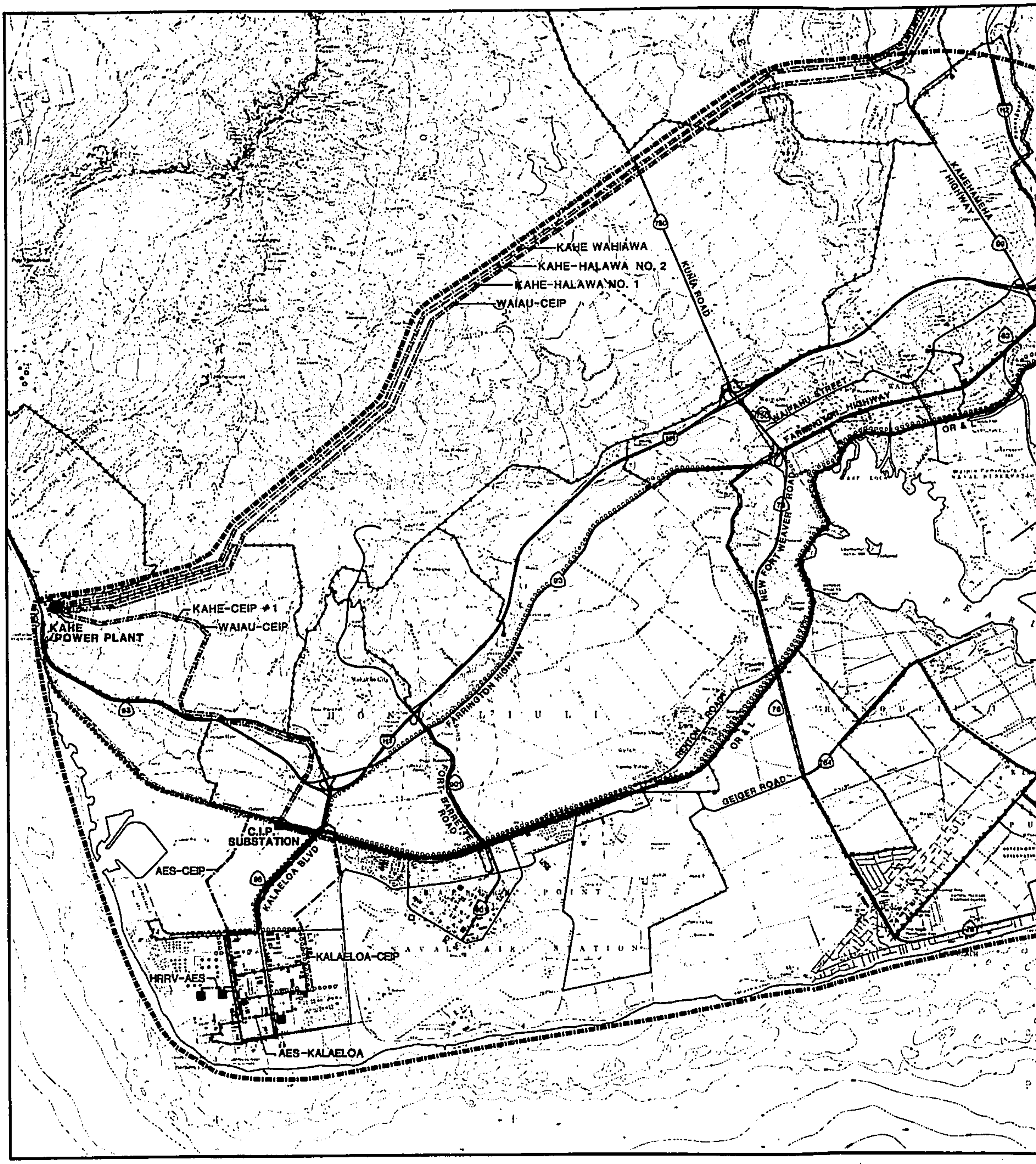
The only existing 138 kV transmission lines in the study area run along the mauka side of Kamehameha Highway for approximately 1,000 feet near the Waiau Power Plant.

The alternatives under consideration have followed these existing linear facilities as much as possible to avoid disruptions that new transmission lines might create in areas where no lines now exist. Oil and gas pipelines and electric utility, water, sewer, and communication ductwork facilities adjacent to the alternative alignments are described below, along with associated siting constraints.

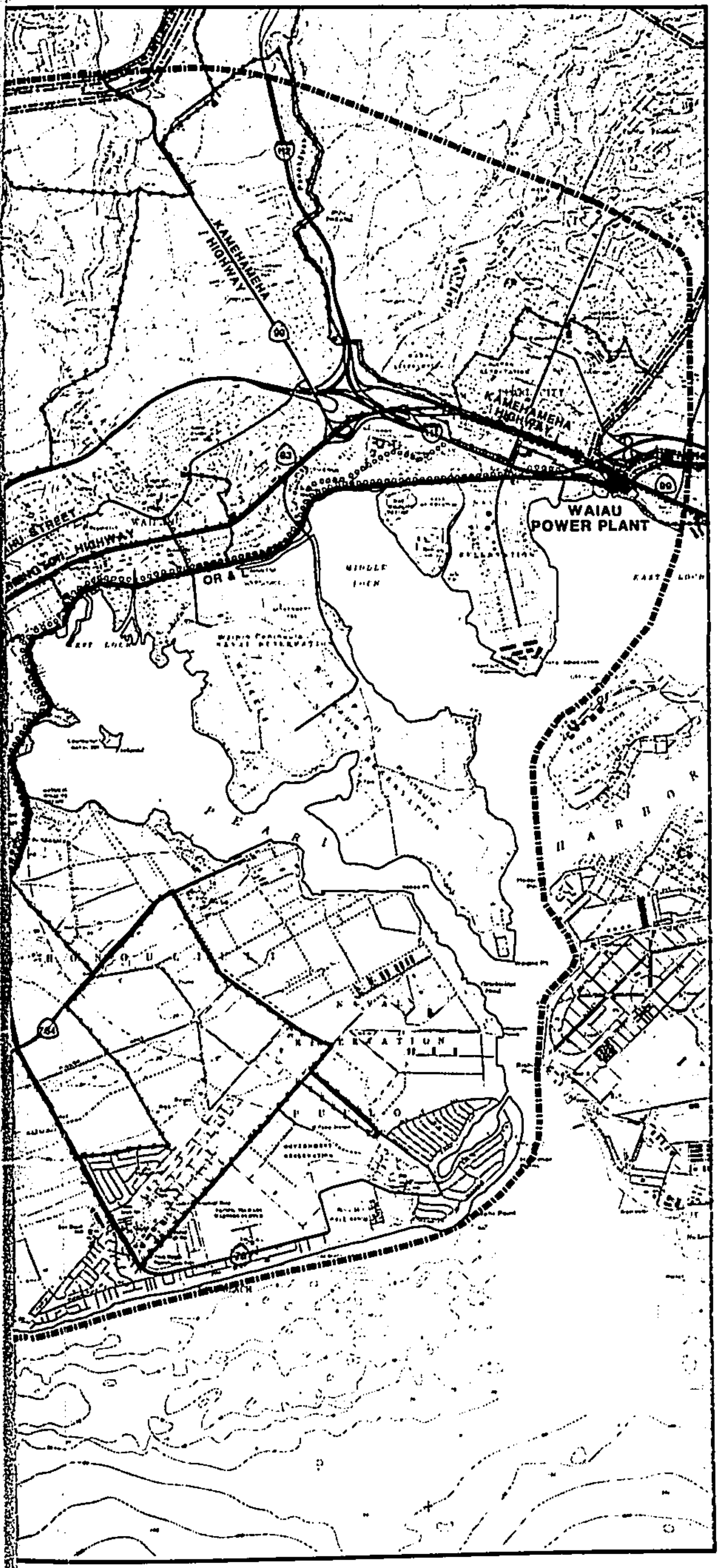
Oil and Gas Pipelines

The State of Hawaii Energy Corridor contains most of the oil and gas pipelines in the study area. The Energy Corridor, established to provide for the transportation of energy sources in the state, begins at the refinery in CIP and runs along Farrington Highway to Kunia Road; it then follows the former OR&L railway alignment along the shore of Pearl Harbor across the top of the Waipio Peninsula. Near Waipahu High School, the Energy Corridor diverges from the OR&L right-of-way and follows a mauka route adjacent to the high school and Leeward Community College and along H-1, Lehua Avenue, and Kamehameha Highway to the Waiau Power Plant. It continues past the Waiau Power Plant along the shoreline to central Honolulu.

The Energy Corridor is 30 feet wide and consists of five 5-foot-wide "slots" that may be leased for pipelines. Two of these slots are currently occupied by pipelines owned by the Hawaiian Independent Refinery, Inc. (HIRI), and by GASCO, Inc. HIRI maintains a 10-inch-diameter jet fuel/gasoline pipeline and GASCO maintains a 16-inch-diameter propane pipeline in these slots.



KAHE WAHIAWA
KAHE-HALAWA NO. 2
KAHE-HALAWA NO. 1
WAIAU-CEIP
KUNIA ROAD
KAMEHAMEHA HIGHWAY
WAIPAHU STREET
FARRINGTON HIGHWAY
OR & L
KAHE-CEIP #1
WAIAU-CEIP
KAHE
POWER PLANT
NEW FORT WEAVER ROAD
FARRINGTON HIGHWAY
RENTON ROAD
OR & L
FORT BARRETT ROAD
GEIGER ROAD
C.I.P.
SUBSTATION
AES-CEIP
KALAELOA BLVD
KALAELOA-CEIP
HRRV-AES
AES-KALAELOA



UTILITY AND TRANSPORTATION SYSTEMS

- Study Area Boundary
- Power Plant
- Substation (138kV, 46kV)
- 138kV Lines
- 46kV Lines
- Interstate Routes
- State Routes
- Major Local Roads
- Oahu Railway and Land Company (O R & L) Right-of-Way
- Oil/Gas Pipelines

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 5-21

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

Chevron USA, Inc., maintains two 8-inch-diameter lines (one black oil and one white oil) and a 4-inch-diameter, heater oil line within the study area. These lines originate at CIP and follow the OR&L alignment adjacent to Renton Road and Barbers Point Naval Air Station; they join the Pearl Harbor shoreline near Honouliuli. The Chevron lines run along the makai side of the Energy Corridor, along the shoreline of Pearl Harbor, and across the top of the Waipio Peninsula. The lines then continue to central Honolulu. There have been documented occurrences of soil contamination by fuel oil from the Chevron lines along this right-of-way.

The U.S. Navy owns an 8-inch-diameter fuel line in the Pearl City Peninsula section of the OR&L. In some locations, the fuel line is makai of the alternative alignment; in other locations, it is immediately adjacent to the alignment.

Electric Utilities

There are sections of 12 kV, 46 kV, and 138 kV transmission lines in the study area, as shown in Figure 5-21. Existing 46 kV lines provide overbuild opportunities where new 138 kV lines and the 46 kV lines can occupy the same pole and right-of-way; 46 kV lines along the Energy Corridor, H-1, Farrington Highway, and Kunia Road have this capability. An important criterion in siting 138 kV transmission lines, however, is to provide adequate separation from other 138 kV lines to reduce the possibility that a single emergency (e.g., fire, aircraft accident, or windstorm) would simultaneously damage two or more of the principal transmission lines. This is essential for this project because increased system reliability is a primary goal. Therefore, no underbuilding of existing 138 kV lines is proposed in any of the alternatives.

Although HECO maintains a 46 kV, double-circuited, wood pole line within the Energy Corridor, it does not own a lease to one of the slots. According to Mr. Derrick Lining, (Property Manager, Department of Transportation Harbors Division, which has jurisdiction over the Energy Corridor), HECO has two options that would allow siting of the transmission lines in the Energy Corridor:

- Option 1: Request that the existing wood poles be replaced with new steel poles

- Option 2: Request that a lease be granted for a slot in the Energy Corridor

Either request must be approved by the Department of Transportation Harbors Division, including review by the Energy Corridor Committee, which is composed of the Harbors Division and tenants of the corridor.

Water, Sewer, and Communication Ductwork

In addition to the electrical utility, oil, and gas lines described above, each of the alignments crosses and is located adjacent to numerous water, sanitary/storm sewer, and communication ductwork lines. The City and County of Honolulu owns two sanitary sewer force mains along the energy corridor from Waimano Home Road to Kapakahi Stream, ranging from 30 to 48 inches in diameter. The Navy owns a single 30-inch-diameter water main serving the Pearl City Peninsula, which crosses the energy corridor near Waimano Home Road. Current mapping data are insufficient to accurately locate these lines.

Hazardous Wastes

An area between Waiawa Springs and Waiawa Stream, along the OR&L alignment, was formerly used as a Navy Public Works land disposal site. The exact location of waste materials has not been mapped, and the size of the site has not been determined. Previous investigations conducted by the Navy in this area have uncovered semi-volatile organics and heavy metals in the soils along the OR&L right-of-way. The Navy is currently conducting more extensive onsite investigations and expects to have the results in July 1992. The extent of contamination and concentrations of hazardous materials in this area are currently unknown, pending the results of these investigations.

Probable Impacts

H-1 Overhead Alternative

This alternative calls for overbuilding existing 46 kV lines along most of the alignment, and presents a low potential for significant adverse impacts or conflicts with existing utilities. The Department of Transportation Highways Division strictly prohibits direct access to transmission lines from the H-1 freeway for construction and maintenance purposes, however. Difficulties related to access would be overcome through engineering and construction methods and negotiation with landowners.

Although a portion of the alignment from Waimano Home Road to the Waiau Power Plant parallels the HIRI and GASCO pipelines, there is sufficient room to avoid the lines. The bike path option would parallel the Energy Corridor, which has no pipelines in this location. There would be no adverse impacts related to pipelines or other utilities with this alternative.

There are no records of hazardous materials in this area. Therefore, the potential for adverse impacts associated with excavation into hazardous materials is considered low.

H-1 Overhead/Underground Alternative

This alternative has generally identical impacts to the H-1 Overhead alternative, with the exception of potential impacts related to placing the section between Pearl City Industrial Park and the Waiau Power Plant underground. The 138 kV lines would be underground along Kamehameha Highway, which parallels the HIRI and GASCO pipelines. As described above, there is sufficient room to avoid the pipelines. Therefore, there is low potential for environmental impacts and liability exposure that could occur if hazardous materials were encountered during excavation. The underground section presents a higher potential for damage to underground utilities that may not appear in maps. No significant impacts to or conflicts with existing electrical, oil, gas, or other utilities are anticipated.

Farrington Overhead Alternative

This alternative presents a low potential for significant adverse impacts to or conflicts with existing utilities. Existing 12 kV lines would be placed underground subject to PUC approval. The last portion of this alignment would parallel the HIRI and GASCO pipelines. The bike path option would parallel the Energy Corridor, which has no pipelines in this location. As described above, there is sufficient room to avoid the pipelines. Therefore, under this alternative, there is low potential for environmental impacts and liability exposure that could occur if hazardous materials were encountered during excavation.

Farrington Underground Alternative

This alternative presents a generally low potential for significant adverse impacts or conflicts with existing utilities, similar to the Farrington Overhead alternative. The alignment calls for crossing a single pipeline that runs from the Energy Corridor to the Oahu Sugar Company Mill in Waipahu. This crossing is well identified and exists on stable soils; therefore, no adverse impacts associated with the crossing are anticipated.

Because excavation is called for along the entire route, there is some potential for impacts related to encountering hazardous materials or unmapped utilities, as discussed in the above alternatives. However, because the excavation would occur primarily in a road right-of-way that has been built for many years, the potential for encountering hazardous materials is considered low.

OR&L Overhead/Underground Alternative

This alternative has the potential for significant adverse impacts related to damaging utility systems and encountering hazardous wastes. Installation of solid dielectric cable in trenches, construction of bridges and pipeline crossings over streams, construction of all-weather road surfaces, and placement of new overhead utility poles all have the potential for adverse impacts, as described below.

Two types of construction impacts are probable in this area: damaging existing pipelines and encountering hazardous materials through excavation or other site work. Damage to existing pipelines could be caused by a direct blow from heavy equipment in trenching or pile-driving operations, or by pipe rupture resulting from indirect effects of ground vibrations.

As described in Section D of this chapter, soil conditions along the alignment include areas where ground settlement of up to 1.75 inches can be expected, depending on the surface crust thickness of soil with "fairly good" engineering properties (Leo Daly Company, 1991).

Ground vibrations from construction activity, vehicle traffic, and the weight of the all-weather road surface itself all contribute to soil settlement, which can cause pipeline failure.

Several special construction methods would be necessary to reduce the risk of pipeline damage if this alternative were selected. Trench excavation in areas of poor soil conditions would require supporting any existing utilities with piles, and would present the potential for their damage. The high water table and soft soils in this area may also require use of cofferdams rather than normal shoring of trenches.

Failure of any pressurized pipeline would result in spillage of oil products and contamination of soils and nearby water bodies. Depending on spill severity and location, biological, water, and soil resources would be adversely affected, and cleanup and remediation efforts would be necessary for an undetermined length of time. The magnitude of such damage could be catastrophic to wildlife in the wetland and open water areas. Adverse health and safety effects could also result from the spillage. Explosion and fire danger would be especially acute if the 16-inch-diameter propane line were ruptured.

Oil is explicitly included as a hazardous substance under recent amendments to the State Emergency Response Law, also known as the State Superfund law (HRS Chapter 128D), which became effective on June 17, 1991. These regulations present significant liability concerns for the owner and operator of a facility where subsurface oil contamination is found.

The underground transmission line section adjacent to the Waiawa Unit of the Pearl Harbor National Wildlife Refuge presents significant potential for encountering hazardous materials from the abandoned Navy solid waste disposal facility. Any excavation in this area might encounter hazardous materials. Although the nature of materials in this area is unknown, preliminary analyses have identified substances of concern that may require cleanup activity pursuant to the State Superfund law. Areas formerly used for refuse disposal are likely to exhibit poor engineering properties as well, which may create a greater potential for pipeline damage, as discussed earlier.

The last portion of this alignment, including the bike path option, would parallel the HIRI and GASCO pipelines. As with the H-1 Overhead and the Farrington Overhead alternatives, there is sufficient room to avoid the pipelines.

No Action Alternative

If the project were delayed or canceled, the HECO electrical transmission and distribution system for Oahu would not achieve improved system reliability, and would therefore remain vulnerable to blackouts related to line outages. In addition, because Part 1 and Part 2 of the Waiau-CIP line are needed to transmit power generated by independent power producers.

Mitigation

The following mitigation measures apply to all identified alternatives:

- Complete surveys that locate all utilities should be performed before construction begins in order to reduce potential damage.
- All owners of each adjacent utility should be informed of the construction schedule and method of construction.
- All contractors should engage a geotechnical engineer to evaluate existing soil conditions and to make construction recommendations.
- All contractors should be held responsible for installing below-ground foundations without damaging any existing utility lines during construction.
- The use of drilled piers should be required in areas near existing pipelines in order to minimize potential damage caused by vibrations.
- Subsurface work should be performed during the dry season, if possible, to mitigate construction difficulties.
- For any construction along the Energy Corridor, guidelines for work near Chevron USA, HIRI, GASCO, and any other pipelines must be followed. These guidelines include measures to maintain access and prevent damage to pipelines.
- Any road crossings of pipelines must use steel plate or other protection, as approved by a geotechnical engineer, to prevent damage.
- Plans will be submitted to the City and County of Honolulu, as appropriate, prior to construction (i.e., Board of Water Supply and Department of Public Works).

G. 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 Code of Federal Regulations [CFR] 50, as amended), and those contained in the Hawaii Administrative Rules Title 11, Chapter 59. No air quality standards have been adopted specific to Oahu or cities. By legal definition, an air quality standard is an ambient air pollutant concentration level not to be exceeded more than once a year during a specified sampling period.

Each pollutant listed has the potential to cause some form of adverse human health or welfare effect, if present in high enough concentrations. The national standards are set at a point below which known adverse effects are not expected to occur. The state standards are more stringent than the comparable national standards. The state standards have been set lower to include an extra margin of safety designed to protect especially sensitive individuals and to allow for the possibility that unexpected undesirable effects could result from long-term exposures to currently allowable concentrations of these pollutants.

All areas of the United States that have air quality better than the national standards are designated as attainment areas. Those areas with air quality worse than the standards are classified as nonattainment areas. The U.S. Environmental Protection Agency (EPA) has designated the project area as an attainment area for all pollutants. Air quality on Oahu is monitored by the Department of Health Division of Pollution Investigation and Enforcement. Monitoring stations in the project area are located at Barbers Point, downtown Honolulu, and Sand Island.

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 (dB). 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-weighting and is abbreviated 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 compared with applicable noise standards contained in 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 shown in Table 5-12 for a specified period of time. There are, however, permit restrictions for construction activities; these are:

- No construction activities that produce noise levels in excess of the values in Table 5-12 at or beyond the property line are allowed before 7 a.m. or after 6 p.m.

- 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 5-12 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 primary sources of noise in the study area are motor vehicles on streets and highways. The highest noise levels are generally heard adjacent to at-grade sections of high traffic volume roads, or near high volume freeway interchanges. These conditions exist along the entire length of the H-1 and Farrington alternatives, and for the portions of the OR&L alternative that run along Farrington Highway and H-1. The H-1/H-2 Interchange is also an area with relatively high ambient noise levels. Of the three alternative alignments, the area adjacent to the OR&L alternative has the lowest ambient noise levels.

Existing land uses that are most sensitive to noise are shown in Figures 5-1 through 5-3 and listed in Table 5-13.

Table 5-12 **Allowable Noise Levels** **(dBA)**		
	Zoning	
Time	**Residential and Preservation**	**Hotel, Apartment, and Business**
Daytime (7 a.m. to 10 p.m.)	55	60
Nighttime (10 p.m. to 7 a.m.)	45	50
Notes: Noise levels shall not exceed the allowable levels for more than 10 percent of the time (L_{10}) within any 20-minute period, except by permit issued under S11-43-6 of Hawaii Administrative Rules. The allowable noise level for impulsive sound shall be 10 dBA above the values in this table.		

Table 5-13 **Sensitive Noise Receptors**	
Sensitive Receptor	Closest Alternative(s)
Kahi Mohala Hospital	Farrington, OR&L
St. Francis Medical Center	Farrington, OR&L
Honowai Elementary School	H-1
Waipahu Elementary School	Farrington
Waipahu Intermediate School	Farrington, OR&L
Hongwanji School	H-1, Farrington
St. Joseph's School	Farrington
August Ahrens Elementary School	H-1
Waipahu High School	Farrington, OR&L
Leeward Community College	Farrington
Lehua Elementary School	H-1, Farrington, OR&L
Pearl City Elementary School	H-1

Probable Impacts

Air Quality

Air quality impacts would be primarily short term, resulting from construction equipment exhaust emissions and dust (particulate) from construction operations. Ambient air quality would be affected in areas surrounding each excavation site. Construction would move continually from one section to the next, and particulate levels should not be highly concentrated in any one area, though they may be a temporary nuisance under especially windy, dry conditions. The amount of construction required depends on the length and width of improvements in the alignment, amount of line being placed underground, and need for other facilities, such as new access roads.

The only air quality impacts associated with normal operations would be from maintenance vehicle emissions, and these are anticipated to be negligible.

H-1 Overhead Alternative. This alternative calls for a minimum of underground construction (i.e., placement of poles). Impacts on air quality would be of short duration and negligible magnitude. Residences exist near the alignment. A description of construction phases and their durations for overhead lines is provided in Chapter 3.

H-1 Overhead/Underground Alternative. Air quality impacts from construction would be of longer duration than for the H-1 Overhead alternative and are related to underground construction. However, impacts would be of negligible magnitude.

Farrington Overhead Alternative. This alternative calls for a minimum of underground construction (i.e., placement of poles). Impacts on air quality would be of short duration and negligible magnitude.

Farrington Underground Alternative. Air quality impacts from construction would be of longer duration than the overhead alternative and are related to underground construction. Because the alignment passes through commercial and residential areas, more people would be affected by air quality impacts, but these would be of negligible magnitude.

OR&L Overhead/Underground Alternative. This alternative calls for road and bridge construction, and underground construction. This alignment has the highest percentage of residential land use, and these people would therefore be exposed to air quality impacts. Impacts would be of negligible magnitude, however.

No Action Alternative. If no action were taken, there would be no air quality impacts in the project area.

Noise

Similar to air quality impacts, construction activity would also generate most of the noise impacts from the project. Onsite construction equipment, generally powered by internal combustion engines, may generate significant maximum noise levels. The actual noise level at any particular receptor would depend on the number of pieces of equipment in operation, the level of noise generated by each piece of equipment, the distance from the receiver to the piece of equipment in operation, and the presence of any natural or manmade barriers.

Overhead transmission line construction includes foundation installation, pole erection, insulator installation, and conductor stringing, as described in Chapter 3. These activities would temporarily increase noise levels in the immediate vicinity. Table 5-14 contains typical sound levels of equipment used during construction compared with common noise sources. Construction of each segment of the line would require use of most of the construction equipment listed in the table at some point. These noise levels would decrease with distance from the construction site.

Table 5-14
Comparison of Transmission Line Construction Equipment Noise with Other Common Sound Levels

Equipment	A-Weighted Sound Level at 50 Feet, Unless Otherwise Specified (dBA)
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 [hp])	72
•Wheeled tractor	72
Freight train	75
•Truck, pickup, and four-wheel drive	77
•Concrete mixer, truck-mounted	78
•Crawler tractor (200 to 450 hp)	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-ton)	83
•Paving breaker	85
•Pneumatic tools	85
•Crane, mobile (50-ton)	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. *Pile Design and Construction Practice*. Cement and Concrete Association, London. 1977.

Noise impacts of the construction activities would be short term and intermittent. Noise impacts at any one location would last only a few days at a time as different phases of construction are completed. Short-term construction noise is generally accepted by nearby sensitive noise receivers, especially if construction schedules are enforced and no nighttime or early morning activity takes place.

A comparison of construction sound levels in Table 5-14 with the current Oahu noise standards in Table 5-12 indicates that, for some periods, some construction activities are likely to exceed the noise standard.

No long-term operational noise of consequence is anticipated. During corona activity, transmission lines (primarily 345 kV and above) generate a small amount of audible noise. This noise from the line can barely be heard in fair conditions on the higher voltage lines and usually not at all on 138 kV lines. During wet weather, water drops collect on the conductor and increase corona activity so that a crackling or humming sound may be heard near the line. The noise is caused by small electrical discharges from the water drops. Audible noise decreases with distance from the line. This audible noise is normally not heard at all on 138 kV lines, even in very quiet areas.

For this project, bundled conductors would be used, which reduces corona activity significantly. Audible operational noise levels for the project, calculated for the edge of the right-of-way during wet weather, are about 10 to 13 dBA, a very low level.

Noise impacts for the different project alternatives are characterized below.

H-1 Overhead Alternative. This alternative calls for a minimum of underground construction and is located along the H-1 alignment, an area with relatively high existing noise levels and some existing residences or residences under construction. Noise impacts from construction and operation would be negligible with appropriate mitigation, as discussed below.

H-1 Overhead/Underground Alternative. Under this alternative, noise impacts from construction would be of longer duration than for the H-1 Overhead alternative and are related to underground construction. However, these impacts would be of negligible magnitude with appropriate mitigation.

Farrington Overhead Alternative. This alternative calls for a minimum of underground construction and is located along the busy Farrington Highway corridor, with relatively high noise levels. Relatively more residences and sensitive receptors would be affected than with the above alternatives, but impacts would be of negligible magnitude with appropriate mitigation.

Farrington Overhead/Underground Alternative. Under this alternative, noise impacts from construction would be of longer duration than for the Farrington Overhead alternative because of underground construction. However, impacts would be of negligible magnitude with appropriate mitigation.

because of underground construction. However, impacts would be of negligible magnitude with appropriate mitigation.

OR&L Overhead/Underground Alternative. The OR&L corridor has the lowest ambient noise levels and would generate noise from construction of underground sections, roads, bridges, and pile foundations in areas of poor soils. Because the alignment lies near residences and sensitive receptors, it would impact a relatively large number of people. As with the other alternatives, however, noise impacts would be of short duration.

No Action Alternative. If the project were delayed or canceled and no action was taken, there would be no temporary or operational noise impacts in the project area.

Mitigation

Air Quality

- Contractors will be required 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 spell out the need to comply with this requirement.

Noise

- Drilled pier foundations will be used for installation of most of the poles along the selected alignment. These generate less noise than driven pile foundations.

- Contract provisions will spell out 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.

H. Cultural and Historic Resources

Environmental Setting

The cultural resources potential of the project area was surveyed early in the siting process for Parts 1 and 2. The survey was completed by an archaeologist working in cooperation with the state archaeologist and the state historian. In addition, a predictive model was used to identify areas of high, medium, or poor cultural resources recovery potential.

A total of 42 separate archaeological reports were on file at the Hawaii Department of Land and Natural Resources for the Part 1 and Part 2 study area. Of these, 17 were either reports on surveyed land containing no sites or were assessment reports, research designs, etc. The remaining 25 reports are listed in Table 5-15. Included are three districts on the National Register of Historic Places: Pearl Harbor Naval Base, Oneula Archeological District, and Barbers Point Archeological District. Only the Pearl Harbor Naval Base is within the Part 2 study area. The Pearl Harbor Naval Base is significant for its role in the start of United States involvement in World War II. The base represents an unknown number of individual sites on the National Register. Most of the Pearl Harbor Naval Base, however, has been developed in such a way that no surface archaeological features are likely to remain. At one time there were a number of historically significant fish ponds in the area. Most of these have been destroyed, although a few remain. None of these remaining ponds are near the proposed transmission line route alternatives.

There are also two sites within the Part 2 study area that are on the National Register but are not contained within a district boundary. These two sites are the Wakamiya Inari Shrine and the Tsoong Nyee Cook House. They are on the National Register because of their architectural excellence. The Dole House is also on the National Register, but it has been destroyed.

A third category of site within the study area on the National Register is the Oahu Railway and Land Company right-of-way, which is a long, narrow strip running the width of the study area. This right-of-way represents one of the last remaining examples of rail traffic in Hawaii. Shown in Figure 5-22 are the National Register sites and districts, recorded archaeological or historic sites, and petroglyphs within the Part 1 and Part 2 study area.

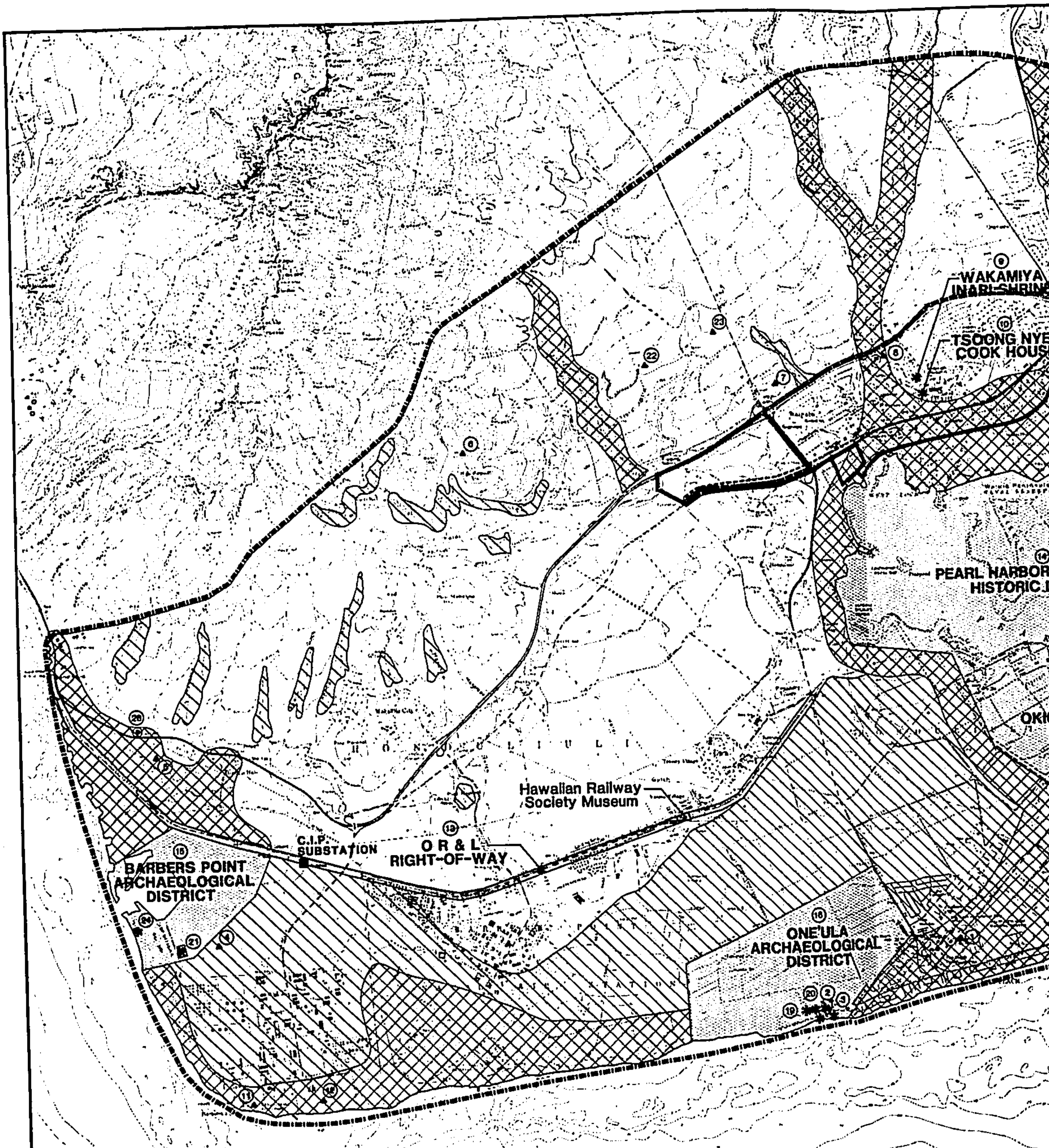
The predictive model was developed to assess the potential for the location of archaeological sites in the unsurveyed sections of the study area. Areas were determined to have high, medium, or low potential for containing cultural resources based on a review of the available ethnographic and ethnohistoric data and on comparisons with environmentally similar areas of Hawaii that had been surveyed for cultural resources.

Table 5-15 Historic Sites on File with State of Hawaii		
Report No.	Description	National Register of Historic Places
1	Fragmentary walls and enclosures; historic material	No
2	Oneula, 107 recorded features	Yes
3	Oneula, 8 sites; platform paved areas, shelters, platforms	Yes
4	14 sites; shelters, kilns, shrines, midden, enclosures	No
5	58 sites	No
6	No data available	No
7	No data available	No
8	23 petroglyphs, Barbers Point	No
9	Wakamiya Inari Shrine	Yes
10	Tsoong Nyee Cook House	Yes
11	No data available	No
12	No data available	No
13	OR&L right-of-way	Yes
14	Pearl Harbor Naval Base	Yes
15	Barbers Point Archaeological District	Yes
16	Oneula Archaeological District	Yes
17	No data available	No
18	No data available	No
19	No data available	No
20	No data available	No
21	No data available	No
22	No data available	No
23	No data available	No
24	Beach Midden Site	State of Hawaii Registered Site
25	Okiokiolepe Fishpond	Yes

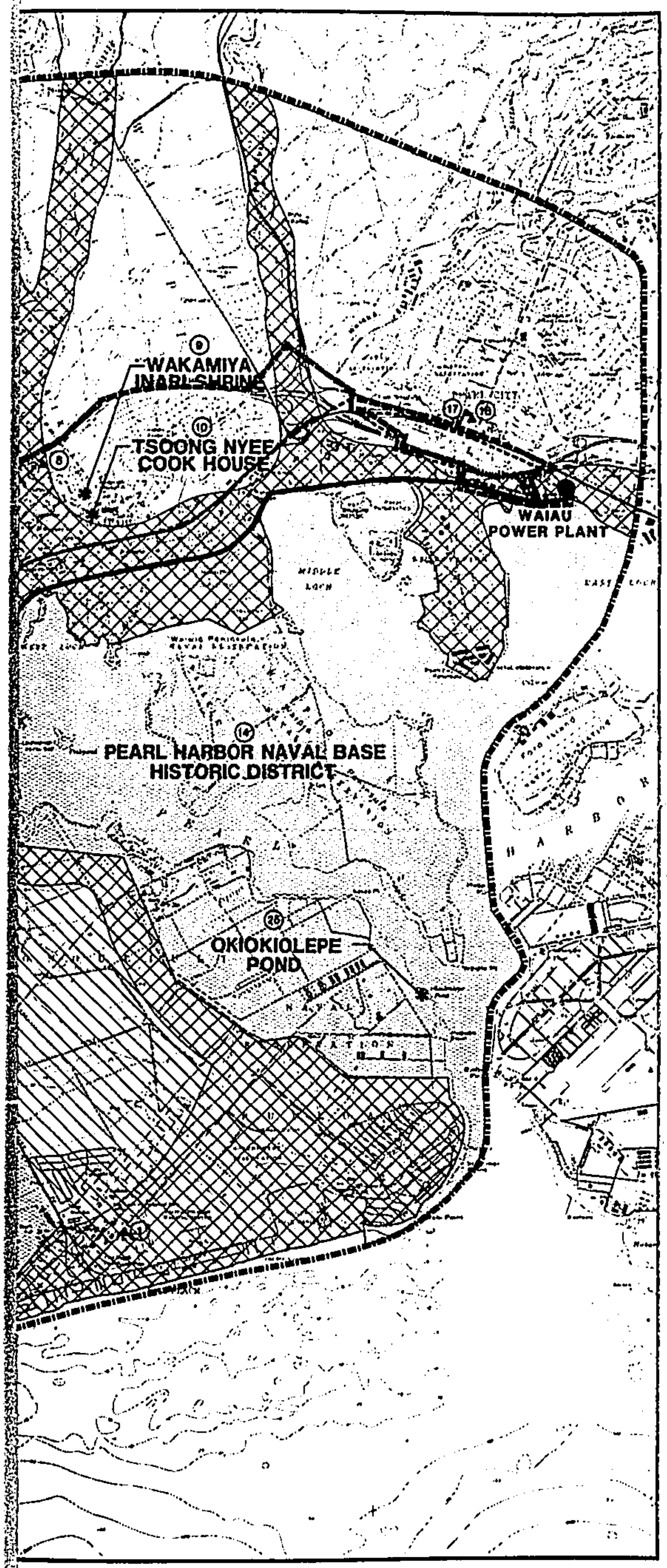
Probable Impacts

H-1 Overhead Alternative

The H-1 Overhead alternative should have no impacts on cultural or historic resources. No cultural resource sites are known to exist along the H-1 alignment. As shown in Figure 5-22, there are two unsurveyed areas with high cultural resource potential (approximately 1,500 linear feet each), and one unsurveyed area with medium resource potential (approximately 1,000 linear feet) crossed by the double-circuit portion of the proposed alignment. The makai circuit of the single-circuit segment at the easterly end is located adjacent to an unsurveyed area of high cultural resource potential. Even though these areas are designated as having high resource potential, they are highly urbanized or otherwise disturbed. As part of the routing study for this project, a brief field reconnaissance was conducted in the vacant portions of the area designated as having high



WAKAMIYA INARI SHRINE
TSOONG NYE COOK HOUSE
PEARL HARBOR HISTORIC
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
- H-1 Alternatives
- Farrington Alternatives
- OR & L Alternative
- Bike Path Option

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 5-22

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

cultural resource potential. This reconnaissance consisted of several transect sweeps on foot. No surface archaeological features were noted.

Under this alternative, construction would include only the placement of poles; no trenching is anticipated. The likelihood of finding subsurface archaeological remains is very low.

H-1 Overhead/Underground Alternative

Because of the subsurface excavation required, there is greater potential for adverse cultural resource impacts with underground placement of the transmission line. However, there are no known archaeological resources and no areas of high resource potential within the underground portion of the alignment. The two recorded sites shown in Figure 5-22 to be makai of H-1 (Nos. 17 and 18) are outside any area of potential disturbance. The potential impacts of the overhead portion of this alternative are exactly the same as those for the H-1 Overhead alternative.

Farrington Overhead Alternative

A significant length of the Farrington Overhead alternative crosses unsurveyed areas with high cultural resource potential (approximately 2.5 miles). There are no known cultural resource sites along the proposed alignment. Because this alternative is entirely overhead, the only potential area of impact is at pole locations. The relatively large area with high potential for cultural resources suggests that there is greater potential for adverse cultural resource impact under the Farrington Overhead alternative than under the H-1 Overhead alternative. However, the potential adverse impacts are still minimal under this alternative.

Farrington Underground Alternative

As discussed under the H-1 Overhead/Underground alternative, potential adverse cultural resource impacts associated with underground transmission lines are greater than with overhead lines. Most of the Farrington Underground alternative crosses through a highly developed area, where the surface has already been disturbed. A portion of the alignment through this developed area (approximately 2.5 miles) crosses through an unsurveyed area of high resource potential. There is some potential for cultural resources in this section.

OR&L Overhead/Underground Alternative

Much of the OR&L alignment crosses through areas identified as having high resource potential. Portions of this alignment are also located adjacent to the edge of the Pearl Harbor Naval Base Historic District. There are, however, no known historic or archaeological resources within the proposed alignment. This alternative follows an existing utility corridor and railroad right-of-way that has been previously filled and is considered disturbed. The portions of Pearl Harbor that are adjacent to the alignment have also been previously filled and disturbed. The only known cultural features within the Pearl Harbor Naval Base Historic District are far from this proposed alignment. Consequently, although this alignment passes through unsurveyed areas of high resource potential, the potential adverse impacts associated with the proposed transmission line are minimal.

No Action Alternative

Under the No Action alternative, there would be no change in existing conditions and no potential for cultural resource disturbance.

Mitigation

No adverse impacts to known archaeological or historical resources are anticipated from any of the proposed transmission line alternatives. In the vicinity of Pearl Harbor, because of the potential of subsurface historic sites, a qualified archaeologist should monitor trench excavation for underground lines that do not follow existing utility rights-of-way. This individual would record any site discovery, collect samples for analysis, and produce a report. For any of the alternatives, if previously undetected prehistoric or historic sites are found during transmission line construction, construction activity in the site area(s) will stop and the State Historic Preservation Officer will be contacted. Consultations with the State of Hawaii will determine what course of action will be taken if an unexpected site discovery is made. Field personnel involved in project construction will be informed about the potential for uncovering historic and/or prehistoric sites and about the proper procedures to follow if a previously unidentified site is discovered.

I. Public Services

Environmental Setting

Public services are located throughout the project area and are shown in Figures 5-1 through 5-3, Existing and Proposed Land Use. General public services, such as police and fire, are available to the project area. The most significant issue regarding these services is their proximity to the proposed transmission line.

Located at the westerly end of all proposed alternatives, on the makai side of the road, are the Kahi Mohala Psychiatric Hospital and the St. Francis Medical Center West. In the central portion of the project area along Farrington Highway are Waipahu Intermediate School, St. Joseph's School, and Waipahu High School, all along the makai side of the road. In the easterly segment of the project area are Lehua School, just makai of the OR&L alignment, and Pearl City Elementary School mauka of the mauka single-circuit alignment for H-1 and Farrington overhead alignments. A bike path begins at the east side of Lehua Avenue mauka of Lehua Elementary School and parallels the elevated section of H-1 freeway in an easterly direction to a point just east of the Waimano Stream, then heads southeasterly through the Waiau Power Plant site and beyond.

Probable Impacts

H-1 Alternatives

No significant impacts to public services are anticipated from the H-1 Overhead or Overhead/Underground alternatives. During the construction period, there would be minimal demand for temporary housing or other special services for temporary employees. Maintenance requirements would be minimal and should not significantly impact public services. Pearl City Elementary School is located mauka of Kamehameha Highway in the easterly segment of the H-1 Overhead alternative. Lehua Elementary School is located makai of H-1 by Lehua Avenue. The bike path option to the H-1 Overhead alternative would require that the bike path be closed temporarily during construction between Lehua Avenue and the Waiau Power Plant. The estimated time of closure would be one month. Construction and long-term impacts to public services along the proposed transmission line alignment are discussed in Sections A, C, and G of this chapter.

Farrington Alternatives

The impacts to public services of the Farrington alternatives, including the Farrington Overhead/bike path option, are similar to those of the H-1 alternatives. There are a number of public services located along the Farrington alignment, including: Kahi Mohala Psychiatric Hospital, St. Francis Medical Center West, Waipahu Intermediate and High Schools, St. Joseph's School, Pearl City Elementary School, and Lehua Elementary School. The impacts to these facilities are addressed elsewhere in Chapter 5.

OR&L Overhead/Underground Alternative

The impacts to public services of the OR&L Overhead/Underground alternative are similar to those of the H-1 and Farrington alternatives. Public service facilities located along the proposed OR&L alignment are Waipahu High School and Lehua Elementary School. At Lehua Avenue, the double-circuit transmission lines split into two single-circuit lines because of right-of-way restrictions and lack of space. One circuit will be placed underground, where there is an easement for 46 kV overhead lines mauka of Lehua Elementary School. The other single circuit will be an overhead one that follows Lehua Avenue to First Street, passes a fire station, then proceeds eastward along First Street to rejoin the other single-circuit line in the OR&L east of Lehua Elementary School. Land use, EMF, and noise impacts associated with this alternative are discussed in Sections A, C, and G of this chapter.

No Action Alternative

No adverse impacts to public services are associated with the No Action alternative. Under this alternative, there would be no construction or maintenance activities. The impacts associated with inadequate transmission capability are discussed in Section F of this chapter.

Mitigation

Because no significant impacts to public services are anticipated for any of the alternatives, no mitigation is necessary.

CHAPTER 6

Chapter 6

Relationship of the Proposed Project to Land Use Plans, Policies, and Controls

Land Use Designations

State Land Use Designation

The transmission line alternatives are principally located within the State Land Use Agricultural and Urban Districts and, according to the State Land Use Law (HRS Chapter 205), a transmission line is a permitted use in all of these districts. In a State Conservation District, however, a Conservation District Use Approval is required for a transmission line.

Only the OR&L alignment is adjacent to any areas identified as Conservation Land Use Districts: two areas have been noted as being in the Protective (P) Subzone. The position of the two Protective Subzone areas has been noted as "approximate only" and "subject to a current certified shoreline survey" in State Land Use Commission Boundary Interpretation No. 91-52, dated January 24, 1992. While the exact location of these Protective Subzone areas in relation to the OR&L alignment is "subject to a current certified shoreline survey," none of the other alternatives cross any land in the Conservation Land Use District.

County General Plan Designation

The City and County of Honolulu's General Plan land use designations are embodied in the Development Plan Land Use Map and Public Facilities Map.

All of the alternatives have the appropriate Development Plan land use designations and will require no Development Plan Land Use Amendments. According to the Department of General Planning, electric utility facilities that must be shown on the Development Plan Public Facilities Map are power generation facilities and major substations (personal communication, E. Connell, March 14, 1988). City Council Bill No. 13 would require that proposed 138 kV transmission lines be shown on the Public Facilities Map, except for transmission lines for which an application has been filed with the Public Utilities Commission prior to April 1, 1992. An application for the Waiau-CIP Part 2 Project was filed with the PUC on March 12, 1992.

The alternatives for the proposed project do not conflict with any elements of the City and County Development Plan Common Provisions or Special Provisions for the Primary Urban Center or the Ewa Development Plan areas.

County Zoning

The City and County of Honolulu zoning is administered through the Land Use Ordinance (LUO). The alternatives for the proposed project do not conflict with any elements of the LUO. The LUO, which establishes zoning for the city and county, provides for the siting of transmission lines as a Conditional Use, Type 1, in all land use districts in which the transmission line alternatives are located.

Conformance to Land Use Laws

Hawaii State Plan (Hawaii Revised Statutes [HRS] Chapter 226)

The portion of the Hawaii State Plan that is most directly relevant to the proposed project is Section 226-18, "Objectives and Policies for Facility Systems--Energy/Telecommunications," which reads as follows:

> (a) Planning for the State's facility systems with regard to energy/ telecommunications shall be directed towards the achievement of the following objectives:
>
> > (1) Dependable, efficient, and economical statewide energy and telecommunication systems capable of supporting the needs of the people.
>
> (b) To achieve the energy/telecommunication objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable power and telecommunication services to accommodate demand.

The proposed project supports these policies because the principal goal of the Waiau-CIP Transmission Line Part 2 Project is to ensure the dependable, efficient, and economic provision of electricity to growing demands on Oahu.

Section 226-18(C)(4) states that:

> (c) To further the energy objectives, it shall be the policy of this State to:
>
> > (4) Ensure that the development or expansion of power systems and sources adequately consider environmental, public health and safety concerns, and resource limitations.

Comprehensive planning and analysis support HECO's development of the project. The Routing Report and this Environmental Impact Statement (EIS) record the environmental, public health, safety, and other resource considerations that are fundamental to the planning of the project, the evaluation of alignment alternatives, and the selection of the preferred alignment.

The Routing Report and this EIS also document that this project complies with Section 226-11(b)(2-4), "Objectives and Policies for the Physical Environment--Land-Based, Shoreline, and Marine Resources":

> (b) To achieve the land-based, shoreline, and marine resource objectives, it shall be the policy of this State to:
>
> > (2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.
> >
> > (3) Take into account the physical attributes of the areas when planning and designing activities and facilities.
> >
> > (4) Manage natural resource and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

During the route selection process, water-based activities and natural areas along the shorelines were constraints to locating the transmission lines, whereas existing urban features of the study area were considered opportunities. For example, existing rights-of-way and linear facilities were considered an opportunity for siting the new line in order to minimize impacts on land resources.

State Energy Functional Plan

The State Energy Functional Plan (State of Hawaii, Department of Business, Economic Development and Tourism, 1991) addresses objectives, policies, and implementing actions in the following areas:

- Energy conservation and efficiency
- Alternate and renewable energy
- Energy education
- Legislation
- Integrated energy management

- Energy emergency preparedness

The proposed project does not conflict with any of the objectives, policies, or implementing actions of the State Energy Functional Plan, which addresses generation and conservation rather than transmission issues.

Coastal Zone Management Law, 1975

As part of the Hawaii Coastal Zone Management program, the City and County of Honolulu Department of Land Utilization (DLU) designates and administers the Special Management Area (SMA) along the coast of Oahu. Any "development, the valuation of which exceeds $125,000 or which may have substantial adverse environmental or ecological effect"[1] within the designated SMA requires an SMA Use Permit issued by the DLU and approved by the City Council.

Much of the OR&L Overhead/Underground alternative along the OR&L right-of-way, and the eastern portion of all the other alternatives in the vicinity of the Waiau Power Plant are located within the SMA. The Waiau Power Plant is located within the SMA (see Figure 6-1).

Section 33-3.2, "Review Guidelines," lists the following guidelines to be used by the City and County of Honolulu for developments proposed in the SMA:

(A) Adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas, and natural reserves is provided to the extent consistent with sound conservation principles.

The proposed transmission line alternatives will in no way impede access to beaches, recreation areas, or natural reserves. The line alternatives will be sited to avoid permanently affecting any rights-of-way for pedestrians or vehicles.

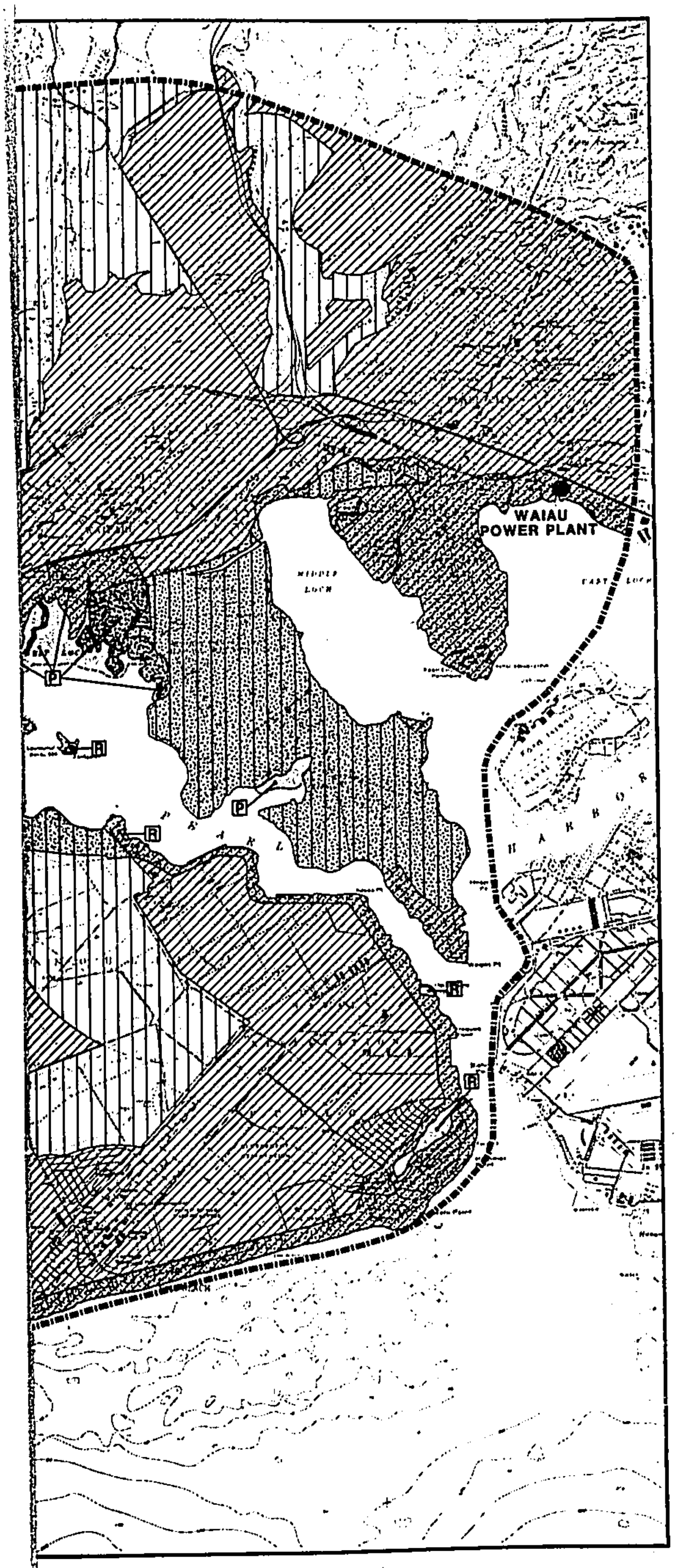
(B) Adequate and properly located public recreation areas and wildlife preserves are reserved.

The proposed transmission line alternatives are not consumptive uses of land. Uses that are compatible with transmission line safety and security, including recreation, will continue within the transmission line rights-of-way.

(C) Provisions are made for solid and liquid waste treatment, disposition, and management that will minimize adverse effects upon Special Management Area resources.

[1] Revised Ordinances of Honolulu, Section 33-1.3.

C.I.P.
SUBSTATION



LAND REGULATION

Study Area Boundary

STATE LAND USE DISTRICTS

Urban

Agricultural

Conservation [Protective (P) Subzone]

Conservation [Resource (R) Subzone]

COASTAL ZONE MANAGEMENT

Special Management Area

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 6-1

Waiau – Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL

The proposed transmission line alternatives will not generate solid or liquid waste other than any excess backfill from foundation excavations, which will be trucked to a landfill.

Coolants used for the underground transmission lines, when replaced, will be recycled or disposed of offsite according to Department of Health regulations.

(D) Alterations to existing land forms and vegetation, except crops, and construction shall cause minimum adverse effect to water resources and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

The proposed transmission lines will involve minimal alterations to existing landforms and vegetation. There will be minimal impact to water resources or to scenic and recreational amenities, and minimal danger of floods, erosion, or siltation. The project will require little or no fill or other major earthwork, so there will be no danger from landslides or failure in the event of earthquake. These issues are discussed in detail in Chapter 5.

(2) No development shall be approved unless the council has first found that:

(A) The development will not have substantial, adverse environmental or ecological effect except as such adverse effect is minimized to the extent practicable and clearly outweighed by public health and safety, or compelling public interest. Such adverse effect shall include, but not be limited to, the potential cumulative impact of individual developments, each one of which taken in itself might not have a substantial adverse effect, and that elimination of planning options.

This EIS reviews all potential adverse environmental impacts and demonstrates that adverse environmental or ecological effects are minimal.

(B) The development is consistent with the objectives and policies set forth in Section 33-3.1 and area guidelines contained in Section 205A-26, Hawaii Revised Statutes.

The objectives and policies cited in Section 33-3.2, Revised Ordinances of Honolulu "shall be those contained in Section 205A-2, Hawaii Revised Statutes." Section 205A-2 of the Hawaii Revised Statutes sets out the objectives and policies of the Coastal Zone Management program and the Special Management Areas.

(b) Objectives

(1) Recreational resources;

(A) Provide coastal recreational opportunities accessible to the public.

As described in Chapter 5, Section A, of this EIS, the proposed transmission line alternatives (except the OR&L and the bike path option of the H-I Overhead, the Farrington Overhead, and the OR&L) will not interfere with the use of any existing recreational areas or with the development of future recreational areas. The bike path option of the H-1 Overhead, Farrington Overhead, and OR&L alternatives would result in a temporary closure (approximately one month) of the bike path during construction of the transmission line in that area of all alternatives between Lehua Avenue and the Waiau Power Plant. Overhead lines along the OR&L would have visual impacts to users of a future bike path. The bike path option of the H-1 Overhead, Farrington Overhead, and OR&L alternatives would have visual impacts to users of the existing bike path between Lehua Avenue and the Waiau Power Plant.

(2) Historic resources;

(A) Protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

As discussed in Chapter 5, Section H, there will be no impacts to known cultural resource sites. There is a possibility of resource site discovery with any of the alternatives under consideration. A predictive model identified areas of high, medium, and low probability. If a resource site is discovered during construction, appropriate measures will be taken.

(3) Scenic and open space resources;

(A) Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

None of the proposed transmission line alternatives, except the OR&L Overhead/Underground alternative, will affect the use or quality of coastal scenic or open space resources identified as significant by the City and County of Honolulu.

The OR&L Overhead/Underground alternative, which is mostly in the SMA, will obscure coastal views from Waipahu Intermediate School, Waipahu High School, and Leeward Community College. These three areas were identified as significant stationary view areas in the City and County of Honolulu's *Coastal View Study.*

Where the other transmission line alternatives are within the SMA, the transmission lines are generally located adjacent to the H-1 freeway or Kamehameha Highway, and will generally use the alignment of existing 46 kV or 138 kV electric lines.

(4) Coastal Ecosystems;

(A) Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

As documented in Chapter 5, Section D of this EIS, a biological survey of the project area revealed few areas of natural plant or animal communities within or adjacent to all of the alternative alignments, except the OR&L alignment. The OR&L alignment is adjacent to wetland areas on the Waipio Peninsula and the Pearl City Peninsula. These wetland areas have been identified by federal and state agencies as habitats for four endangered species of waterbirds. No sensitive plant communities have been identified along the alternative alignments.

(5) Economic uses;

(A) Provide public or private facilities and improvements important to the State's economy in suitable locations.

As documented in Chapter 2 of this EIS, the project is essential for transmission system reliability and to serve local and islandwide loads.

(6) Coastal hazards;

(A) Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.

The alternatives for the proposed project are not located in any area subject to tsunami, storm waves, or erosion. All of the alternative alignments pass through areas susceptible to stream flooding (discussed in detail in Chapter 5, Section D). However, underground trench locations, foundation design, and pole locations will be selected in accordance with soil conditions, and to avoid areas susceptible to flooding.

(7) Managing Development;

(A) Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

The routing study process for this project included extensive public participation, including public workshops and presentations to neighborhood boards (as documented in Chapter 8 of the Part 2 Routing Report and in Chapter 11 of this EIS).

(c) Policies

(1) Recreational resources;

(A) Improve coordination and funding of coastal recreation planning and management

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

  (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

  (ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites and sandy beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

  (iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

  (iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

  (v) Encouraging expanded public recreational use of county, State and federally owned or controlled shoreline lands and waters having recreational value;

  (vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect and where feasible restore the recreational value of coastal waters;

  (vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, artificial reefs for surfing and fishing; and

  (viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of section 46-6.

Except for the OR&L alternative and the bike path option of the H-1 Overhead, the Farrington Overhead, and the OR&L alternatives, the transmission line alternatives will neither affect the use of any existing coastal recreational resources nor interfere with the development of new coastal recreational resources. The bike path option common to the H-1 Overhead, Farrington Overhead, and OR&L alternatives would result in a temporary closure (approximately one month) of the bike path during construction of the transmission line in the area of all alternatives between Lehua Avenue and the Waiau Power Plant. As described in Chapter 5, Section D, of this EIS, there will be no significant effects on coastal water quality.

(2) Historic resources;

(A) Identify and analyze significant archaeological resources;

(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

As noted in Chapter 5, Section H of this EIS, a cultural resources survey was conducted and predictive model run during the routing study process. There are no known cultural resource sites that will be adversely impacted by the proposed project. The predictive model identified areas of high, medium, and low probability for resource discovery. Although most of the proposed transmission line alignment is on land that has already been extensively disturbed, if any evidence of cultural resources is discovered during excavation for pole foundations or for the underground line, work will be interrupted until the extent and significance of the resource have been evaluated by an archaeologist.

(3) Scenic and open space resources

(A) Identify valued scenic resources in the coastal zone management area;

(B) Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(C) Preserve, maintain, and where desirable, improve and restore shoreline open space and scenic resources; and

(D) Encourage those developments which are not coastal dependent to locate in inland areas.

The visual impacts of the new transmission line are described in Chapter 5, Section B of this EIS. Views of the shoreline in the project area are few. The *Coastal View Study* identifies three significant stationary view areas within the study area: Waipahu Intermediate School, Waipahu High School, and Leeward Community College.

Only the OR&L alignment would affect the coastal views from these three areas. However, views of Pearl Harbor from these three areas should not be seriously affected by the OR&L alignment because transmission poles are widely spaced (300 to 600 feet).

The OR&L alternative could affect the enjoyment of shoreline open space.

(4) Coastal Ecosystems;

(A) Improve the technical basis for natural resource management;

(B) Preserve valuable coastal ecosystems of significant biological or economic importance

(C) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(D) Promote water quantity and quality planning and management practices which reflect the tolerance of freshwater and marine ecosystems and prohibit land and water uses which violate state water quality standards.

A biological resource survey of the project area (Chapter 5, Section D) identified few significant biological communities within the alternative alignments. The most significant and least disturbed vegetation occurs in the wetlands along the shores of the West, Middle, and East Lochs of Pearl Harbor. No stream channels are expected to be altered. Except for the potential adverse impacts to the wetland areas adjacent to the OR&L alignment, the proposed project is not expected to impact coastal water ecosystems or water quality.

(5) Economic uses;

(A) Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy;

(B) Insure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(i) Utilization of presently designated locations is not feasible;

(ii) Adverse environmental effects are minimized; and

(iii) Important to the State's economy.

The Routing Report documents the consideration of social, visual, and environmental impacts that guided the evaluation of alternative alignments and the selection of the preferred alignment. The proposed 138 kV transmission line will largely use the alignment of existing 46 kV electric lines.

(6) Coastal hazards;

(A) Develop and communicate adequate information on storm wave, tsunami, flood, erosion, and subsidence hazard;

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program;

(D) Prevent coastal flooding from inland projects.

The alignment alternatives are not located in any areas subject to storm waves or tsunami. Erosion-prone soils are found in three small areas of the H-1 alignments and one small area of the Farrington alignment. New poles will replace existing 46 kV poles, minimizing any new impacts.

All of the alternative alignments pass through areas susceptible to stream flooding, which is discussed in detail in Chapter 5, Section D. However, underground trench location, foundation design, and pole locations will be selected in accordance with soil conditions, and to avoid areas susceptible to flooding.

Poles or underground sections of the transmission line alternatives located in flood-prone areas will be designed and constructed to conform with the requirements of the Federal Flood Insurance Program. The project will not cause or contribute to coastal flooding.

(7) Managing development;

(A) Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development;

(B) Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements; and

(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

The routing study and EIS process for this project included extensive public participation, including public workshops and presentations to neighborhood boards (as documented in Chapter 8 of the Routing Report).

After incorporating by reference the objectives and policies contained in HRS Section 205A-2, Section 33-3.2 of the Revised Ordinances of Honolulu continues with the following guidelines:

(C) The development is consistent with the County General Plan, development plans, zoning and subdivision codes, and other applicable ordinances.

This chapter addresses plans, policies, codes, and other applicable ordinances, and demonstrates that the proposed project is consistent with them.

(3) The council shall seek to minimize, where reasonable:

(A) Dredging, filling, or otherwise altering any bay, estuary, salt marsh, river mouth, slough, or lagoon.

The proposed project will not involve dredging, nor is it expected to involve filling, nor will it otherwise affect any bay, estuary, salt marsh, river mouth, slough, or lagoon (see Chapter 5, Section D).

(B) Any development that would reduce the size of any beach or other area usable for public recreation.

The proposed project will not reduce the size of any beach or other area usable for public recreation (see Chapter 5, Section A).

(C) Any development that would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, portions of rivers and streams within the Special Management Area and the mean high tide line where there is no beach.

The proposed project will not reduce or impose restrictions on any of the lands cited in this paragraph of the SMA guidelines.

(D) Any development that would substantially interfere with or detract from the line of sight toward the sea from the state highway nearest the coast.

As discussed in Chapter 5, Section B, only the OR&L Overhead/Underground alternative, and a portion of all the other alternatives near the Waiau Power Plant would introduce structures between the state highways designated in the *Coastal View Study* nearest the shoreline (Farrington Highway and Kamehameha Highway) and Pearl Harbor. However, the new line will generally use the alignment of existing 46 kV electric lines, and the new line will not substantially detract from the shoreward views from the highway.

(E) Any development that would adversely affect water quality, existing areas of open water free of visible structures, existing and potential fisheries and fishing grounds, wildlife habitats, or potential or existing agricultural uses of land.

The alternative alignments, except for the OR&L alternative, are not expected to affect water quality, areas of open water free of visible structures, fisheries and fishing grounds, wildlife habitats, or agricultural land. Wildlife habitat for four endangered waterbird species adjacent to the OR&L alignment could be adversely impacted from project development activities. These issues are discussed in detail in Chapter 5.

County General Plan

The General Plan (City and County of Honolulu, Department of General Planning, 1988) objective that is most directly relevant to the proposed project is in Objective C, Policies 1 and 3, of "Transportation and Utilities":

<u>Objective C</u>: To maintain a high level of service for all utilities.

Policy 1: Maintain existing utility systems in order to avoid major breakdowns.

Policy 3: Plan for the timely and orderly expansion of utility systems.

The Waiau-CIP Transmission Line Part 2 Project is designed to increase the reliability of electric service to existing and future electrical customers, and thus supports this objective of the General Plan.

Objective D, Policy 4, of "Transportation and Utilities" is also relevant to the proposed project:

Objective D: To maintain transportation and utility systems that will help Oahu continue to be a desirable place to live and visit.

Policy 4: Evaluate the social, economic, and environmental impact of additions to the transportation and utility systems before they are constructed.

The Routing Report and this EIS document the extensive analysis of social, economic, and environmental impacts of the alternative alignments that contributed to selection of the preferred alignment.

Policy 5: Require the installation of underground utility lines wherever feasible.

HECO's distribution lines (12 kV) are commonly installed underground and, in some areas (such as downtown Honolulu and Waikiki), 46 kV lines are also installed underground. However, only a small section of HECO's 138 kV transmission system is underground (i.e., approximately 2 miles between the Iwilei Street and School Street Substations and the Archer Substation). Placing 138 kV lines underground involves extensive excavation and poses a greater risk to biological and cultural resources than an overhead line. Underground construction would also disrupt traffic longer than overhead construction. After the line is operational, locating and repairing faults would be more time-consuming, with greater disruption to traffic. The costs of constructing an underground line are also substantially higher than the costs of an overhead line, as described in Chapter 9. To the extent that this policy applies to 138 kV transmission lines, all alternatives with overhead lines would not meet this policy.

Chapter 4 of this EIS analyzes the underground options in detail. However, HECO does propose (subject to PUC approval) to place existing overhead 12 kV distribution lines underground, when feasible, wherever they are located along the same corridor as the proposed 138 kV transmission lines.

The General Plan chapter on "Natural Environment" includes several policies related to the proposed project:

> Objective A: To protect and preserve the natural environment.

All the transmission line alternatives are located on developed land. The OR&L alignment, although adjacent to wetland areas (Chapter 5, Section D), is still on areas previously developed. Other than the potential for short- and long-term adverse impacts to the wetlands adjacent to the OR&L alignment, the impacts of the proposed project on the natural environment will be minimal.

Objective B of "Natural Environment" addresses scenic views and natural resources:

> Objective B: To preserve and enhance the natural monuments and scenic views of Oahu for the benefit of both residents and visitors.
>
> > Policy 1: Protect the Island's well-known resources: its mountains and craters; forests and watershed areas; marshes, rivers, and streams; shoreline, fish ponds, and bays; and reefs and offshore islands.

Adverse effects on natural resources will be minimal because the preferred alignment is located on land that has already been developed and because the new line will generally replace or be adjacent to existing 46 kV poles.

> > Policy 2: Protect Oahu's scenic views, especially those seen from highly developed and heavily traveled areas.
> >
> > Policy 3: Locate roads, highway, and other public facilities and utilities in areas where they will least obstruct important views of the mountains and the sea.

The Waiau-CIP Part 2 138 kV Transmission Lines will be located in a highly urbanized area with few scenic or important views of the mountains and the sea. The principal views toward the sea are of Pearl Harbor. Within the study area, however, the shores of Pearl Harbor are largely developed and/or blocked from views along major roadways by development between the roadways and the shoreline. Chapter 5, Section B of this EIS describes potential visual impacts of the project.

Objective A of "Physical Development and Urban Design" addresses planning for development:

> Objective A: To coordinate changes in the physical environment of Oahu to ensure that all new developments are timely, well designed, and appropriate for the areas in which they will be developed.

Policy 1: Plan for the construction of new public facilities and utilities in the various parts of the island according to the following order or priority: first, in the primary urban center; second, in Ewa; and third, in the urban fringe and rural areas.

The proposed project is located in the Primary Urban Center and the Ewa development plan areas. The purpose of the project is to provide reliable electric service to the Primary Urban Center and to the Ewa development plan areas, as well as to other load centers on Oahu.

Necessary Permits and Approvals

This section discusses the federal, state, and county discretionary permits or authorizations that may be required because of the location or design of the Waiau-CIP Transmission Line Part 2 Project (Table 6-1). It also identifies permits and approvals that are not required because the preferred alignment avoids areas where constructing the line would trigger the requirement. Routine construction permits are not discussed here.

Federal Permits and Approvals

The H-1 Overhead and H-1 Overhead/Underground alternatives would use the alignment of existing transmission lines crossing Waiawa Stream, and the poles of the new lines would replace the poles of existing lines. Construction will not alter any existing stream channels and will not affect the navigable waters of the United States. Consultation with a representative of the U.S. Army Corps of Engineers permit branch indicates that Sections 10/404 are not applicable. The Corps will provide formal written confirmation after review of conceptual plans for the stream crossing points (personal communication, W. Kanai, 1989).

Consultation with a representative of the Department of Transportation Airports Division indicates that the routing for all the alternatives will not require approval under Federal Aviation Administration (FAA) Advisory Circular 70/7460-1G, Chapters 4, 5, and 9. The circular governs objects penetrating the air interference zone within navigation facilities (personal communication, H. Sumida, 1988).

The Federal Highway Administration (FHWA) U.S. Department of Transportation rules (23 CFR Part 645 Subpart B) allows the State of Hawaii Department of Transportation to act as lead agency to permit utilities to use or occupy the right-of-way of a federal-aid highway project, as long as the proposed installation is in accordance with 23 CFR Part 645 Subpart B and the State of Hawaii Department of Transportation's utility accommodation policy approved by FHWA. Prior FHWA approval is required only if the proposed project is inconsistent with FHWA and State Department of Transportation rules or policies, or if the proposed project involves specific special cases or private lines. FHWA approval may be required to place poles in the H-1 freeway right-of-way as proposed for the H-1 alternatives.

Table 6-1
Potential Permits/Approvals Required for Transmission Line Alternatives

Authorizing Agency	Permit/Approval	Alternative: H-1 Overhead	H-1 Overhead/ Underground	Farrington Overhead	Farrington Underground	OR&L Overhead/ Underground
Federal						
U.S. Army Corps of Engineers	General Permit/Section 10 Permit	P	P	P	P	P
U.S. Army Corps of Engineers	Section 404 Permit					P
Federal Highway Administration	Use of Freeway Right-of-Way (concurrence with State DOT)	Y	Y			
Council on Environmental Quality	NEPA Compliance	P	P	P	P	Y
U.S. Navy	Use of Federal Lands	Y		Y		Y
Coast Guard	Bridge Permit					P
State						
Office of State Planning	Coastal Zone Management (CZM) Federal Consistency	P	P	P	P	P
Department of Health	Variance from Community Noise Control Rules	Y	Y	Y	Y	Y
Department of Land and Natural Resources	Historic Site					P
	Stream Channel Alteration Permit					P
	Use of State Lands	Y	Y	Y	Y	Y
	Conservation District Use Permit					P
Department of Transportation	Use of Energy Corridor					Y
	Work on State Highways	Y	Y	Y	Y	Y
	Freeway Crossing of Utility Line	Y	Y	Y	Y	
	Use of Freeway Right-of-Way	Y	Y			

Y = Yes, permit probably required.
P = Permit potentially required, depending on location of alignment.

Table 6-1
Potential Permits/Approvals Required for Transmission Line Alternatives

Authorizing Agency	Permit/Approval	Alternative: H-1 Overhead	H-1 Overhead/ Underground	Farrington Overhead	Farrington Underground	OR&L Overhead/ Underground
State (continued)						
Office of Environmental Quality Control	State Environmental Impact Statement Law Compliance	Y	Y	Y		Y
Public Utilities Commission	Approval for Construction in Residential Area	Y	Y	Y	Y	Y
	Exemption from Requirements Relating to Conflicting Lines					
	Approval of Capital Expenditure Exceeding $500,000	Y	Y	Y	Y	Y
City/County						
Department of Land Utilization	Conditional Use Permit, Type 1	Y	Y	Y	Y	Y
	Shoreline Setback Variance					Y
	SMA Use Permit	Y	Y	Y	Y	Y
Public Works Department	Construction within County Road ROW	Y	Y	Y	Y	Y
Department of Transportation Services	Street Usage Permit	Y	Y	Y	Y	Y

Y = Yes, permit probably required.
P = Permit potentially required, depending on location of alignment.

In the OR&L alternative (reconstruction of bridges along the OR&L right-of-way), federal law prohibits the reconstruction of bridges across a navigable waterway of the United States without a Coast Guard permit. For Coast Guard purposes, a navigable waterway is defined as: (1) a waterway which is subject to the ebb and flow of the tide, or (2) any waterway which is presently used or is susceptible to use in its natural condition, or by reasonable improvement, as a means to transport interstate or foreign commerce. The waterways under the bridges in the OR&L alternative may be subject to tidal influence; a Coast Guard Bridge Permit may be required for the reconstruction of the bridges in the OR&L alternative.

State Permits and Approvals

All of the transmission line alternatives will be developed within areas designated by the state as part of the Agricultural and Urban Districts. The project will not require any changes to the state's Land Use Boundaries.

Segments of some alternatives will require the transmission lines to overhang state highways and will require a Permit to Perform Work within a State Highway and "Extreme Case Exemption for Freeway Crossing of Utility Line." The permits are administrative authorizations issued by the Department of Transportation Highways Division. Published notice and a public hearing are not required. Consultation with the Highways Division indicates that compliance with Hawaii Revised Statutes Chapter 343 is a prerequisite to actions on the permits. This EIS has been prepared to meet this requirement.

Portions of the OR&L alignment parallel the boundary of the Pearl Harbor Historic District, which is on both the state and federal registers of historic places. The Department of Land and Natural Resources Historic Preservation Program is responsible for the review of construction in the vicinity of a site that is listed on either the state or the federal register. The state's review requires notice of intention to work on a site 90 days in advance, as well as submittal of plans depicting the nature of the proposed construction and the location with respect to any sites on the state or federal register. Construction plans will be submitted to the Department of Land and Natural Resources for review and comment.

Because portions of the alternative alignments crossing Waikele and Waiawa Streams will use the alignment of existing lines, and because the new line is not expected to alter any existing stream channels, the project is not expected to require a Stream Channel Alteration Permit.

The OR&L alignment crosses the state Energy Corridor. The Department of Transportation Harbors Division, which has jurisdiction over the Energy Corridor, must review the project before construction begins.

No portion of the project is proposed to be in the state's Conservation Land Use District; therefore, a Conservation District Use Application (CDUA) will not be required. However, the exact relationship of two Protective Subzones in the Conservation District to the OR&L

alignment, and whether these subzone areas impact the OR&L alignment, are "subject to a current certified shoreline survey" that has not yet been done. A CDUA could be required for the OR&L alternative.

The state's Coastal Zone Management Consistency Review would be necessary only if federal approvals are required.

The Department of Health Administrative Rules (Chapter 43, Community Noise Control for Oahu) specify that daytime noise levels must not exceed 55 dBA in areas zoned Residential and 60 dBA in areas zone Apartment. Because noise in excess of 60 dBA may be generated during construction in areas that are zoned Apartment or Residential, a noise variance will be required. The noise variance is issued by the State Department of Health within 30 days of application.

State Public Utilities Commission (PUC) authorization under PUC General Order 7 is required for the project because the construction cost exceeds $500,000. HECO will need PUC approval for underground placement of 12 kV distribution lines and service connections because such placement is counter to HECO tariff conditions, which conform to PUC General Order No. 7. PUC approval is also required for construction of a utility line 46 kV and above within a residential area. The PUC's consideration of the project will follow all other federal, state, and county approvals affecting the design and location of the project.

County Permits and Approvals

All of the alternatives have the appropriate county land use designations and will not require any amendments to the county's General Plan or zoning.

A county SMA Permit will be required for portions of all of the alternatives because they are all within the SMA established under the Coastal Zone Management Program. The permit application is submitted to and reviewed and processed by the Department of Land Utilization. The Department of Land Utilization will forward its recommendation to the City Council, which is the approving authority.

A City and County of Honolulu Conditional Use Permit, Type I, is required for 138 kV lines, substations, power generation, and base yards in either urban or agricultural districts. Type I permit applications do not require a public hearing. Action on the SMA Permit must precede action on the Conditional Use Permit.

Segments of each alternative will require the placement of transmission line poles or underground lines within county-owned rights-of-way along country roadways and will require a Street Usage Permit and a Permit to Construct within a County Road Right-of-Way. The Street Usage Permit is an administrative authorization issued by the county's Department of Transportation Services after review of construction plans and proposed traffic control measures. The Permit to Construct within a County Road Right-of-Way (also known as a trenching or excavation permit) is an administrative authorization issued by the City and County of Honolulu Department of Public Works after review of construction plans by the Department of Land Utilization, the Board of Water Supply, the Department of Transportation Services, and utilities. Consultation with a representative of the Department of Public Works indicates that its review may be conducted concurrently with the Department of Land Utilization's processing of the Conditional Use Permit, with the action on the Public Works Permit following action on the Conditional Use Permit.

A City and County of Honolulu Shoreline Setback Variance may be required for the OR&L Overhead/Underground alternative, if any portion of the alternative is located within the area 40 feet mauka of the shoreline. A current certified shoreline survey, which has not yet been done, will determine whether the line is within the 40-foot shoreline setback. If a Shoreline Setback Variance is required, it will be included in the SMA permit processing, with the City Council as the approval authority.

CHAPTER 7

Chapter 7
Irreversible and Irretrievable Commitments of Resources and the Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Irreversible and Irretrievable Commitments of Resources

The proposed Waiau-Campbell Industrial Park 138 kV transmission lines will require the irreversible and irretrievable commitment of a number of resources. These resources include the materials, capital, labor, and energy needed to plan, construct, operate, and maintain the transmission lines.

The commitment of land area within any of the alignments will not necessarily be irreversible and irretrievable. Permanent land uses under overhead lines are severely restricted; however, since overhead lines are underbuilt in most locations, no new restrictions will be imposed. Underground lines also restrict the use of land lying over them, but permanent existing land uses will remain as they are, since alignments generally run along existing utility corridors. The land consumed by new lines will be subject to land use restrictions for the life of the improvements. It is likely the selected alignment will not be relocated, and therefore will be committed to this use.

Implementation of the proposed project will not result in the significant loss of natural or cultural resources. Although impacts to endangered wildlife species could potentially occur, such impacts are avoidable.

The Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Residents, businesses, and industry will continue to require electricity for an indefinite time into the future. Transmission lines are a necessary means of distributing electricity from its source to its area of use. The use of electricity on the Island of Oahu requires use of a separate transmission corridor in order to prevent major system outages. Because the availability of a reliable energy source is critical to so many activities, there is a direct relation between a properly functioning electrical transmission system and long-term productivity.

Because the power producers in the Campbell Industrial Park represent an important contribution to the island's generating capacity, the ability to send this power through the system is crucial in order to maintain long-term productivity.

The proposed project will not necessarily result in a significant loss of environmental resources. One alternative, however, the OR&L Overhead/Underground alternative, would probably have significant environmental impacts.

CHAPTER 8

Chapter 8
Unavoidable Adverse Impacts

Each of the alternatives evaluated in this EIS has some adverse impacts associated with its implementation. Many of these impacts can be mitigated. Shown in Table 8-1 is a summary of the unavoidable adverse impacts associated with each alternative.

Table 8-1
Summary of Unavoidable Adverse Impacts

Resource	H-1 Overhead Alternative	H-1 Overhead/ Underground Alternative	Farrington Overhead Alternative	Farrington Underground Alternative	OR&L Overhead/ Underground Alternative	No Action Alternative
Interference with views of ocean from hillside	X	X	X			
Disruption of coastal views within SMA					X	
Interference with traffic on Farrington Highway			X	X	X	
Interference with traffic on Kamehameha Highway	X	X	X	X		
Potential liability associated with oil pipelines and old landfill					X	
Soil contamination					X	
Potential impact to sensitive species habitat from hazardous material contamination					X	
High potential of cultural resource discovery			X	X	X	
Presence of EMF	X	X	X	X	X	
Increased potential for interruption of power; blackouts						X

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CHAPTER 9

Chapter 9
Summary of Unresolved Issues

Public Health Impacts from Electric and Magnetic Fields

According to a comprehensive background paper on the biological effects of electric and magnetic fields (Carnegie Mellon University, 1989), scientists do not yet know what attributes of electric and magnetic fields could produce adverse public health effects.

The 1989 paper noted that the simple assumption that "more is worse" may not be true, and, consequently, a simple standard for a maximum limit to magnetic and electric field strengths "cannot be adequately supported by the science that is now available." The paper also stated:

> 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.

The paper considered the public health policy question, and what should be done given our present knowledge. The paper suggested three possible courses of action:

- **Do Nothing.** Conclude that there is not yet enough evidence to warrant any action.
- **Prudent Avoidance.** Adopt strategies that 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, while recognizing that we may eventually learn that some or all of this effort and money has been wasted.

On April 3, 1991, the Hawaii State Department of Health issued a policy relating to electromagnetic 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.

HECO has adopted strategies consistent with the "prudent avoidance" approach in routing and designing the Waiau-CIP Transmission Line Part 2 Project. Land uses along the alternatives were evaluated with the prudent avoidance strategy in mind. For example, residential areas were avoided to the extent practical. Recognizing that none of the alternative routes could avoid every residential area, 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 is in contrast to the normal "like phasing" of transmission lines. Placement of the 138 kV lines underground would eliminate public exposure to electric fields, but not magnetic fields (see section 5.C). Technically, therefore, undergrounding of 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 upon a smaller neighborhood within that community, the question of social equity arises. 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 some members of the community as such facilities. Local neighborhood objections are largely related to visual concerns. In the Waipahu and Pearl City sections, for instance, the major roadways are lined with numerous overhead transmission and distribution lines and poles. Members of the public sometimes make comparisons with other neighborhoods that do not have a lot of roadside transmission lines and poles. 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.

There are those in the community who 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 Public Utilities Commission 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 neighborhood through which the lines pass. This is especially true if a less expensive overhead line is a viable option.

The construction costs of alternative alignments for the Waiau-CIP 138 kV Transmission Line Part 2 Project, including an all-underground alternative (Farrington Underground) and an all-overhead alternative (H-1 Overhead), are shown on Table 9-1. If the cost of the all-underground alternative were passed on to ratepayers, then the average residential customer that consumes 600 kilowatt-hours per month would pay an additional $2.10 per month in electric service cost. This is an estimate; the actual rate increase would depend on the Public Utilities Commission's decision.

A decision to have ratepayers bear the cost of placing the project's 138 kV transmission line underground could set a precedent for placing all electrical lines underground. A few years ago, the City's Chief Engineer 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.

Table 9-1
Estimated Capital Costs of Alignment Alternatives

Cost Component	Alignment Alternative				
	OR&L Overhead/ Underground	Farrington Overhead	Farrington Underground	H-1 Overhead/ Underground	H-1 Overhead
138 kV overhead system	$34,130,800	$22,333,500	N/A	$12,929,000	$25,081,800
138 kV underground system	$19,731,200	N/A	$118,936,600	$31,425,600	N/A
12 kV distribution line underground placement along Farrington Highway	N/A	$12,000,000	N/A	N/A	N/A
12 kV distribution line underground placement along Kamehameha Highway	N/A	$6,204,000	N/A	N/A	$6,204,000
138 kV overhead to underground transition station	N/A	N/A	$10,400,000	$10,400,000	N/A
Total alternative alignment cost	$53,862,000	$40,537,500	$129,336,600	$54,754,600	$31,285,800

Note: Easement acquisition costs not included.

Table 9-2
Comparison of Estimated Operation and Maintenance Present-Value Costs of Overhead and Underground 138 kV Lines

Cost Component	Overhead 138 kV Lines	Underground 138 kV Lines
Routine operation	$0	$120,000
Routine maintenance	$200,000	$420,000
Normal system losses	$4,210,000	$3,992,000
Total	$4,410,000	$4,532,000

Source: HECO Engineering.
Notes: The estimated cost per occurrence for emergency repairs ranges from $1,000 to $200,000 for overhead lines and from $25,000 to $500,000 for underground lines. Present value equals the annual costs over the expected life of the facility discounted to present dollars.

In order to improve visual quality along the alternative alignments that are along Kamehameha and Farrington Highways, HECO has asked the Public Utilities Commission to approve the underground placement of the existing 12 kV and secondary distribution lines and services in certain locations. Underground placement of the 12 kV and secondary distribution lines, and underbuilding of existing 46 kV subtransmission lines on the same pole as the 138 kV transmission line, will reduce visual clutter at the pedestrian level.

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 10

Chapter 10
Preparers of the EIS

Paul Luersen	Project Manager; prepared summary of Electric and Magnetic Fields section of the EIS. M.S. in City and Regional Planning. Project management and EIS preparation experience, 16 years.
Leslie Howell	Assistant Project Manager; prepared Summary; Chapters 2, 3, 4, and 8; and Cultural Resources and Public Services sections of the document. B.A. in Geography and Environmental Studies. Project management and EIS experience, 13 years.
Bennett Mark	Prepared Land Use, Visual, and Transportation and Traffic sections and Chapters 6, 9, and 11 of the document. M.S. in Civil Engineering. Environmental studies, land use planning, and regulatory affairs experience, 15 years.
David Kmetovic	Prepared Utilities, Pipelines, and Hazardous Waste and Air Quality and Noise sections and Chapter 7 of the document. B.S. in Natural Resources. Environmental analysis experience, 16 years.
Jane Hart	Prepared Biology, Water, and Soil Resources section of the document. B.S. in Botany. Natural resources experience, 6 years.
Jim Cox	Performed senior review in Cultural Resources section. B.S. in Anthropology. Archaeological excavation, cultural resource survey, and National Register evaluation experience, 11 years.
Michelle Girts	Performed senior review in Biology, Water, and Soil Resources section of the document. M.S. in Biology. Environmental science experience, 12 years.
Carol Plambeck	Document Editor. B.A. in History. Editorial experience, 17 years.
Michael Silva	Enertech Consultants; prepared technical report on Electric and Magnetic Fields. M.S. in Engineering and 20 years of experience related to EMF research.

CHAPTER 11

Chapter 11
Comments During the Consultation Period

Consulted Parties

The Environmental Impact Statement Preparation Notice (EISPN) for the proposed Waiau-CIP Transmission Line Part 2 Project was published in the *OEQC Bulletin* on January 8, 1992. The 30-day review period, announced in the *OEQC Bulletin*, ended on February 7, 1992.

The following agencies and individuals responded to the EISPN within the 30-day review period. The letters are included in Appendix C.

- Federal: none
- State: none
- City and County of Honolulu: Department of General Planning
- Individuals and Organizations: AMFAC/JMB Hawaii, Inc.

There were no responses received within the 30-day review period that indicated "no comment."

Public Information Meeting

A public information meeting was held on February 4, 1992, at Pearl City High School. About 40 people attended this meeting.

Approximately 425 invitation letters were mailed to elected officials, agencies, individuals, and community leaders on January 21, 1992, inviting them to the public information meeting. The letter indicated that an EIS was being prepared for the project and that comments on what the EIS should address would be accepted at the meeting. Meeting attendees were also given the opportunity to mail in EIS concerns to HECO by February 12 on a pre-addressed form provided at the meeting. All those who signed in at the meeting will be notified of the EIS's availability and locations for review.

On January 29, 1992, HECO sent out the fifth in a series of newsletters on the Waiau-CIP Transmission Line Part 2 Project. About 390 newsletters were sent to elected officials, agencies, individuals, and community organizations on an updated mailing list. The newsletter included information on the February 4, 1992, public information meeting and described:

- 1991 preferred alignment for Part 2

- Need for the project

- Route selection process and HECO's consideration of environmental, land use, community, agency, and engineering concerns

- Required permits

- Opportunities for future public input to the agency decision-making process and the EIS

- Responses to public concerns about electric and magnetic fields, visual impacts, and alternatives considered (including underground lines and a submarine cable)

- Project schedule

A newspaper advertisement announcing the public meeting was published in the *Central Sun Press* and in the *Sunday Honolulu Star Bulletin and Advertiser.* Publication dates were January 30 and February 2, 1992.

Previous Public and Agency Consultation

An extensive public and agency consultation process began in June 1987. This consultation process included meeting with elected officials; neighborhood boards; community and service organizations; community leaders; major landowners; federal, state, and City and County of Honolulu personnel; media; and the general public. A description of the public and agency consultation program, and the concerns that surfaced during this process, is included in Appendix D.

Summary of Consultation Comments

The following list summarizes comments related to the scope of the EIS:

- Discuss the potential effects of electric and magnetic fields on human health, radio and television reception, etc.

- Discuss the advantages and disadvantages of underground lines as an alternative to overhead lines.

- Discuss the social equity issues of why the affected communities through which the lines will pass (Waipahu/Village Park and Pearl City) must bear the burden of project impacts while other communities that benefit from more reliable service do not bear any impacts. Is it worthwhile to the ratepayers to pay the extra cost for placing the lines underground?

- Discuss the safety of motorists on the freeway and highways.
- Are underground lines more reliable than overhead lines because they are better protected from natural disasters (e.g., floods, hurricanes, fires)?
- What are the visual impacts of overhead lines?
- How would overhead lines impact existing and proposed land uses?
- Discuss the potential conflicts of the preferred alternative and the City's proposed rapid transit line
- What are the potential impacts to natural resources, including wetlands, wildlife habitat, and protected species?
- Would the preferred alternative adversely affect State Conservation Land Use District lands and historic/cultural sites?
- What permits and approvals are required for construction?

CHAPTER 12

Chapter 12
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APPENDIX A

Appendix A

Glossary

Access road	A route for vehicular travel extending across private or governmental land from a public road to utility facilities. Generally, easements are acquired on existing roads. If no suitable road exists, new roads are connected.
Aesthetics	The science and art of protecting and helping to create that which is beautiful, attractive, and pleasant.
Alignment	A strip of land varying in width up to 100 feet in which a transmission line right-of-way could be located. One or more alignments could be located within a single corridor.
Alluvium	Clay, silt, sand, or gravel sediments deposited by flowing watercourses, or landforms originated by flowing watercourses.
Alternating current (AC)	An electric current that reverses its direction of flow periodically, as contrasted with direct current.
Ambient	Surrounding on all sides; encompassing.
Ampacity	The capacity of a conductor, expressed in amperes.
Ampere	The basic unit of rate of electric current flow.
Aquifer	A water-bearing stratum of permeable rock, sand, or gravel.
Arcing	Discharging electric current so that it crosses a gap between two electrodes.
Backfill	Earth or other material that has been used to refill a ditch or trench; also, the act of refilling a ditch or trench.
Boring	A hole made by sinking a shaft or tunneling underground.
British thermal unit (Btu)	The standard unit for measuring a quantity of heat energy such as the heat content of fuel. It is the amount of heat energy necessary to raise the temperature of 1 pound of water 1°F.
Bundled	Having an assembly of two or more subconductors that operate in a single phase, used as a single conductor.

Cable	A conductor with insulation, a stranded conductor with or without insulation and other covering (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).
Capability	The maximum amount of electric power demand that a generating station or other piece of electrical equipment can carry under specified conditions for a given period.
Capacity	The amount of electric power for which a generating unit, generating station, or other electrical apparatus is rated either by the user or manufacturer.
Cathodic protection equipment	Electrical equipment designed to supply a negative voltage to buried cable systems and other lines for protection against corrosion.
Circuit	A configuration of electrically connected devices permitting the flow of an electric current. The term single circuit in this report means one three-phase circuit composed of three sets of one or two conductors, each corresponding to a different phase. Double circuit means two three-phase circuits. Most often, circuits operate independently of one another.
Combined cycle plant	An electric generating plant using one source of energy to drive two types of turbines: a combustion turbine and a steam turbine. Waste heat from the combustion cycle provides heat energy to the boiler of the steam cycle. Each cycle generates electricity.
Combustion turbine	An electric generating station in which the prime mover is a gas turbine engine.
Conductor	Wire(s), cable, or bus bar suitable for carrying an electric current. The metal employed is usually copper or aluminum.
Corona	A luminous electrical discharge that appears around transmission line conductors when the air adjacent to the conductor is ionized (electrically charged) as a result of the applied potential exceeding a certain critical value. Corona can be seen as bluish tufts or streamers surrounding the conductor, usually accompanied by an audible hissing sound. Transmission line corona varies with atmospheric conditions, being more intense during wet weather.

Corridor	A broad strip of land (varying between 1/4 and 1/2 mile wide in most cases) that could contain one or more transmission line alignments connecting two termini.
Dead-end tower	A heavily reinforced transmission tower structure that can withstand unusually high pulling forces. Used at angle points, river and canyon crossings, and at substation entry and exit points.
Demand	The rate at which electric energy is delivered, usually expressed in kilowatts, at a given instant or averaged over a designated period.
Dielectric	Material with electrical insulating properties.
Direct current (DC)	Electricity that flows continuously in one direction, as contrasted with alternating current.
Distribution	The delivery of electric energy to customers on the *distribution system* (12 kV and below voltage).
Easement	An interest in land owned by another that entitles the holder to a specific limited use or enjoyment. A limited right to do certain specified actions on another's property.
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 household appliances and transmission lines, creates electric and magnetic fields.
Firm capacity	A predetermined quantity of power that is offered to customers under contracts guaranteeing no interruption.
Floodplain	Level land that may be submerged by floodwaters. Often, a plain built up by stream deposition.
Fluid-filled self-contained cable	A paper-insulated cable impregnated with a dielectric fluid that is encased in a moisture-impervious jacket at the factory and maintained under low pressure through a hollow core in the conductor. The cable as it comes from the factory needs no additional protective jacket; hence, the name self-contained.
Gauss (G)	A unit used in measuring magnetic induction or magnetic flux per square centimeter. The magnetic field of the earth is approximately 1/2 gauss.

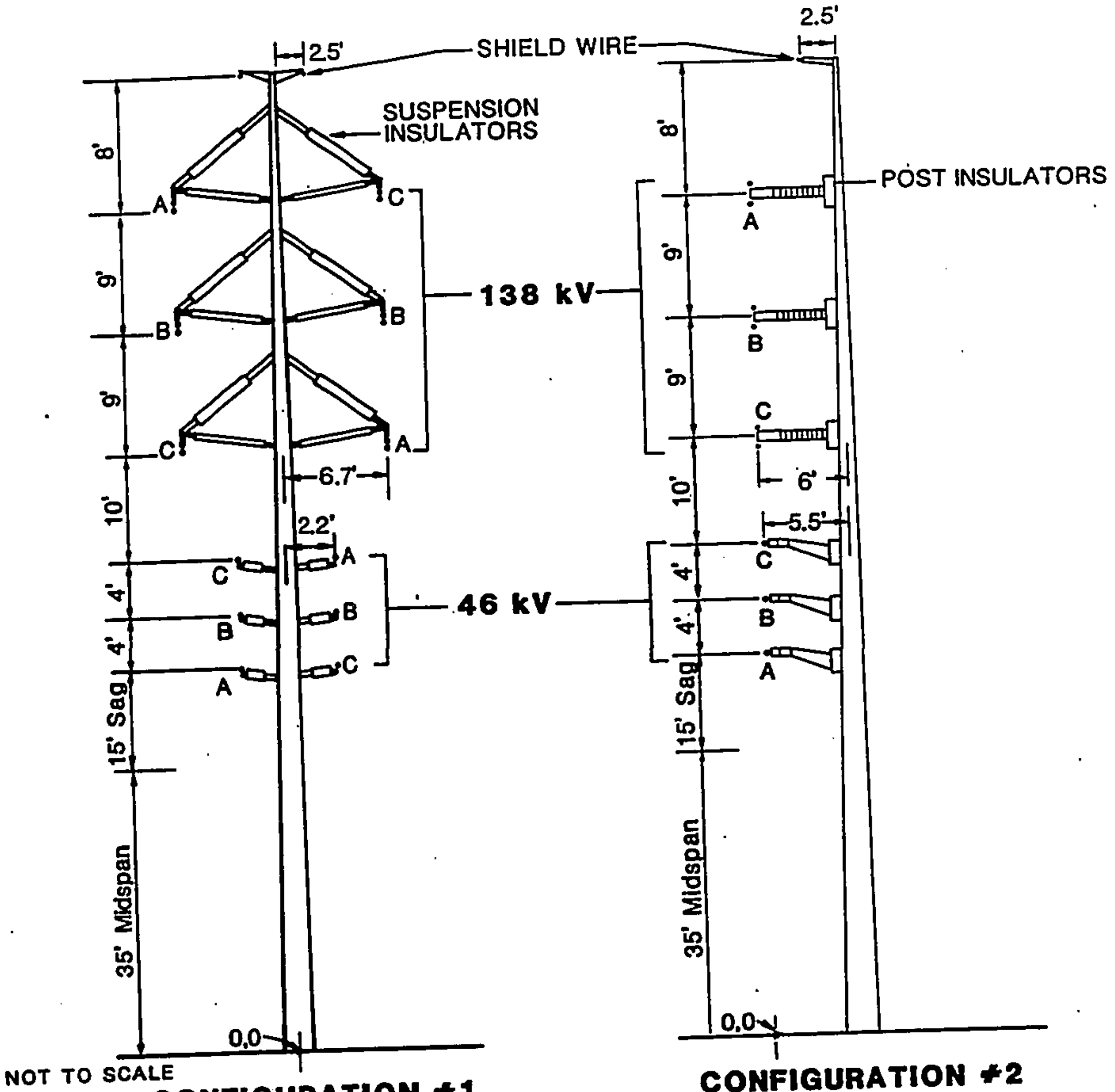
High-pressure fluid-filled (HPFF)	High-pressure fluid-filled pipe-type cable system in which three paper-insulated cables are placed in a pipe and pressurized with a dielectric fluid.
Impulsive sound	A peak noise level of short duration.
Insulation	Material having a high resistance to the flow of electric current, to prevent leakage of current from a conductor.
Insulator (string)	The device connecting conductors to transmission towers, which also insulates the conductors from one another, the tower, or other grounded surfaces.
Intermittent	Referring to streams that are dry during nonrainy seasons.
kilovolt (kV)	1,000 volts.
kilowatt (kW)	1,000 watts.
Load	The amount of service (e.g., electric power) delivered to or required at any specified instant or over a period of time at any point or points on a system. Load originates primarily at customers' energy-consuming equipment.
Magnetic flux	The lines of force of a magnetic field.
Makai	Toward the sea.
Manhole	A subsurface structure large enough for a person to enter. Manholes are spaced along the cable route at intervals depending on the type and design of the cable system. Manholes provide an underground location for cable installation and for joining cables. Manholes are usually made of concrete and may be either cast or lowered into an excavation provided in advance; they are sometimes called splice vaults.
Mauka	Toward the mountains.
Megawatt (MW)	A unit of power equal to 1,000,000 watts.
MilliGauss (mG)	One-thousandth of a Gauss.
Mitigation	Any measure that avoids, lessens, or rectifies environmental impacts of the proposed action or alternatives. Mitigation also includes measures that compensate for the impact by providing substitute resources or environments.

Peak load	The maximum demand for electric power that determines the generating capacity required by a utility. More generally, it is the maximum load consumed or produced over a stated period of time.
Perennial	Referring to streams that flow with water throughout the year.
Power (electric)	The time rate of generating, transferring, or using electric energy, usually expressed in kilowatts.
Power (firm)	Power or power-producing capacity intended to be available at all times during the period covered by a commitment, even under adverse conditions.
Power (interruptible)	Power made available under agreements that permit curtailment or cessation of delivery by the supplier.
Pumping plant	A device used to maintain pressure and (sometimes) to circulate dielectric fluid in cable systems that use dielectric fluid as the insulation medium. The plant usually consists of one or more pumps (usually driven by an electric motor), storage tank, nitrogen storage cylinder, plumbing, control equipment, and housing for the above equipment.
Reliability	An electric utility's ability to deliver uninterrupted electricity to its customers on demand, to whatever degree required.
Right-of-way (ROW)	A type of easement consisting of the privilege to pass over another's land. A right-of-way is an accurately located strip of land with a defined width, point of beginning, and point of ending within which the user has authority to construct and maintain a utility facility, such as transmission lines, as authorized by a written agreement.
Span length	The horizontal distance between two adjacent supporting points (towers) of a conductor; for this project, usually 300 to 600 feet.
Splice	The physical connection of two or more conductors to provide electrical continuity.
Splice vault	See definition for manhole.
Splice, insulated	A splice with a dielectric medium applied over the connected conductors and adjacent cable insulation.

Substation	An assemblage of equipment for the purpose of switching and/or changing or regulating the voltage of electricity.
System reliability	See definition for reliability.
Termination	Formerly called pothead. This latter term is being dropped from usage by the latest proposed Institute of Electrical and Electronics engineers standard. A cable termination is located at the terminal ends of an underground cable system and is usually located aboveground. The termination serves to prevent entrance of the external environment into the cable and to maintain the pressure, if any, within the cable system. The termination also controls, by design, electrical stresses so that external overhead connections may be made to cable systems, such as those at substations and generating plants.
Transition station	An aboveground installation where a transition is made from an underground or submarine transmission line to an overhead transmission line or vice versa.
Transmission systems	As distinguished from distribution systems, transmission systems are the backbone or main arteries of a utility's electric system. Usually, the transmission line between generator plants and substations or between substations does not serve customers. Distribution systems, on the other hand, distribute electric power to customers, either directly or through step-down transformers. HECO's transmission lines are 138 kV lines.
Turbine (steam or gas)	An enclosed rotary-type of prime mover where heat energy in steam or gas is connected into mechanical energy through high-velocity flow of steam or gas against successive rows of radical blades connected to a central shaft.
Underbuild	To install a separate circuit of power lines on the same poles used for another circuit of power lines, usually below or under the existing circuit.
VAR losses	Volt-ampere reactive is the basic measure of reactive power. Reactive power is used to maintain system voltage.

Visual impact	A change in the perception of the visual quality of a landscape resulting from a visual change or modification in the landscape. Visual impact can result from natural ecological changes, such as erosion; development activities, such as buildings or transmission lines; and land management activities, such as cultivation, clearing, timber harvesting, or fire breaks.
Volt	The unit of electromotive force or electric pressure analogous to water pressure in pounds per square inch. It is the electromotive force that, if steadily applied to a circuit having a resistance of 1 ohm, will produce a current of 1 ampere.
Volts per meter	The unit of measure that describes an electric field, expressed as volts per meter (V/m) or kilovolts per meter (kV/m).
Voltage	The effective root-mean-square (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.
Wetlands	Those areas that are inundated by surface or groundwater with a frequency sufficient to support (and under normal conditions, would support) a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include marshes, bogs, sloughs, stream channels, gravel bars, wet meadows, or similar areas.

APPENDIX B



CONFIGURATION #1

138 kV POLE WITH
46 kV UNDERBUILD

CONFIGURATION #2

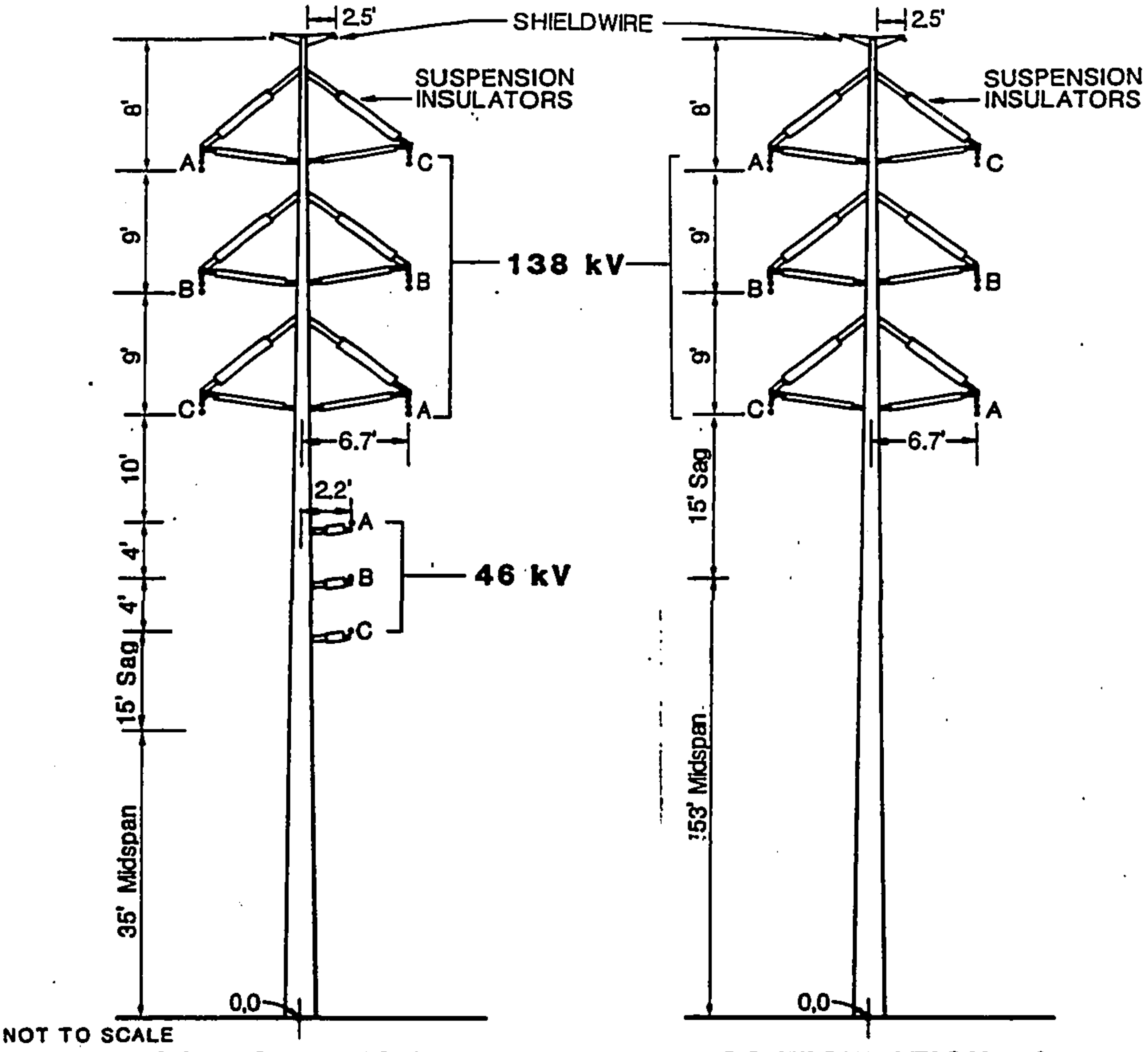
138 kV POLE WITH
46 kV UNDERBUILD

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

FIGURE B-1

TYPICAL 138 kV POLE CONFIGURATIONS AND DETAILS

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



CONFIGURATION #3

138 kV POLE WITH ONE
46 kV UNDERBUILD

CONFIGURATION #4

138 kV POLE WITHOUT
46 kV UNDERBUILD

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

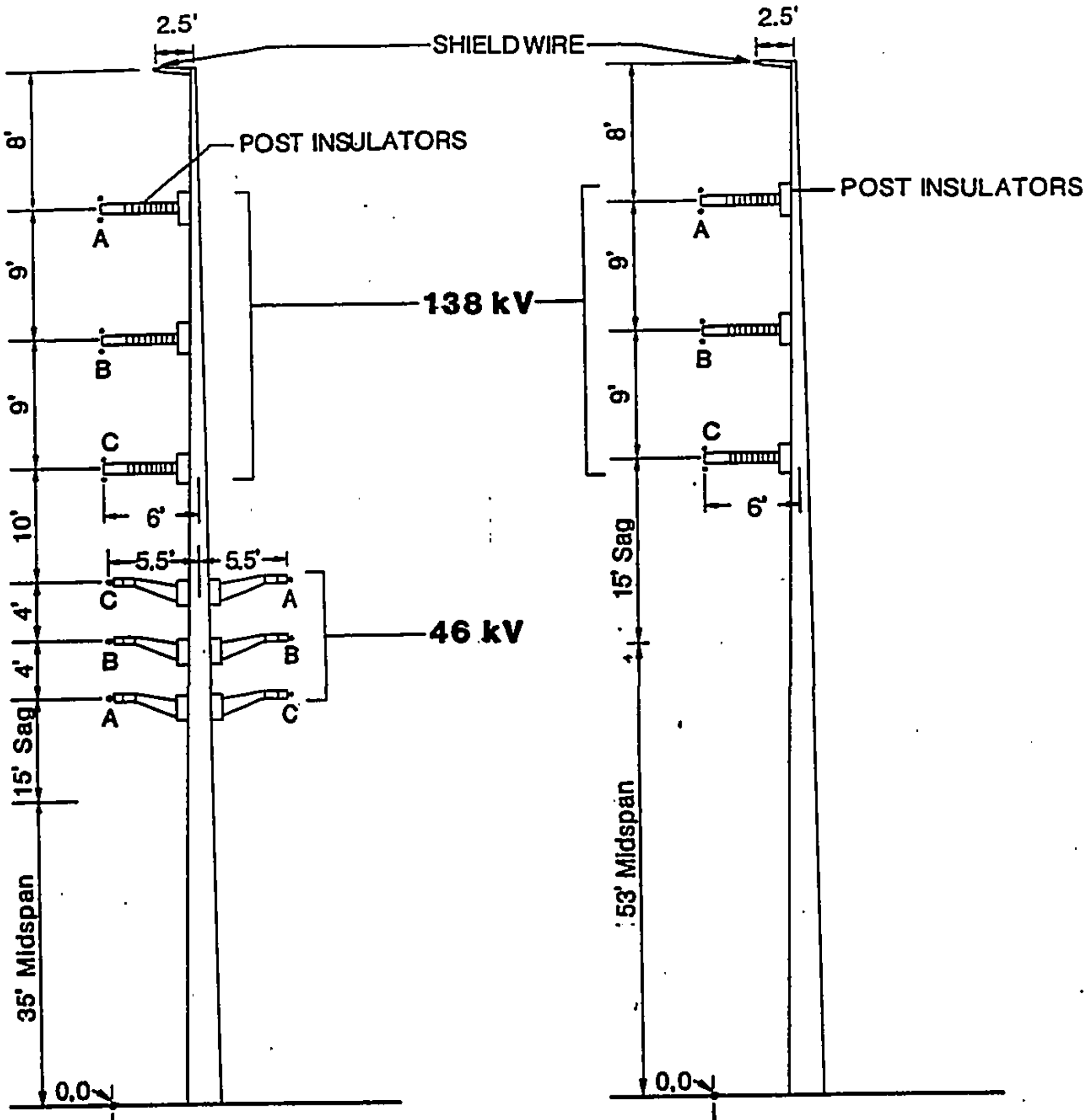
FIGURE B-2

TYPICAL 138 kV POLE CONFIGURATIONS AND DETAILS

Waiau-Campbell Industrial Park Transmission Line Project

Hawaiian Electric Company

CH2M HILL



CONFIGURATION #5

138 kV POLE WITH
46 kV UNDERBUILD

CONFIGURATION #6

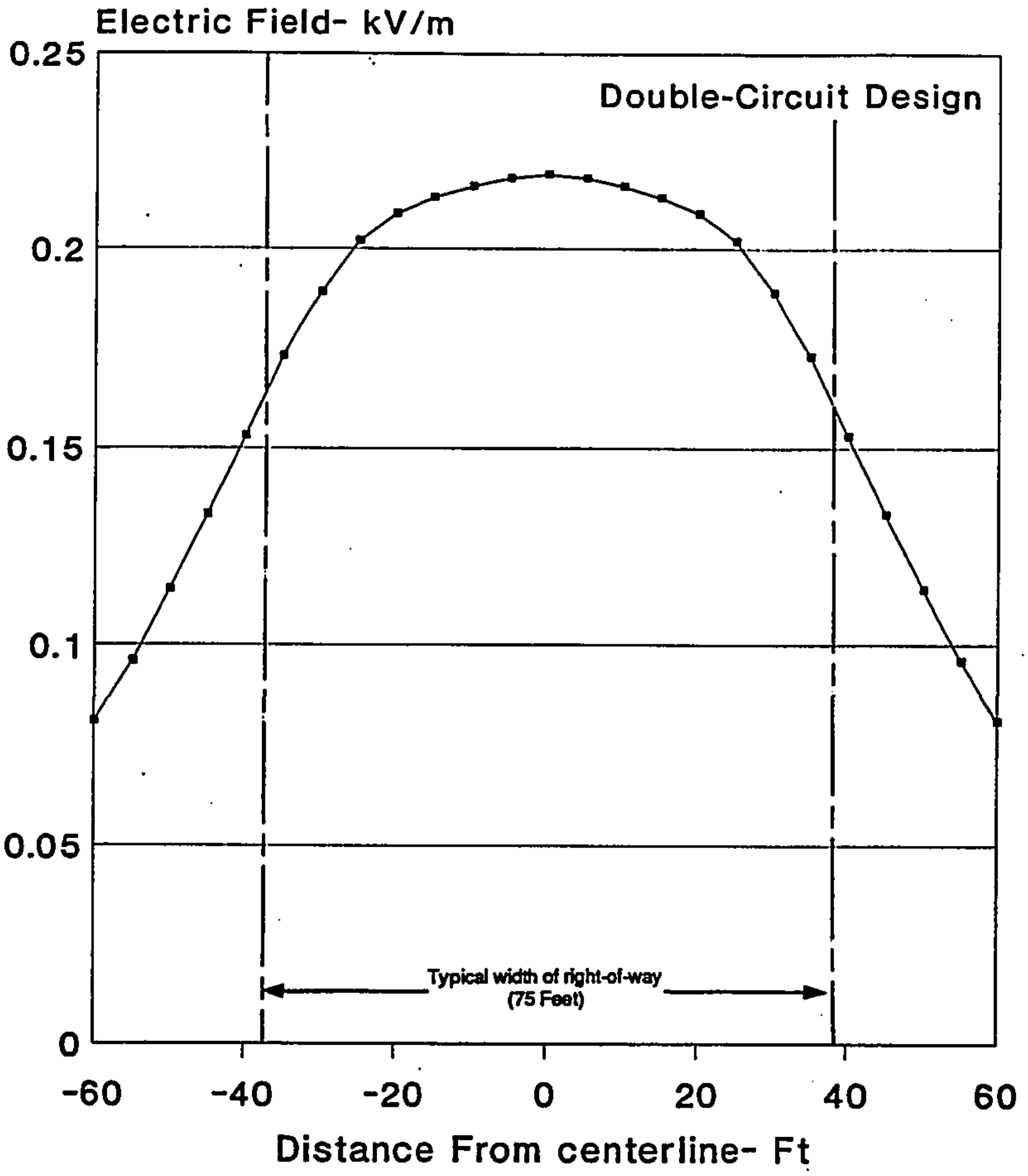
138 kV POLE WITHOUT
46 kV UNDERBUILD

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

FIGURE B-3

TYPICAL 138 kV POLE CONFIGURATIONS AND DETAILS

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

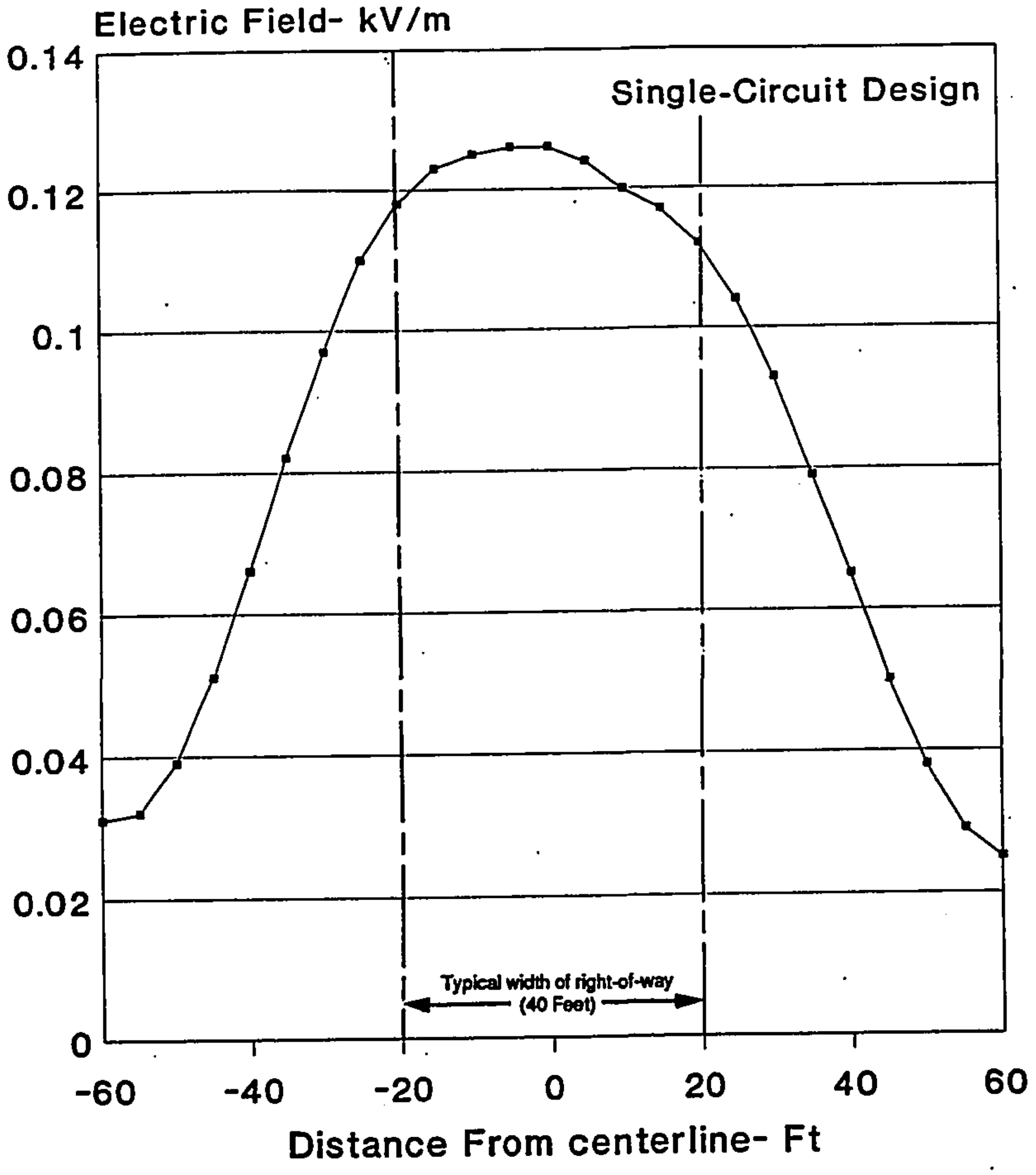


138/46 kV with UNLIKE Phasing

FIGURE B-4

LATERAL PLOT OF ELECTRIC FIELD FOR CONFIGURATION 1

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

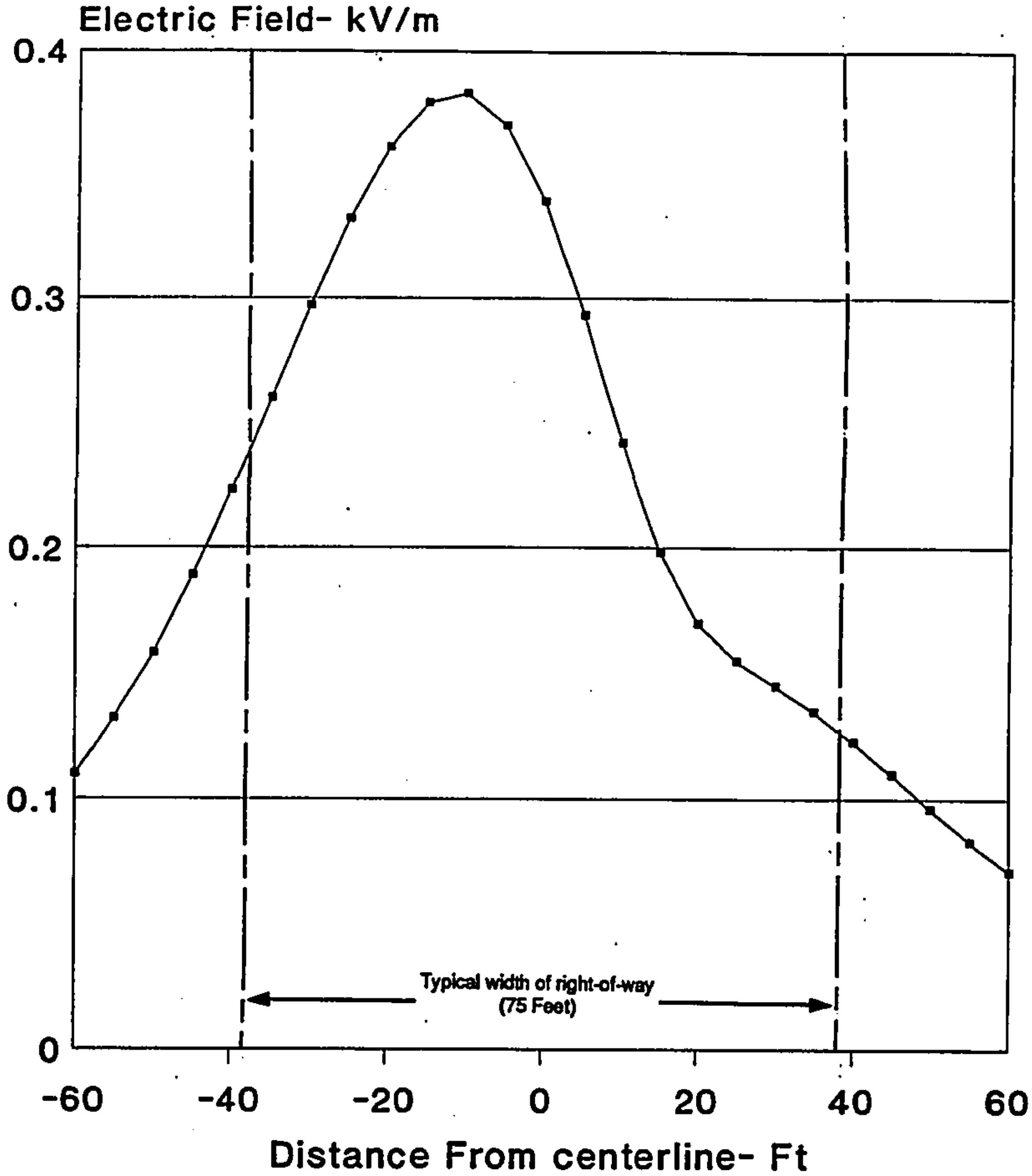


138/46 kV with UNLIKE Phasing

FIGURE B-5

LATERAL PLOT OF ELECTRIC FIELD
FOR CONFIGURATION 2

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

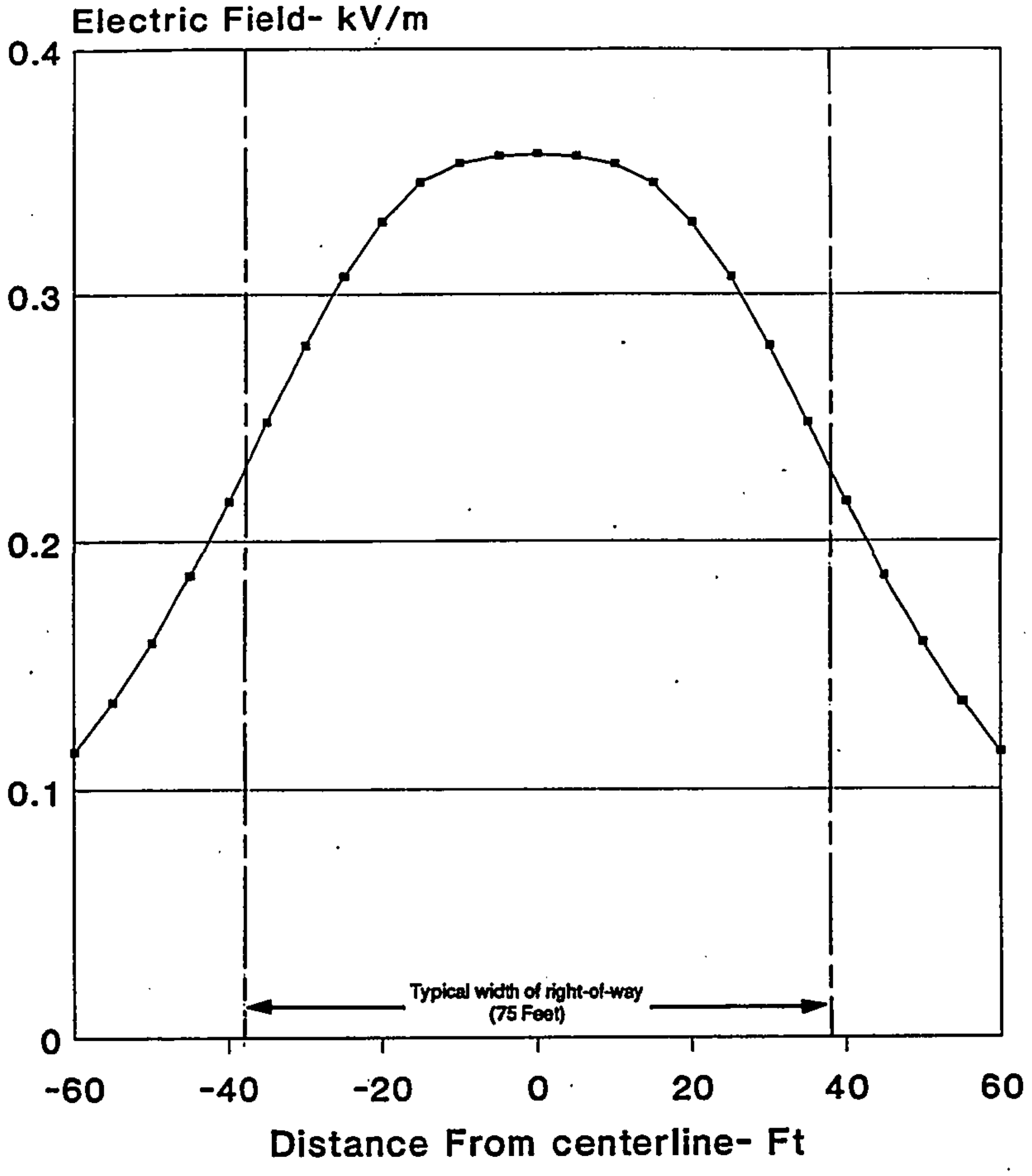


138/1-46 kV with UNLIKE Phasing.

FIGURE B-6

LATERAL PLOT OF ELECTRIC FIELD
FOR CONFIGURATION 3

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

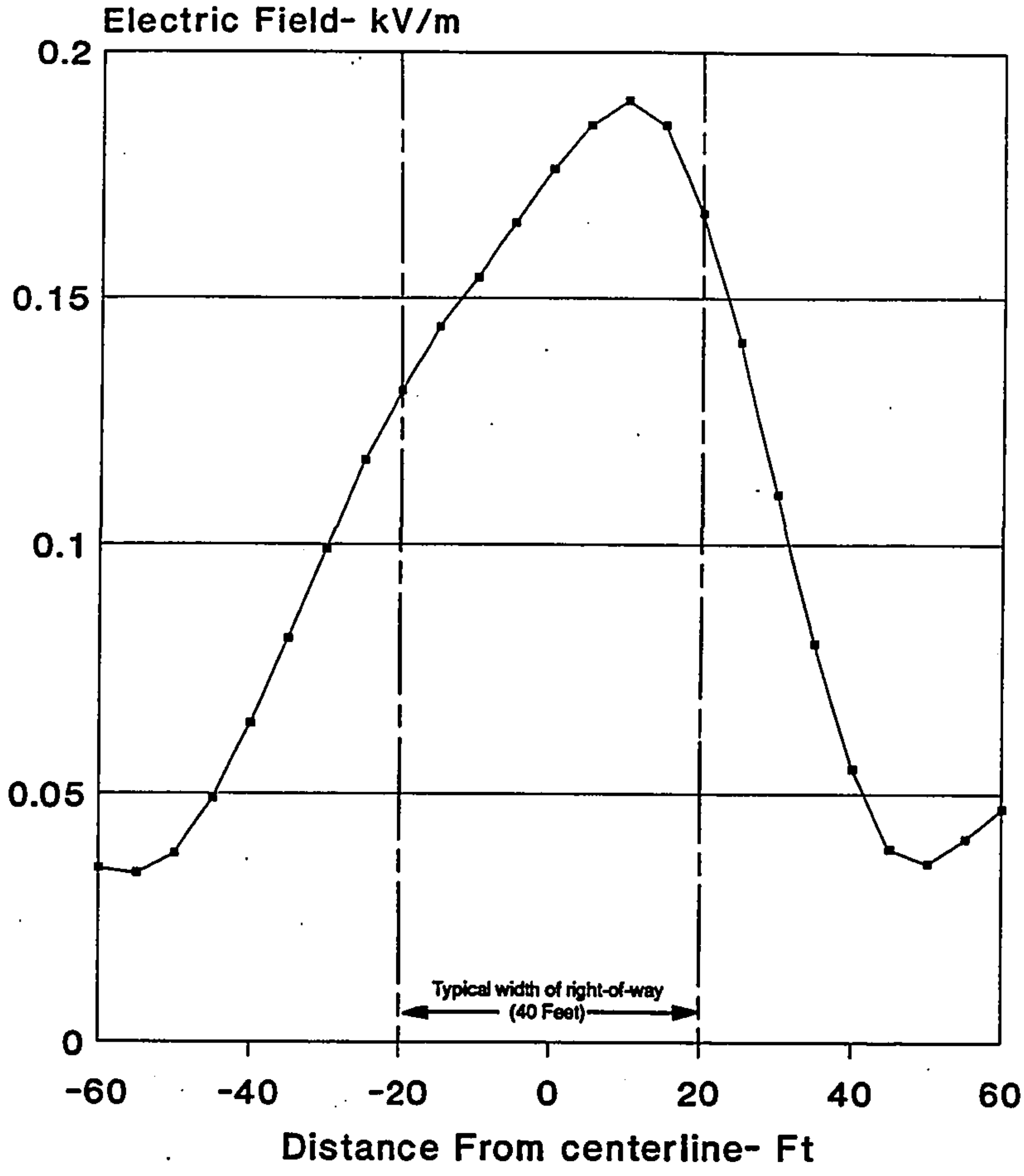


138 kV (No Underbuild) w/ UNLIKE Phasing

FIGURE B-7

LATERAL PLOT OF ELECTRIC FIELD
FOR CONFIGURATION 4

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

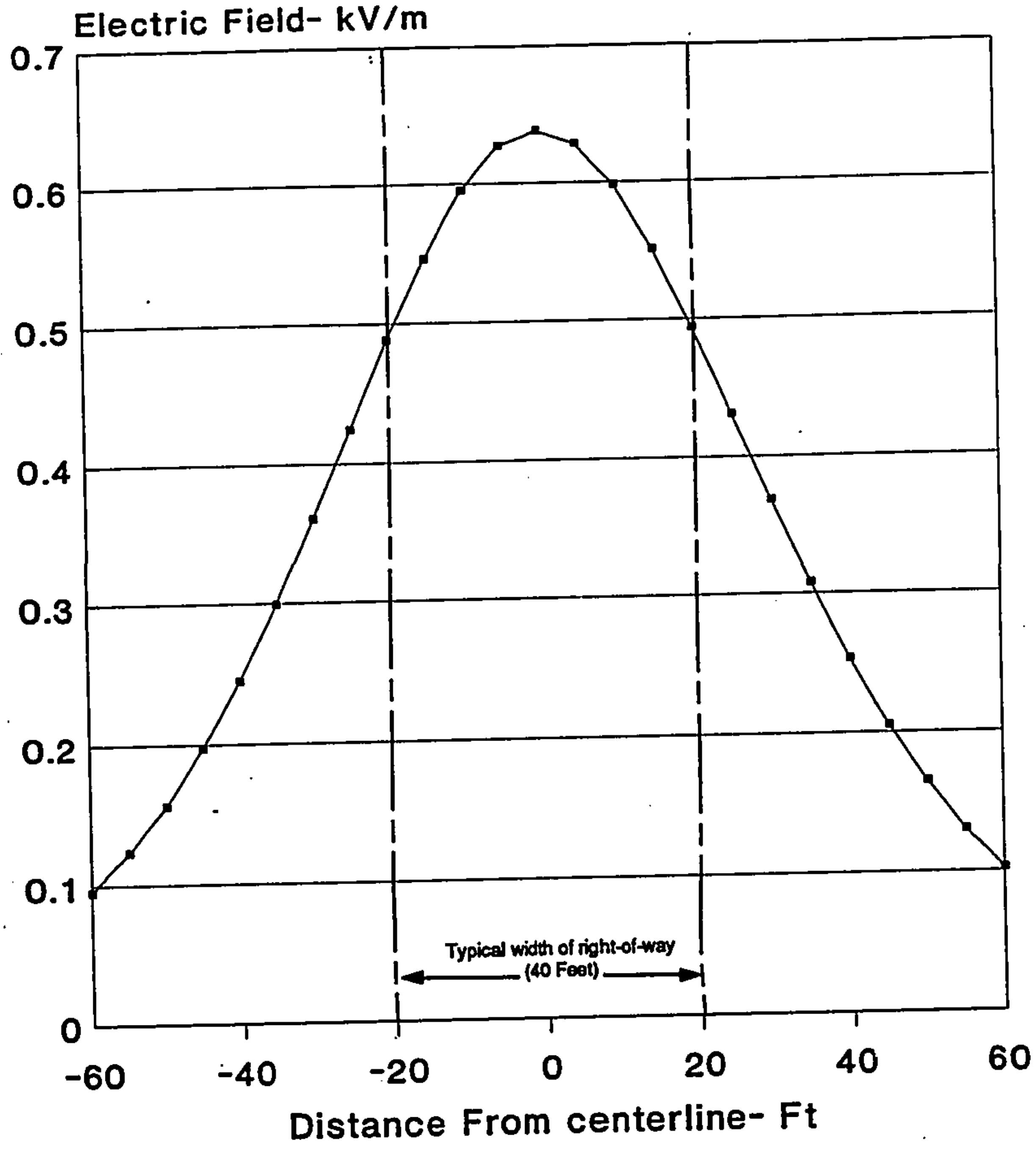


138/46kV with UNLIKE Phasing

FIGURE B-8

LATERAL PLOT OF ELECTRIC FIELD FOR CONFIGURATION 5

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

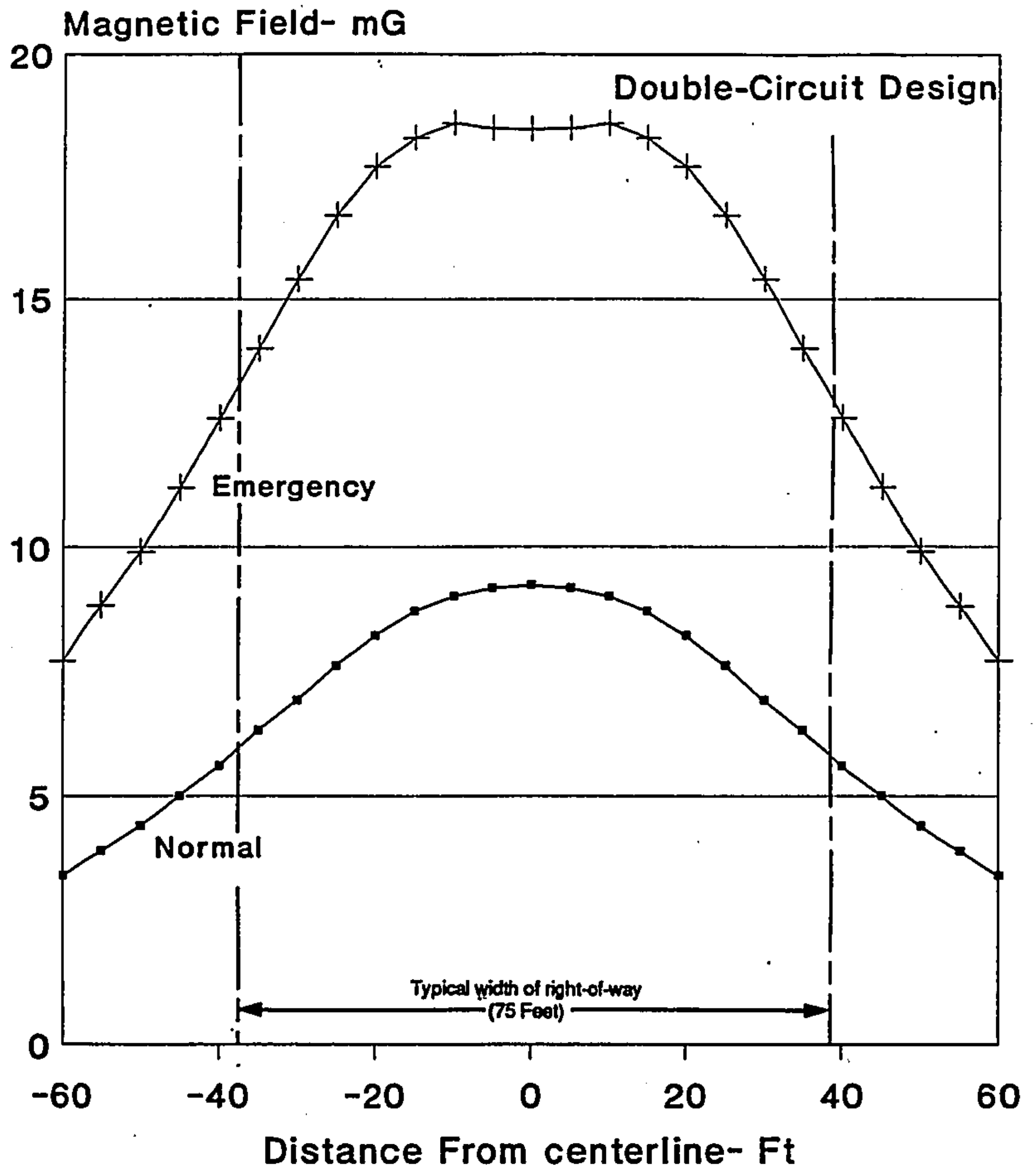


138kV with UNLIKE Phasing

FIGURE B-9

LATERAL PLOT OF ELECTRIC FIELD FOR CONFIGURATION 6

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



138/46 kV @ Normal & Emergency Loads

FIGURE B-10.

LATERAL PLOT OF MAGNETIC FIELD
FOR CONFIGURATION 1

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

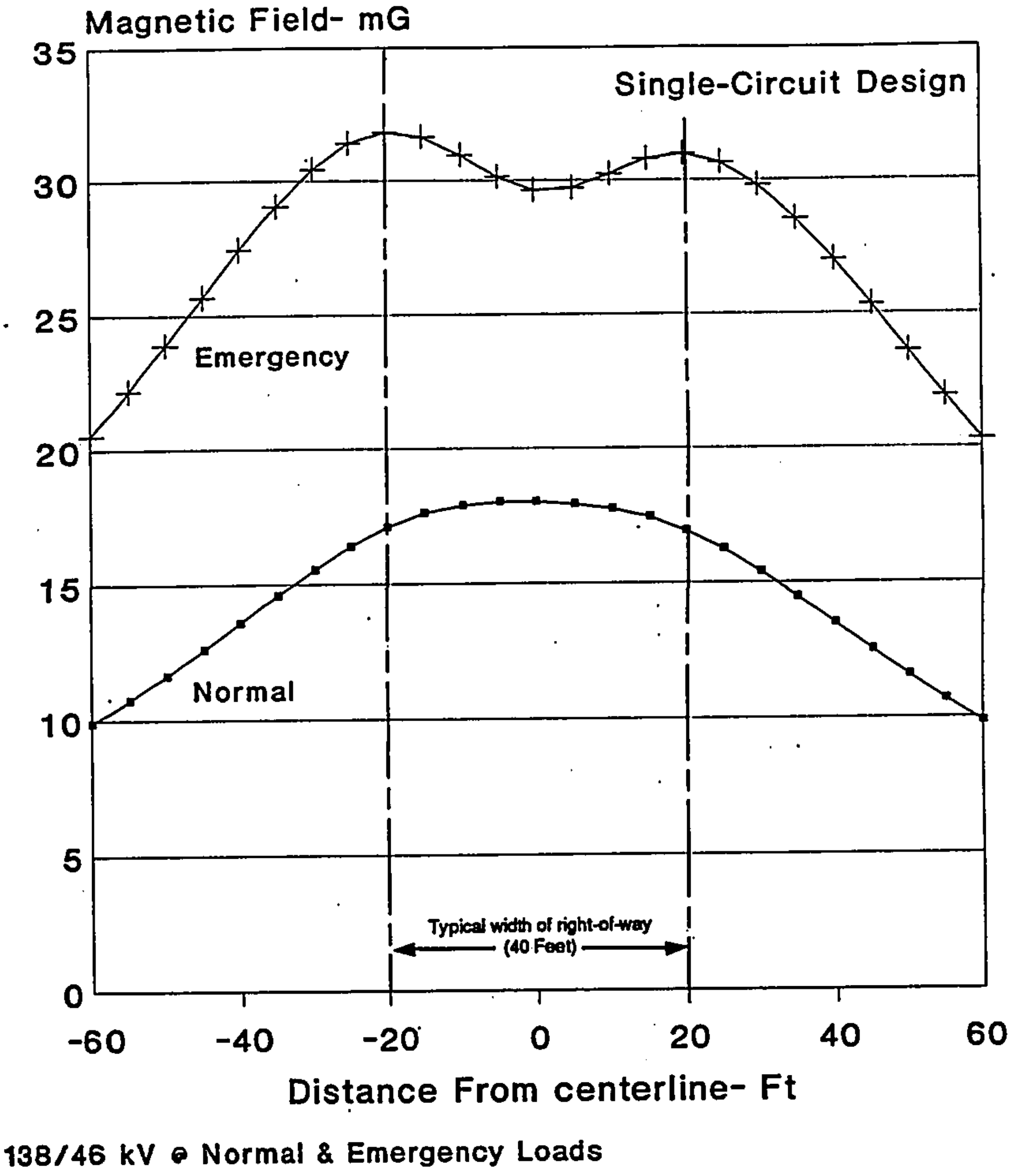


FIGURE B-11

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 2

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

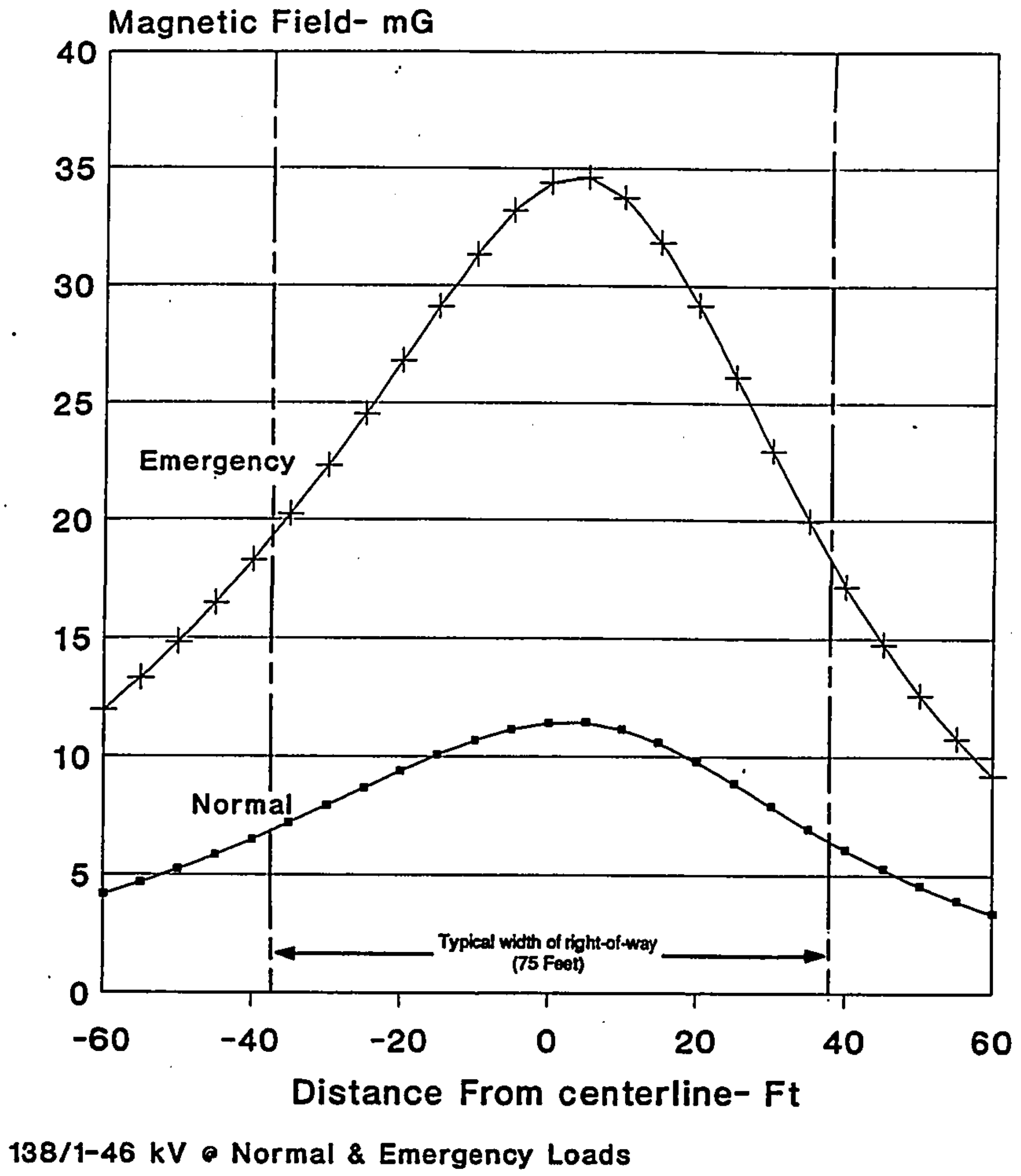
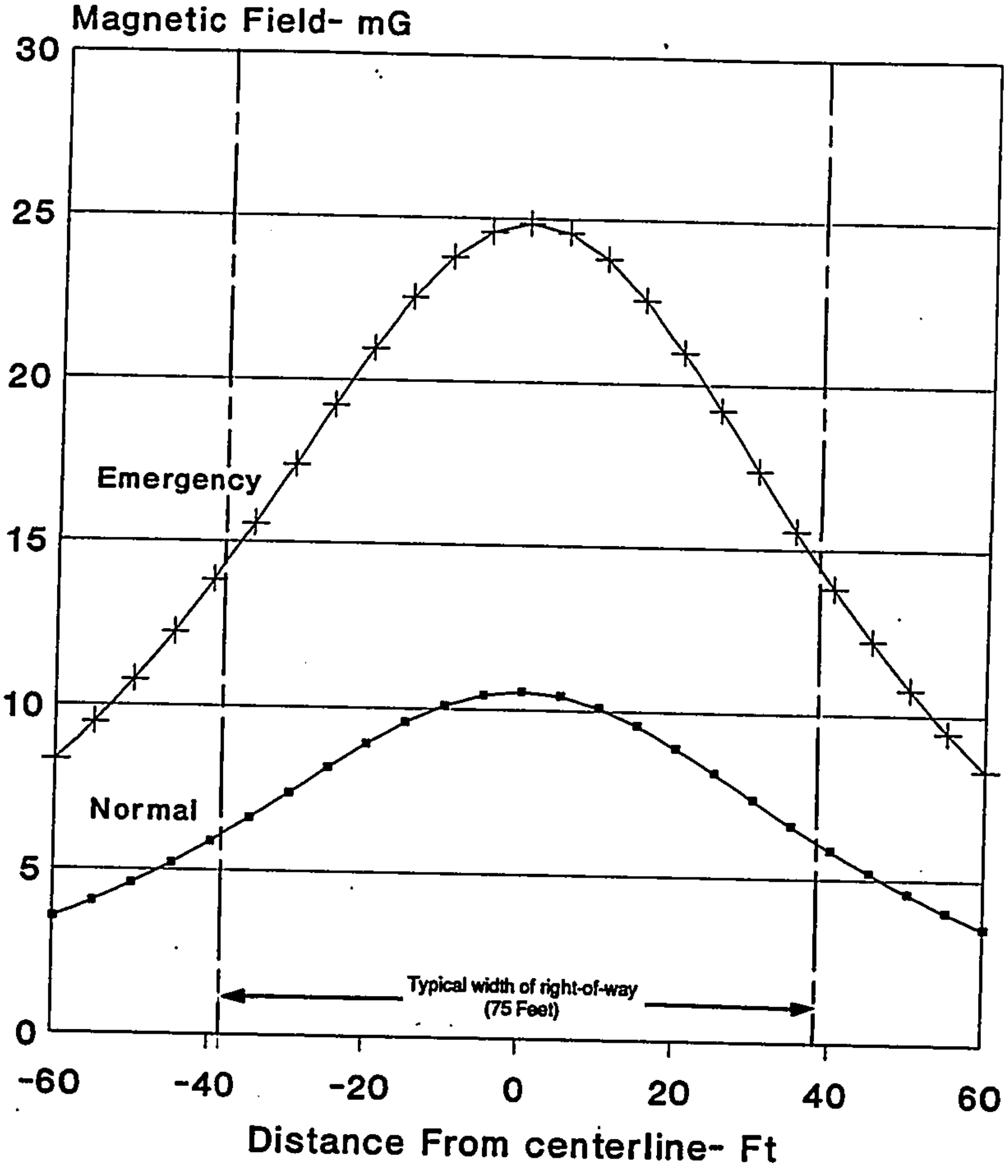


FIGURE B-12

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 3

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

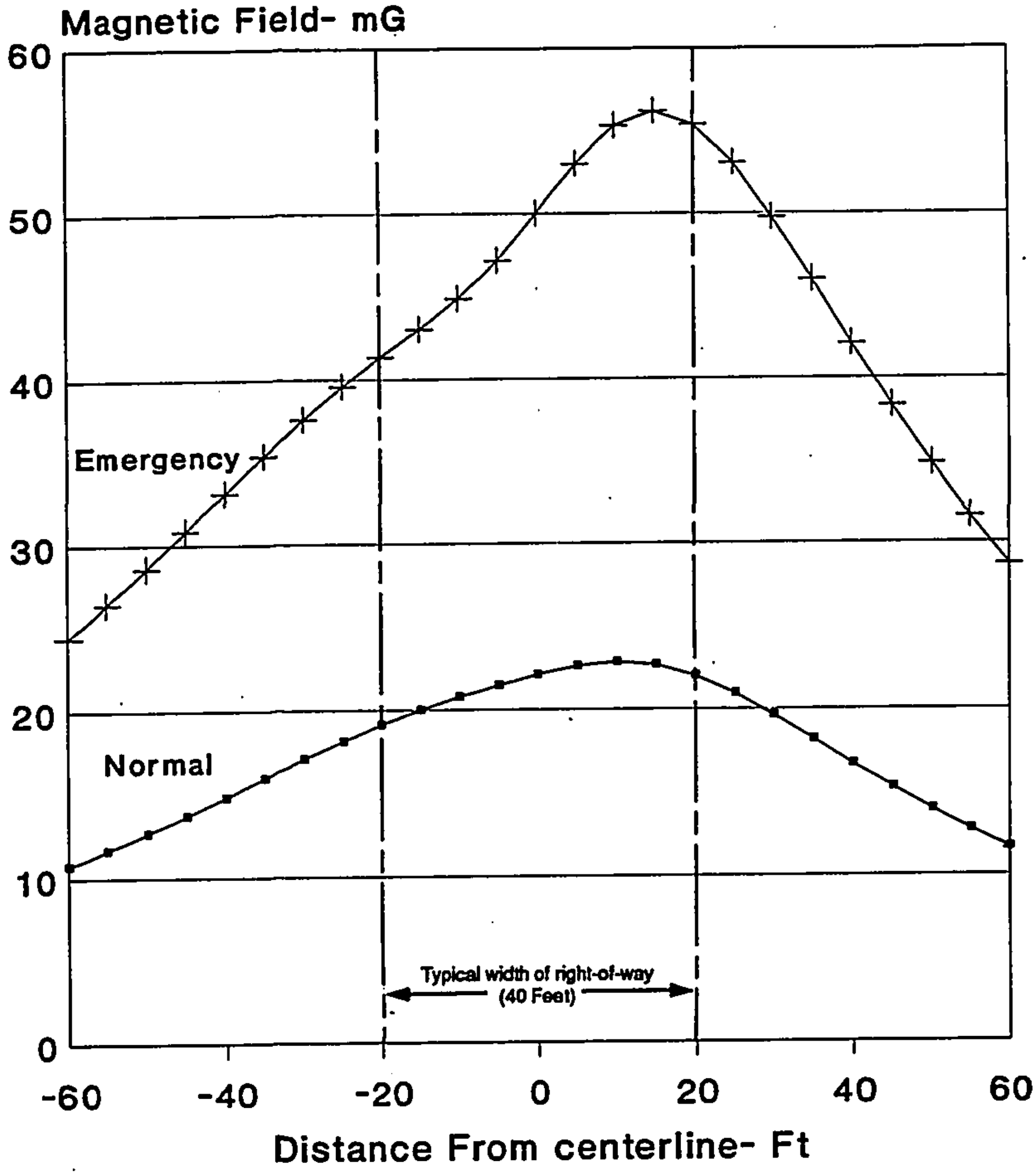


138 kV @ Normal & Emergency Loads

FIGURE B-13

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 4

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

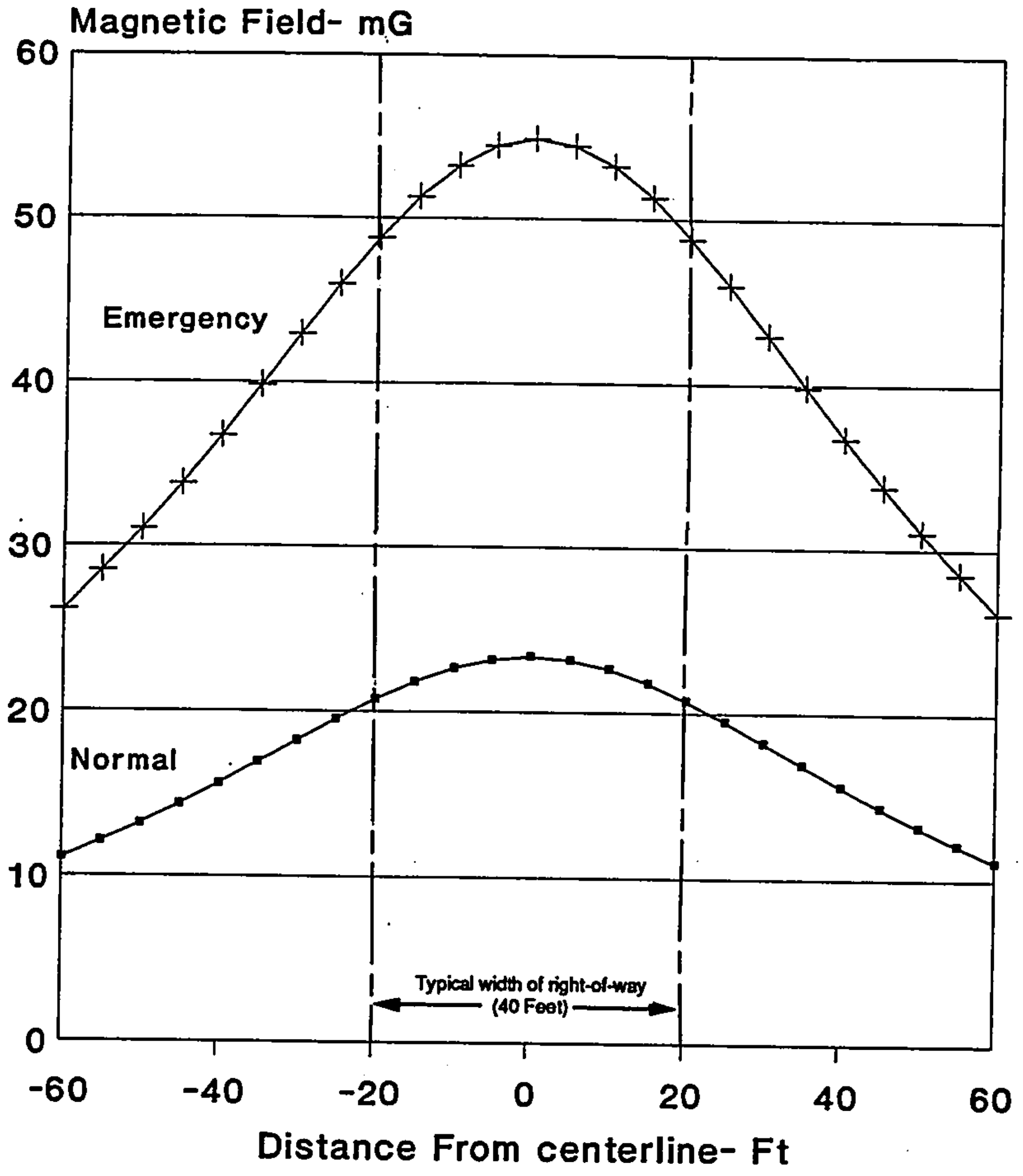


138/1-46 kV @ Normal & Emergency Load

FIGURE B-14

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 5

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

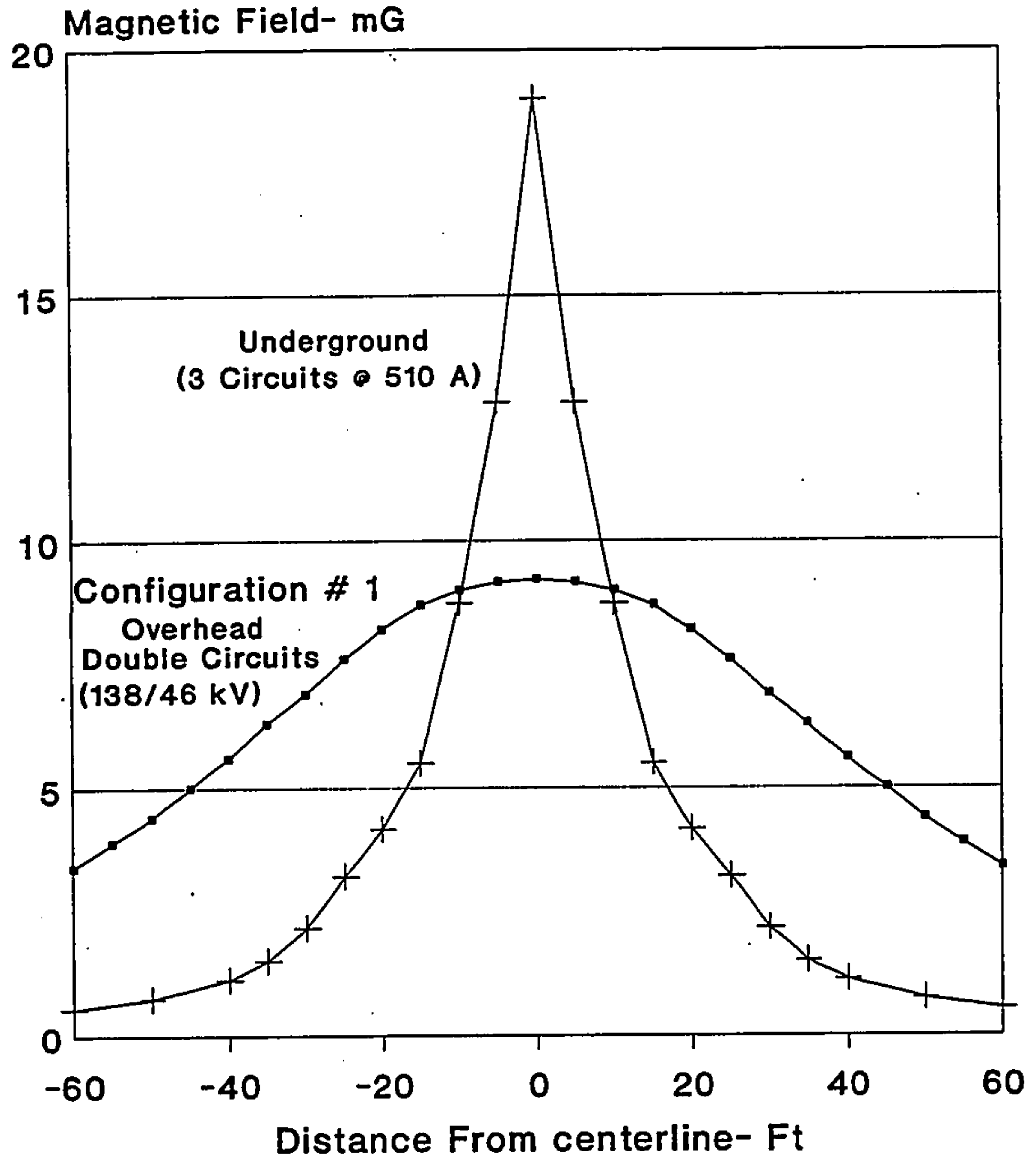


138 kV @ Normal & Emergency Loads

FIGURE B-15

LATERAL PLOT OF MAGNETIC FIELD FOR CONFIGURATION 6

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

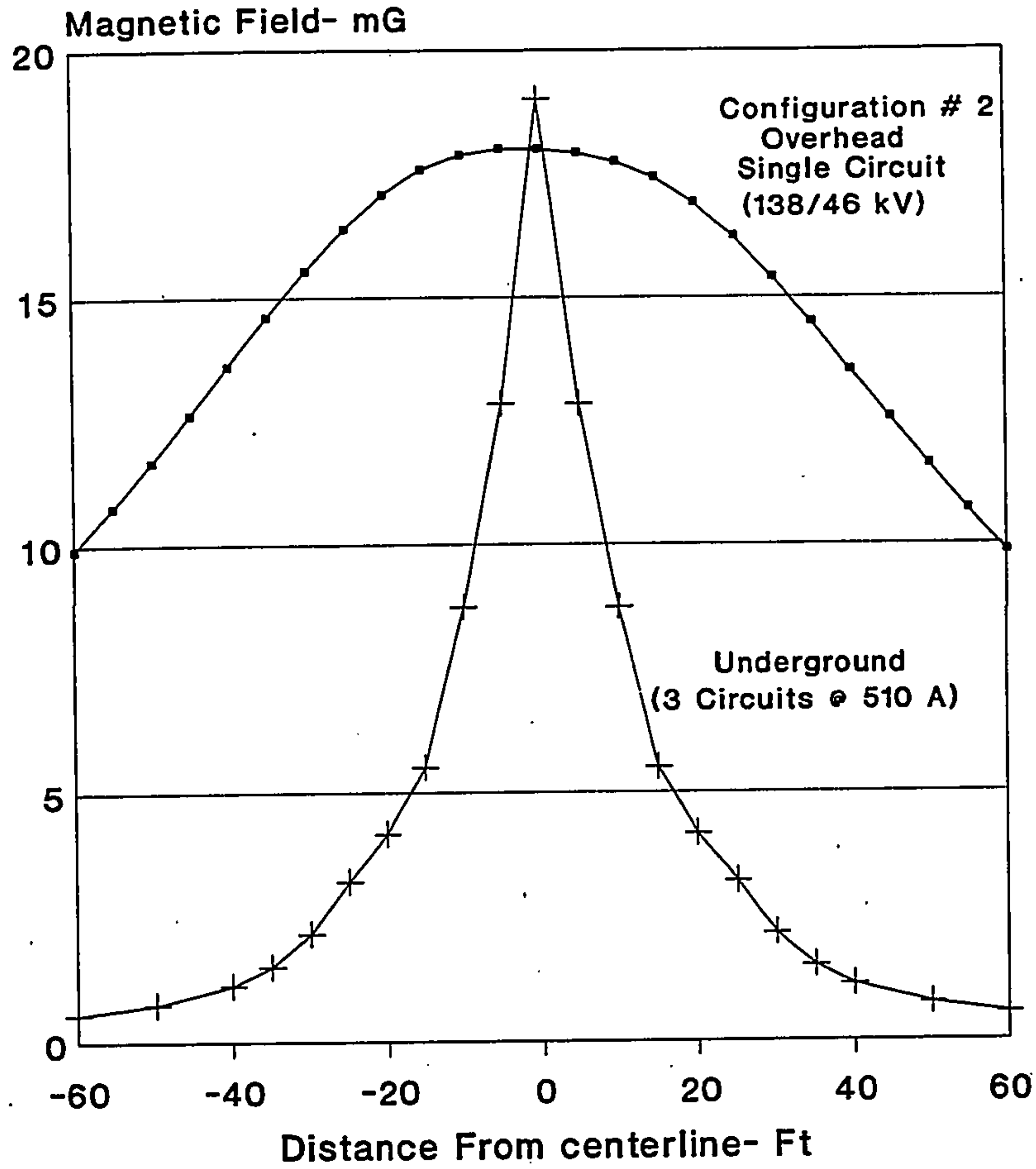


Normal Loading Assumed

FIGURE B-16

LATERAL PLOT OF MAGNETIC FIELD:
UNDERGROUND VERSUS OVERHEAD
CONFIGURATION NO. 1

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



Normal Loading Assumed

FIGURE B-17

LATERAL PLOT OF MAGNETIC FIELD: UNDERGROUND VERSUS OVERHEAD CONFIGURATION NO. 2

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

APPENDIX C

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

February 3, 1992

Ms. Mary Ellen Nordyke-Grace
Hawaiian Electric Company
P.O. Box 2750
Honolulu, Hawaii 96840

Dear Ms. Nordyke-Grace:

Environmental Impact Statement Preparation Notice
for the Proposed Waiau-Campbell Industrial Park
Part 2 138 kV Transmission Line

We note that in HECO's EIS Preparation Notice for this project published in the OEQC Bulletin, January 8, 1992, the proposed 138 kV transmission lines will generally follow the mauka edge of the H-1 Freeway in Waipahu and the makai side of Kamehameha Highway in Pearl City. Of the alternative routes studied, we agree with your selection of the preferred alternative along the H-1 Freeway. We would, of course, prefer that all overhead utilities be placed underground, but we recognize that this would be cost prohibitive.

Based on the preferred alignment shown in Figure 4-2 of the Project Description/Environmental Assessment, the two single-circuit overhead lines will traverse the alignment of the Honolulu Rapid Transit Development Project between Kamehameha Highway and the H-1 Freeway near the Waiawa terminus. The EIS should discuss how any conflict between the alignment of the 138 kV transmission lines and the Honolulu Rapid Transit Development Project will be avoided.

Ms. Mary Ellen Nordyke-Grace
Hawaiian Electric Company
February 3, 1992
Page 2

Should you have any questions, please contact Matthew Higashida of our staff at 527-6056.

Sincerely,

BENJAMIN B. LEE
Chief Planning Officer

BBL:lh

cc: Department of Transportation Services
State Department of Transportation

AMFAC/JMB HAWAII, INC
700 Bishop Street
PO Box 3230
Honolulu, Hawaii 96801
(808) 945-8111
Fax (808) 945-8153

Amfac

February 7, 1992

Mr. Kenneth Umemoto
Highways Division
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Re: OEQC Bulletin, January 23, 1992: Waiau-Campbell Industrial Park Part 2 138 Kv Transmission Line

In response to Hawaiian Electric Company's ("HECO") proposed Waiau-Campbell Industrial Park Part 2 138 Kv Transmission Line project published in the Office of Environmental Quality Control ("OEQC") Bulletin dated January 23, 1992, please be advised that Amfac/JMB Hawaii, Inc. ("Amfac") is opposed to this project.

The proposed route along the H-I Freeway fronts Amfac's Waikele development. Amfac has made a significant investment in placing all Waikele utilities underground, including the burying of offsite communication lines fronting the Waikele project along Kamehameha Highway. The master plan for Waikele orients its sites to take advantage of the makai views of the ocean, diamond head and the Ewa plains and is constructing a new freeway interchange, planned to be the main entrance into the project. Clearly, the installation of the 138 Kv transmission lines along the "front door" of the Waikele community would negate our efforts in preserving the views from the project.

Amfac is also concerned about the health and safety issues surrounding these power lines within urban areas. Presently, HECO's position on the potential health hazards of these lines is that the facts are "inconclusive". Furthermore, while there may be arguments supporting the safety of these transmission lines, the public perceptions towards these facilities as a health hazard will adversely impact the marketability of the various projects within Waikele.

The proposed route will require the condemnation of portions of the Waikele project. This would require the taking of lands which are presently under development for residential and commercial projects. This action will result in the taking of land not only from three other land owners but may also include third party homeowners. Enclosed for your information are copies of letters sent to Hawaiian Electric Company by two of the Waikele property owners adversely affected by the proposed alignment.

While Amfac is cognizant of the cost considerations involved in the selection of the transmission line alignment, Amfac is not convinced that HECO has considered all alternatives which may be as cost effective as the current proposed alignment. As an example, one of the alternative routes, discarded by HECO as being not cost effective, calls for the burying of existing 12 Kv lines which are presently overhead lines. According to HECO staff, taking these existing lines underground adds an additional $12 million to the project cost. If these 12 Kv lines were left as overhead lines, it would make this alternative route the most cost effective.

Amfac has been in discussions with Hawaiian Electric Company since 1989 regarding this proposed project. Amfac has been consistent in its position in opposing the proposed alignment. Your consideration in this matter would be greatly appreciated. Should you require any additional information, please do not hesitate to contact me at 945-8296.

Very truly yours,

Chris J. Kanazawa
Vice President and General Manager
Oahu Development Division

CJK:ms

Enclosures

cc: Hawaiian Electric Company - Mary Ellen Nordyke-Grace
CH2M Hill - Paul Luersen
Office of Environmental Control
WCC Associates - R. Gushman
Schuler Homes Inc. - J. Schuler
Castle & Cooke Properties - W. Miyahira
Armstrong Builders Ltd. - R. Armstrong

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu. HI 96840-0001

March 16, 1992

Mr. Benjamin B. Lee
Chief Planning Officer, City and County of Honolulu
Department of General Planning
650 S. King Street
Honolulu, Hawaii 96813

Dear Mr. Lee,

Subject: Environmental Impact Statement for the Proposed Waiau-Campbell Industrial Park 138 kV Part 2 Transmission Line

Thank you for your letter of February 3, 1992 and your review of the Environmental Impact Statement Preparation Notice (EISPN) for this project.

The text of the Environmental Impact Statement (EIS) will discuss the general relationship of the proposed transmission line and the City and County of Honolulu's Rapid Transit Development Project. Hawaiian Electric Company, Inc. will continue to coordinate with City Rapid Transit Project staff concerning the engineering requirements of the Waiau-CIP Part 2 transmission line, and the EIS will reflect the status of our discussions with Rapid Transit.

Please feel free to contact me at 543-7876 if you have any questions concerning the project EIS.

Sincerely,

Mary Ellen Nordyke-Grace

Mary Ellen Nordyke-Grace
Project Manager

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

March 16, 1992

Mr. Chris J. Kanazawa
Vice President and General Manager
Oahu Development Division
AMFAC/JMB HAWAII, INC.
700 Bishop Street
P.O. Box 3230
Honolulu, Hawaii 96913

Dear Mr. Kanazawa,

Subject: Environmental Impact Statement for the Proposed Waiau-Campbell Industrial Park 138 kV Part 2 Transmission Line

This is to acknowledge receipt of your letter of February 7, 1992 regarding the Environmental Impact Statement Preparation Notice (EISPN) for this project.

We have forwarded your letter to our consultant, CH2M Hill, to ensure that your concerns are addressed in the project's Draft Environmental Impact Statement (EIS), which is currently being prepared. View impacts, health issues related to electric and magnetic fields, affected existing and proposed land uses, and cost issues will be discussed in the Draft EIS.

Please feel free to call me at 543-7876 if you have any questions concerning the development of the project EIS.

Sincerely,

Mary Ellen Nordyke-Grace

Mary Ellen Nordyke-Grace
Project Manager

APPENDIX D

Appendix D

Chapter 8 of the Routing Report: "Public and Agency Consultation for Waiau-CIP Transmission Line Project"

8.1 Public/Agency Involvement Summary

8.1.1 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 138 kV Transmission Line Project in June 1987. The Public Involvement Planning Group consisted of 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 publics including 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

8.1.2 Public Involvement Activities by Phase

The public involvement activities included dissemination of information and opportunities for direct public involvement. The principal activities involved public meetings that corresponded with major project study milestones. Other focused public and agency meetings were held on an ongoing basis throughout the project. These included project briefings and information meetings with neighborhood boards. All of the public involvement activities incorporated in the project are described below.

Phase I Regional Study and Corridor Identification

The major activities for the initial phases of the work, the regional study, corridor identification, and alternative corridor evaluation included:

Mailing List (July 1987). At the beginning of project studies a mailing list was prepared of key public groups and individuals in the study area. The project mailing list initially included 275 people, including elected officials; community and service organizations; federal, state, and City and County of Honolulu agencies; major landowners; utilities; and interested persons. During the project the list was expanded to include those who contacted HECO or its consultants for project-related information, persons who attended the meetings, and other organizations and individuals who returned mailing list mailback cards from the newsletter or requested that their names be added. The final project mailing list included more than 400 people.

Fact Sheet (July 1, 1987). A map of the study area and 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. It served as the announcement of the project for the public.

Announcement Letter (July 13, 1987). HECO mailed personal letters to key elected officials, chairpersons of affected neighborhood boards, and major landowners. These mailings included copies of the fact sheet and formally announced the project.

News Release (July 13, 1987). HECO issued the fact sheets and a press release to the media and conducted a media briefing session.

Announcement to Other Interested Groups/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/developers on the project mailing list.

Announcement to Public Agencies (August 1987). A letter was mailed to federal, state, and City and County of Honolulu agencies announcing the project and requesting that they designate a contact person.

Phone Calls/In-person Interviews (July to 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 if individual briefings were desired.

Meetings with Community Associations and Neighborhood Boards (August to 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. Refer to Section 8.2 for a summary of the meetings. Presentations were given to:

- 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 Campbell Estate, Oahu Sugar Company, and the U.S. Navy to discuss the project and 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 announced the time and place of the community meetings and included a description, discussion of purpose and need, the route selection methodology of the project, and a study area map showing alternative corridors. HECO mailed newsletters to all persons on the project mailing list; interested individuals were asked to respond with their comments on the enclosed mailback card.

News Article for the Cane Tassel (November 24, 1987). This local newspaper asked to feature the Waiau-Campbell Industrial Park Transmission Line Project in their 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 to 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. Refer to Section 8.3 for a discussion of the results of these workshops.

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 comment on the alternative and preferred corridors and potential permit requirements. Refer to Section 8.5 for a discussion of the results of this meeting.

Phase II Corridor Evaluation and Alignment Selection

The alternative corridor public workshops and the first joint agency meeting marked the completion of Phase I Regional Study and Corridor Evaluation. The 1988 preferred corridors were selected for more detailed study in February 1988.

During the period February to September 1988, additional information on conditions within the 1988 preferred corridors was gathered through detailed field study. The information was mapped and analyzed and alternative alignments within the 1988 preferred corridor were identified. Using input received from neighborhood boards, community groups, and consultation with agencies, a 1988 preferred alignment was selected. A brief chronology of the major public involvement during Phase II is presented below.

Presentation to the Neighborhood Boards (February 11 to April 21, 1988). Waipahu and Pearl City Neighborhood Boards were interested in having an update following the corridor workshops. The Project Team presented the 1988 preferred corridors and discussed community concerns regarding the project. Refer to Section 8.2 for a summary of these meetings.

• 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 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 1988 preferred corridors.

Meetings with Agencies and Landowners (April to July 1988). The Project Team conducted several presentation/discussions with interested landowners and agencies that had a specific interest in the project. The input from these meetings was considered in selection of the 1988 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 3 contained a description of a 1988 preferred alignment and included a map insert showing the location of the 1988 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 to 16, 1988). A display ad announcing the time, location, and purpose of the public meetings was placed in the *Honolulu Advertiser* for three consecutive days.

Public Meetings (November 14 to 17, 1988). A series of three meetings was held in Ewa, Waipahu, and Pearl City to present and discuss the 1988 preferred alignments and the reason they were selected, and to answer questions and receive comments (see Section 8.4).

CAP/Public Agency Meeting No. 2 (November 29, 1988). A second joint meeting of federal, state, and city and county agencies was held. The purpose of the meeting was to present the location of the 1988 preferred alignments; to identify permits, approvals, and reviews that would be required; and to determine the sequencing of the permits. Refer to Section 8.6 for discussion of the results of this meeting.

Meetings with Landowners (February to March, 1989). The project team conducted several meetings with landowners to discuss the 1988 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 1989 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 1989 alignment, and responses to key concerns raised by the public, such as visual effects, underground lines, and the health effects of electric and magnetic fields.

Media Release (May 20, 21, and 22, 1989). A display ad announcing 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). A series of two public meetings was held in Waipahu and Pearl City to present and discuss the selected 1989 alignment, the reasons for the selection, and the environmental effects. Comments were solicited and questions answered (see Section 8.5).

Meetings with Elected Officials, Agencies, and Landowners (June 1989 to January 1992). As a result of strong opposition to the selected 1988 and 1989 alignments by some agencies, elected officials, and landowners, HECO met regularly with interested parties to build a consensus on an acceptable route for Part 1 and Part 2 that could receive permit approvals and easements without condemnation (see detailed list of meetings in Section 8.7).

Newsletter No. 5 (January 29, 1992). A newsletter was prepared to describe the 1991 preferred alignment for Part 2, the need for the project, the route selection process, the required permits, opportunities for future public input to the agency decision-making process, and the project schedule. The newsletter was mailed to elected officials, agencies, individuals, and community organizations on an updated mailing list.

Letters to Elected Officials, Agencies, and Community Leaders. Letters were mailed on January 21, 1992, to invite people to the February 4, 1992, public meeting on Part 2.

Media Release (January 30 and February 2, 1992). A display ad announcing the time, location, and purpose of the Part 2 public meeting of February 4, 1992, was placed in the *Central Sun Press* and in the Sunday *Star Bulletin/Advertiser.*

Public Meeting (February 4, 1992). A public meeting was held in the cafeteria of Pearl City High School to review HECO's studies on the Part 2 corridors and to discuss the 1991 selected alignment for Part 2, the reasons for the selection, and the project's environmental effects. Comments were solicited and questions answered (see Section 8.5).

8.2 Neighborhood Board and Community Association Meetings

8.2.1 Schedule, Format, and Attendance

After the formal announcement of the project (through letters and fact sheets to elected officials, community leaders, neighborhood board chairs, and the media release), each organization was invited to have HECO present the Waiau-Campbell Industrial Park 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/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, routing methodology, and 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 the responses provided by HECO were recorded and are summarized in Section 8.2.2.

Additional meetings were held at the request of the neighborhood boards after the selection of the 1988 preferred corridors 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 community 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 for Part 1 of the project 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 are summarized in Section 8.2.2:

• 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.

8.2.2 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 (e.g., public health and radio/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 to 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 if the new lines could be routed along an existing transmission line corridor or highway

Effect on the Ratepayer

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., 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 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 EMF
- Safety of the new high-voltage lines
- Visual appearance of the new lines if they have to be sited aboveground
- 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 (Part 1)

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 proposed for Part 1 (discussed in a separate routing report of October 1991). 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 of Honolulu approve HECO's petition to amend the City's Development Plan--Public Facilities Map. Concerns raised by the board included:

- Need for the substation
- Health effects from EMF from the substation and lines
- Height and location of the transmission lines

8.3 Alternative Corridor Workshop Summary

8.3.1 Schedule, Format, and Attendance

Public workshops were held in Pearl City, Ewa, and Waipahu on December 8-10, 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:

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 status of the project, the workshop attendees participated in small group discussions of the corridor selection factors and the corridor alternatives. Each individual was asked to identify issues and concerns, to develop corridor selection guidelines. These guidelines were then presented to the group and all participants were asked if they concurred with the choice. 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.

The public workshops were not well attended. A total of only 27 people attended the three meetings.

8.3.2 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
- Maximize use of government land
- 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 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 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.

8.4 Alignment Public Meeting Summary

8.4.1 Schedule, Format, and Attendance

Three public meetings on the 1988 preferred alignment 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 alignments, the alignment selection criteria, and the options for undergrounding 12 kV distribution lines as part of the project.

The meetings opened with a slide presentation by the Project Team describing the purpose and need for the project, the routing methodology and description of the location of the preferred alignments. 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 alignments, three were representing elected officials, and four were from the neighborhood boards.

8.4.2 Summary of Comments

Generally, the comments involved four main issues: location of the preferred alignments, 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 with each a single transmission line circuit) through Waipahu and Pearl City. They wanted to know whether just one double-circuit alignment could be sited. Why not site the new alignment along the H-1 freeway, thereby avoiding siting a new transmission line along both 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 of this option were discussed. Most of the questions that were 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/maintenance) would be on underground relative to overhead lines.

Electric and Magnetic 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 electric and magnetic field 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? And who pays?
- When will the new lines be completed?
- Are there other ways that HECO could help improve the Waipahu and Pearl City communities?

8.5 Selected Alignment Public Meeting Summary

8.5.1 Schedule, Format, and Attendance

Two selected alignment meetings were held in Pearl City and Waipahu on May 23 and 24, 1989, respectively. The meetings were held to present HECO's selection of the 1989 alignment and to respond to questions by the public. A third public meeting was held on February 4, 1992, in the Waipahu/Pearl City area to present HECO's selection of a 1991 alignment and to respond to questions by the public.

The meetings opened with a presentation of the project need, routing methodology, alternatives, and the selected alignment. A question and answer period followed the presentation. At the 1992 meeting, public comments were requested on what the project's Environmental Impact Statement should address.

A total of 21 people attended the two 1989 meetings. A total of 40 people attended the 1992 meeting. About half the attendees were residents of the area. Others included representatives of business associations, neighborhood boards, community associations, and elected officials.

8.5.2 Summary of Comments in 1989 Meetings

Generally, the comments in 1989 involved five main issues: undergrounding (both transmission and distribution lines), electric and magnetic field 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 compared 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

Questions were asked 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., OR&L or mauka of developed areas in Waipahu. Requests were made to see the Routing Report to understand how alternatives were evaluated.

Pole Design and Effects

Questions were raised on pole heights, design, strength, and appearance. One landowner asked whether the right-of-way for the project would require use of private property.

Project Costs and Schedule

Other questions raised at the meeting included questions regarding the costs of the project, who pays for the project, the schedule for construction/operation, and what the next steps are for the process. Questions were asked concerning permit applications and an environmental assessment.

8.5.3 Summary of Comments at 1992 Meeting

The comments at the 1992 public meeting covered six general topics: system reliability of overhead versus underground lines, social equity, freeway safety, electric and magnetic field effects, preferred alignment, and concerns that should be addressed in the project's Environmental Impact Statement.

System Reliability

Questions were asked about whether system reliability would be compromised because overhead lines and poles are exposed to hurricane winds, floods, fires, and other disasters. Underground lines would be more protected from the elements and therefore more reliable. What are HECO's procedures and priorities in restoring power after a widespread outage? Would the affected communities of Waipahu/Village Park and Pearl City have more reliable service than other areas because of the proposed lines?

Social Equity

The State of Hawaii and ratepayers should decide whether it is worthwhile to pay the extra costs to underground the lines. Why must the affected communities have a disproportionate amount of public utilities (e.g., Waiau Power Plant) compared to other communities that will benefit from the reliable service provided by lines?

Freeway Safety

Concerns were expressed about motorist safety on the freeway or highway where poles for the lines would be placed. HECO will provide cross sections of the alignment to show the relationship of the poles to the roadway.

Electric and Magnetic Fields

Concerns were expressed over the potential effects of EMF on human health, computers, pipelines, and TV and radio reception. Residents asked if calculated EMF values match actual levels. People asked if HECO would address the issue of cumulative EMF values from all the existing power lines. HECO made a commitment to measure EMF at specific locations along the lines after construction to confirm that actual EMF is within the range predicted by EMF models. The data would be made public.

Preferred Alignment

Questions were asked about the reasons for having two single circuits in Pearl City, instead of one double circuit, and about the width of the easements for single and double circuits.

Environmental Impact Statement

The attendees were asked to identify issues and concerns that should be addressed in the project's Environmental Impact Statement. Issues identified were EMF, social equity, and system reliability, as described above.

8.6 Agency Consultation

8.6.1 Consolidated Application Process (CAP) Meeting No. 1 February 5, 1988

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. Through a slide presentation, HECO provided an overview of the project, purpose and need, routing study methodology, and alternative corridors.

The objectives of the CAP meeting were to:

1. Brief the agencies on the purpose and need for the Waiau-Campbell Industrial Park 138 kV Transmission Line Project

2. Present the corridor alternatives and discuss the constraints and opportunities considered in identifying them

3. Identify specific agency issues and concerns:

    - Compatibility or conflict with jurisdiction or statute
    - Information or policies that would influence corridor acceptability

4. Identify criteria or guidelines which agencies feel are important to consider in evaluating and selecting preferred corridors

5. Discuss agency jurisdiction, possible permits, and the permit process

6. 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

7. Discuss corridor preferences and identify possible means for minimizing and resolving siting conflicts--land use jurisdiction and policy

8. 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 8.6-1.

Table 8.6-1
Summary of Agency Response
CAP Meeting--February 5, 1988

Agency	Principal Concerns/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	No action/concerns from LUC unless a land use district designation was to be amended.
Department of Land Utilization (City/County)	Conditional Use Permit (Type 1) would be required for any route selected. SMA Use Permit would be required if the selected route passed through a Special Management Area. Special Use Permit (Type B) may also be required, depending on the location of the route.
Coastal Zone Management (State)	No action/concerns unless the project was constructed in the SMA or Coastal Zone.
U.S. Fish and Wildlife Service	Concerned with protection of wildlife resources and the National Wildlife Refuge Units in the project area.
U.S. Army Corps of Engineers	Actions that could trigger the Corps 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 Highways Division	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)	Concerned that the routing of the new lines avoids schools, playgrounds, and nursery schools.
Department of General Planning (City/County)	Concerned with the necessity of including the proposed project on the Public Facilities Map of the Development Plan.
Department of Land and Natural Resources (State) (no representative present)	DLNR involvement could be triggered if the project crossed Conservation District Lands, historic sites, or districts or any lands owned by the State of Hawaii.

8.6.2 Consolidated Application Process (CAP) Meeting No. 2 November 29, 1988

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.

Through a slide presentation, HECO's Project Team described the 1988 preferred alignment.

The objectives of the meeting were to:

- Solicit input from the agencies regarding the location of the 1988 preferred alignment
- Identify permits, approvals, and reviews that would be required if the lines were built in the alignment
- Determine the sequencing of the permits
- Determine the necessity of a public hearing for any of the approval processes
- 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 identify required permits or approvals.

The major conclusions from the meeting were that an SMA Use Permit would be required by the City and County of Honolulu DLU for the Waiau end of the line and, because the application for an SMA permit must precede all other City and County permits for Part 2, the DLU would become the City and County lead agency for environmental review. DLU would also be responsible for processing the Conditional Use Permit.

Other comments were expressed by the State Department of Transportation—Highways Division and the City/County Department of Transportation Services (DTS). 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/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.

8.7 Elected Official/Agency/Landowner Consultation

8.7.1 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 for Parts 1 and 2. Strong opposition by landowners caused a reevaluation of segments of the alignment to accommodate the landowners' concerns. A series of meetings was held to discuss solutions. In December 1989, 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 the then-preferred Quartermaster Site. The department deemed the site "inappropriate" in February 1990. The city also found part of the Part 1 preferred alignment along Old Fort Weaver Road "not acceptable." Issues and concerns over the Part 2 alignment were also addressed. The project team met with city agencies, elected officials, state agencies, and landowners to develop a new consensus on an acceptable corridor and alignment for Parts 1 and 2 and a site for the Ewa Nui Substation. Table 8.7-1 is a list of these meetings and the agencies, landowners, and elected officials who participated in them.

8.7.2 Summary of Topics Discussed

Undergrounding

The possible routes, costs, and who should pay for undergrounding the transmission lines were topics 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 and in the Waipahu/Pearl City area. Certain constraints to construction and maintenance were identified, although the alignments along H-1 were still feasible. Approval to parallel and cross H-1 was needed from the State Department of Transportation and the Federal Highways Administration. An alignment could run along H-1 all the way from the CIP Substation to the Waiau Power Plant. Visual impacts and community concerns were recognized disadvantages common to all the alternatives.

OR&L Corridor

The feasibility of locating the transmission lines in the OR&L corridor was reexamined. Poor soil conditions, limited access, conflicts with shoreline areas, effects on the Pearl Harbor Wildlife Refuge, and difficult permit requirements were

Table 8.7-1
Agency, Elected Officials, and Landowner Meetings
Waiau-CIP Project, December 1989 to March 1992

Date	Organization/Elected Official
11 December 1989	Campbell Estate
2 January 1990	Campbell Estate
11 January 1990	Campbell Estate
11 January 1990	City and County of Honolulu (C&C) Department of Housing and Community Development C&C Managing Director's Office
16 January 1990	C&C Department of Housing and Community Development
16 January 1990	Campbell Estate
31 January 1990	C&C Managing Director's Office C&C Budget Department C&C Finance Department C&C Department of Housing and Community Development
15 February 1990	Campbell Estate
26 February 1990	C&C Managing Director's Office C&C Budget Department C&C Finance Department C&C Department of Housing and Community Development
2 March 1990	C&C Managing Director's Office C&C Department of Housing and Community Development Campbell Estate
20 April 1990	C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development
25 April 1990	C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development

Table 8.7-1
Agency, Elected Officials, and Landowner Meetings
Waiau-CIP Project, December 1989 to March 1992

Date	Organization/Elected Official
19 June 1990	C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development Campbell Estate
26 June 1990	C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development Campbell Estate
29 June 1990	Office of State Planning Campbell Estate
3 July 1990	Office of State Planning State Department of Land and Natural Resources C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development C&C Department of Public Works Campbell Estate
10 July 1990	State Department of Transportation–Highways Division

Table 8.7-1
Agency, Elected Officials, and Landowner Meetings
Waiau-CIP Project, December 1989 to March 1992

Date	Organization/Elected Official
17 July 1990	Office of State Planning State Department of Land and Natural Resources C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development C&C Department of Public Works Campbell Estate
17 July 1990	State Department of Transportation–Highways Division
31 August 1990	State Department of Transportation–Highways Division
10 September 1990	Office of State Planning State Department of Land and Natural Resources State Department of Transportation C&C Managing Director's Office C&C Department of General Planning Campbell Estate
24 October 1990	State Department of Land and Natural Resources State Department of Transportation C&C Managing Director's Office C&C Department of General Planning C&C Department of Housing and Community Development C&C Department of Transportation Services Campbell Estate
30 January 1991	C&C Managing Director Office
20 March 1991	Councilmember Rene Mansho

Table 8.7-1
Agency, Elected Officials, and Landowner Meetings
Waiau-CIP Project, December 1989 to March 1992

Date	Organization/Elected Official
7 May 1991	State Senator Norman Mizuguchi
8 May 1991	Campbell Estate
9 May 1991	State Representative Noboru Yonamine
13 May 1991	City Council Aide
14 May 1991	State Representative Annelle Amaral
16 May 1991	State Representative Clarice Hashimoto
22 May 1991	Office of State Planning
23 May 1991	State Representative Daniel Kihano
30 May 1991	C&C Department of General Planning
2 July 1991	Council Chairman Arnold Morgado
10 July 1991	Councilmember John DeSoto
22 July 1991	Councilmember Rene Mansho
2 August 1991	Ewa Neighborhood Board Committee
2 August 1991	Campbell Estate
8 August 1991	Ewa Neighborhood Board
14 August 1991	C&C Department of General Planning
28 August 1991	Campbell Estate
5 September 1991	C&C Department of Transportation Services–Rapid Transit C&C Department of Transportation Services–Planning
8 October 1991	U.S. Army Corps of Engineers U.S. Fish and Wildlife Service State Department of Transportation–Highways Division
18 October 1991	State Department of Land and Natural Resources, Division of Forestry and Wildlife
23 October 1991	C&C Department of Transportation Services–Rapid Transit
11 December 1991	State Department of Transportation–Highways Division
14 January 1992	City Council Aides to Arnold Morgado, Rene Mansho, and John DeSoto
23 January 1992	State Representative Paul Oshiro
29 January 1992	State Senator Eloise Tungpalan

Table 8.7-1
Agency, Elected Officials, and Landowner Meetings
Waiau-CIP Project, December 1989 to March 1992

Date	Organization/Elected Official
3 February 1992	State Senator James Aki
3 February 1992	State Senator Norman Mizuguchi
3 February 1992	State Senator Michael Crozier
4 February 1992	Councilmember Rene Mansho
25 February 1992	State Representative Julie Duldulao
25 February 1992	State Representative Clarice Hashimoto
27 February 1992	State Representative Daniel Kihano
27 February 1992	State Representative David Ige
6 March 1992	State Representative Peter Apo
6 March 1992	C&C Office of Rapid Transit
20 March 1992	State Representative Annelle Amaral

recognized as disadvantages. The possibility of shoreline enhancements (e.g., pathway, mangrove trimming, benches, lights) was proposed by some agencies to gain acceptability for the corridor.

Kaloi Gulch Corridor (Part 1)

A new corridor for Part 1 was identified during the joint planning meetings as a result of the State of Hawaii'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 be acceptable because the pattern of future development would take into account the natural barrier in any case. The State of Hawaii was agreeable to having the alignment through its future property.

Ewa Nui Substation Sites (Part 1)

For each alternative corridor in Part 1, possible sites for the new Ewa Nui Substation were identified and evaluated. With an underground line, a substation was still 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.

Environmental/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 E

Appendix E

Comments and Responses During Preparation of the Draft Environmental Impact Statement

Copies of the Draft Environmental Impact Statement (DEIS) were mailed out to seventy-eight (78) recipients on April 8, 1992. Notice of the DEIS was published in the April 8, 1992, *OEQC Bulletin*. Copies of the report were distributed to interested public agencies, organizations, and individuals. In addition, the original and four copies of the DEIS were delivered to the accepting authority, the Department of Transportation, State of Hawaii. A total of 26 agency, organization, or individual comments were received in response to the DEIS. HECO responded to all comments; both comments and responses are reprinted in this appendix.

Table E-1 lists all the agencies, organizations, and individuals that were sent the DEIS and indicates those that submitted comments.

Table E-1
List of Recipients of the
Draft Environmental Impact Statement

	Response
Federal	
Army Directorate of Facilities Engineer	NR
Regional Division U.S. Environmental Protection Agency	NR
Environmental Protection Agency-PAC Islands Contact	NR
Department of the Navy, Naval Base, Pearl Harbor	R
Mr. J. M. Kilian, Director Real Estate Division Dept. of Navy, Pacific Div. Navy Facilities, Engr. Command	NR
USDA Soil Conservation Service	NC
U.S. Army Corps of Engineers	NR
U.S. Coast Guard	NR
U.S. Fish and Wildlife Service	NR
U.S. Geological Survey	NR
Elected Federal Legislator	
Office of Rep. Patsy T. Mink	R
State	
Office of Environmental Quality Control	NC
Department of Agriculture	NR
Department of Accounting and General Services	NC
Department of Defense	R
Department of Education	R
Department of Hawaiian Home Lands	NR
Department of Health	R
Department of Land and Natural Resources (DLNR)	R
DLNR State Historic Preservation Office	NR
Department of Business, Economic Development and Tourism (DBEDT), Land Use Commission	R
DBEDT Library	NR
Housing Finance and Development Corporation	R
Department of Transportation	NR
State Archives	NR
DBEDT State Energy Office	NR
Office of State Planning	R
University of Hawaii	
Environmental Center	R
Marine Programs	NR
Water Resources Research Center	NR
Elected State Legislator	
The Honorable Eloise Tungpalan, State Senate	NR

Key:
R--Response received on DEIS
NC--Response received on DEIS, but no comment
NR--No response received on DEIS
DGP--Agency's comment included in a consolidated response by the Department of General Planning

Table E-1
List of Recipients of the
Draft Environmental Impact Statement

	Response
City and County of Honolulu	
Board of Water Supply	DGP
Building Department	NC, DGP
Department of Housing and Community Development	DGP
Department of General Planning	R
Department of Land Utilization	DGP
Department of Parks and Recreation	NC, DGP
Department of Public Works	DGP
Department of Transportation Services	NC, DGP
Fire Department	DGP
Mr. Jeremy Harris, Managing Director, Municipal Reference and Records Center	NR
Police Department	DGP
Elected City and County of Honolulu Legislators	
The Honorable Arnold Morgado, Jr. Chair, City Council	R
The Honorable Rene Mansho Councilmember, City Council	NR
The Honorable John Desoto Councilmember, City Council	NR
City and County of Honolulu Neighborhood Boards	
Mr. Thomas Kam, Chair Pearl City Neighborhood Board	NR
Mr. Calvin Kawamoto, Chair Waipahu Neighborhood Board	NR
Mr. Michael Wong, Chair Ewa Neighborhood Board	NR
Nongovernmental	
American Lung Association	NR
Hawaiian Electric Company	NR
Office of Hawaiian Affairs	NR
Mr. Sam Kaina, Village Park Community Association	NR
Mr. Chris Kanazawa, VP/General Manager AMFAC/JMB, Oahu Development Division	R
Mr. Henry Eng (response by Mr. Charles Ehrhorn) James Campbell Estate	R
Mr. Richard W. Gushman, II, President WCC Associates (Waikele Center)	R

Key: R--Response received on DEIS
NC--Response received on DEIS, but no comment
NR--No response received on DEIS
DGP--Agency's comment included in a consolidated response by the Department of General Planning

Table E-1
List of Recipients of the
Draft Environmental Impact Statement

	Response
Nongovernmental (continued)	
Mr. Jim Wriston, Oahu Sugar Company, Limited	NR
Mr. Paul Cathcart, Manager Bishop Estate–Land Division	NR
Mr. Steve Mau, Esq., Robinson Estate	NR
Ms. Patrice Lin, Gentry Hawaii Ltd.	NR
Ms. Christine Camp, Project Manager Castle and Cooke Residential, Inc.	NR
Mr. James K. Schuler, President JPS Hawaii, Inc.	NR
News Media	
Honolulu Star Bulletin	NR
Honolulu Advertiser	NR
Sun Press	NR
Libraries	
University of Hawaii, Hamilton Library	NR
Legislative Reference Bureau	NR
State Main Library	NR
Kaimuki Regional Library	NR
Kaneohe Regional Library	NR
Pearl City Regional Library	NR
Hilo Regional Library	NR
Kauai Regional Library	NR
Aiea Library	NR
Ewa Beach Community School Library	NR
Mililani Public Library	NR
Waipahu Library	NR

Key:
R--Response received on DEIS
NC--Response received on DEIS, but no comment
NR--No response received on DEIS
DGP--Agency's comment included in a consolidated response by the Department of General Planning

Public Meeting on Draft EIS

A public meeting was held on May 7, 1992, at 7:00 p.m. at Pearl City Elementary School to accept comments on the Draft EIS for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Five people signed in on the meeting's sign-in sheet:

- Jerry Souza
- Charles J. Keever, Office of U.S. Representative Patsy Mink
- Sallie Edmunds, Office of State Planning
- Tim Johns, AMFAC/JMB
- Donna Hoshide, Arnold Morgado's Office, City Council

Two of these individuals asked specific questions:

- **Jerry Souza**
  P.O. Box 19
  Pearl City, Hawaii 96782

  - Does the line run along the edge of AMFAC's property? Which alternative is favored by HECO? Besides cost, what other reasons were considered to eliminate undergrounding?

  - Will HECO make any effort to get information out to the public? Is there still time to submit comments to the PUC?

- **Sallie Edmunds**
  State of Hawaii
  Office of State Planning
  P.O. Box 3540
  Honolulu, Hawaii 96811

  - How is construction of the transmission lines being done through the wetlands?

Response letters were prepared, and copies of these letters are included in this appendix.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Jerry Souza
P.O. Box 19
Pearl City, Hawaii 96782

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Souza:

Thank you for the questions you asked at the May 7, 1992, public meeting regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your questions and this response will be included in the Final Environmental Impact Statement (FEIS).

As discussed in the DEIS, at the February 4, 1992, public meeting at Pearl City High School, and in a newsletter mailed out to the affected communities in January 1992, HECO's preferred alternative is the all-overhead transmission line alignment that runs along the mauka edge of H-1 in a double-circuit configuration through Waipahu and Waikele; then as two single-circuit lines through Pearl City along the makai side of Kamehameha Highway and the mauka side of H-1. The project would run along the edge of AMFAC's Waikele property.

Cost is the main reason HECO did not select an underground alternative. The comparative costs of the alternatives, including all-underground and partial-underground configurations, are shown in Table 9-1 of the DEIS. Other considerations included environmental impacts and operation/maintenance/repair factors. Chapter 7 of the Routing Report for this project describes in detail the factors considered by HECO. You received a copy of the report at the DEIS public meeting.

Appendix D of the DEIS summarizes the various ways HECO has disseminated information to the public during the route selection process. In addition, HECO has held briefings upon request from community groups, elected officials, and individuals throughout the various phases of the project. HECO will continue to respond to such requests. The FEIS, which will include your comments and this response, will be available to the public this summer.

Mr. Jerry Souza
Page 2
August 4, 1992

As stated at the public meeting for the DEIS, the PUC had scheduled a hearing to receive public comments on May 28, 1992, at Waipahu High School. At that meeting, the State Consumer Advocate stated that his office will represent the public's interest at all future PUC proceedings.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AED.PDX

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Ms. Sallie Edmunds
State of Hawaii
Office of State Planning
P.O. Box 3540
Honolulu, Hawaii 96811

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Ms. Edmunds:

Thank you for the question you asked at the May 7, 1992, public meeting regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your question and this response have been included in the Final Environmental Impact Statement.

For all alternatives (except the OR&L alternative east of Lehua Avenue), disturbance of wetlands is not required during construction. The steel poles permit longer spans (400 to 600 feet) than wooden poles and, because of fingers of dry land between the wetlands, HECO is able to avoid any work in wetlands. Steel pole foundations would be placed on dry land where access to such sites is over dry land. Conductors or lines that span wetlands can be strung with the use of helicopters. Under the OR&L alternative, there are potential impacts to wetlands along stream courses that must be crossed. Should this alternative be required by the PUC, appropriate permits will be obtained from the U.S. Army Corps of Engineers. Impacts will be minimized where possible, and mitigation will be provided where necessary.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

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

March 20, 1992

RECEIVED
MAR 30 10 26 AM '92
DEPT. OF TRANSPORTATION
HIGHWAYS DIVISION

Mr. Rex D. Johnson
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Mr. Johnson:

I understand that your office has invited comment regarding the routes under consideration by HECO for the Waiau-Campbell Industrial Park 138kV voltage transmission lines, part 2 from Waiau to Kehe Point.

My long held views on the subject is that these lines should be placed where the others are already located, ie in the available routes through the sugar fields and other vacant lands.

I do not favor putting these overhead lines through any residential or commercial areas such as through Waipahu town. The Farrington Highway route is totally unacceptable and must be avoided at all costs. Along Farrington Highway are numerous residences, apartments, schools, bus stops, and other living areas which are too close to these lines for health and safety reasons. Obviously if these lines were to be placed underground it would be acceptable.

The Waipahu Street route is unacceptable for the same reasons. Likewise the OR&L route which is rejected for other reasons, but it too runs parallel to the Wailani Subdivision and other residential areas.

The H-1 freeway route where it does not run close to homes in Village Park would be acceptable. However where the lines are close to the homes it should be placed underground for health and safety reasons.

There is growing concern about the electromagnetic effects of these transmission lines and I am strongly of the view where new lines are being placed the best precaution is to put them underground. Obviously they must go somewhere and I chose the sugar and vacant lands mauka of the residential areas.

Mr. Rex D. Johnson
March 20, 1992
Page 2

Each year we learn that technology which we readily accepted has turned out to be injurious to health (asbestos) and which is very costly to remove (State Capitol).

Its time for planners and decision makers to plan for the future; not for costsavings expediency.

We do have a law which <u>does</u> require all electric lines to go underground. We should apply that law to these transmission lines as well.

Every citizen under our Constitution has a right to a clean and healthful environment. By government action or inaction we should not negate that principle.

Whether it's EDB, DBCP, CFC, asbestos, lead, silicone breast implants, or other items, the cost of removing these hazards later is far greater than not having used them in the first place, if we could have known.

We do know there are deep concerns about EMF. We should act in accordance with these concerns.

Very truly yours,

Patsy T. Mink

PATSY T. MINK
Member of Congress

RECEIVED
MAR 32 8 59 AM '92
HIGHWAYS DIVISION
DEPT. OF TRANSPORTATION

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-00

August 4, 1992

The Honorable Patsy Mink
Congress of the United States
House of Representatives
5104 Prince Kuhio Federal Building
P.O. Box 50124
Honolulu, Hawaii 96850-4977

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Representative Mink:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

We understand your concerns about transmission lines that pass through residential and commercial areas. HECO's route selection study identified existing agricultural and vacant lands as areas of low constraint to locating the proposed transmission lines. Even in these areas, an effort was made to minimize disruption to agricultural operations (e.g., follow existing utility lines and canehaul roads) and impacts to future development of vacant lands (e.g., follow existing natural boundaries or keep to the edges of the development parcels). A number of residential developments are proposed for the agricultural and vacant lands mauka of H-1 (e.g., Hale Ola, Royal Kunia, Gentry Kunia, and Waikele, as shown in Figure 5-3b, FEIS). These developments come close to the existing Kahe-Halawa transmission line corridor from which the proposed transmission line must be separated by one-half mile to meet the project's objective of providing a separate, alternate corridor to transmit electricity from the power-generating plants in west Oahu to the load centers farther east. This objective and the proposed residential developments effectively constrained HECO from identifying an alternative corridor in central Oahu.

In its route selection process, HECO did not select the Farrington Overhead alternative (double-circuit overhead lines in the median of Farrington Highway) as its preferred alternative because of potential conflicts with the possible future extension of the City's fixed guideway system, future improvement plans by the State Department of Transportation, and the concerns stated in your letter. Underground lines in Farrington Highway were evaluated in detail, but they have a significantly higher cost ($129.4 million) compared with the preferred H-1 Overhead alternative ($31.3 million), and these costs result in higher costs to ratepayers. Chapter 9 of the FEIS discusses the additional monthly cost to an average residential customer that consumes 600 kilowatt-hours per month, assuming ratepayers bear the costs of an underground line. Such a customer would pay an additional $2.10 per month for the Farrington Underground alternative.

Waipahu Street was eliminated in the early stages of HECO's route selection process because the street is too narrow for the transmission lines and is closely bordered by residential uses for much of its length. The OR&L alternative alignment has fewer existing and proposed residential uses in close proximity. This alternative is not preferred by HECO because of the unlimited liability for cleanup costs and environmental damage from fuel oil spills if any of the existing pipelines in the OR&L ruptured during or after construction of the transmission lines. Also, according to the Office of State Planning, the impacts of the OR&L alternative would violate the Coastal Zone Management Act.

HECO selected the H-1 Overhead alternative as the least objectionable alternative that could meet the project's reliability objectives at a reasonable cost. Because the proposed lines would pass by the edge of Village Park in an existing subtransmission (46 kV) line easement mauka of the freeway right-of-way, HECO is proposing to install the steel poles immediately inside the freeway right-of-way to provide as much distance as possible from the existing residences. (The poles would also be away from the freeway lanes and shoulder.) Placing the lines underground would not eliminate magnetic field levels: estimated magnetic field levels would be 19 milliGauss (mG) directly over underground lines, compared with 11.4 mG directly under overhead lines. However, the magnetic field levels would decline more quickly over distances for underground lines than overhead ones: at 40 feet from the lines, underground lines would emit 1 mG compared with 6.5 mG for overhead lines. (See section 5.C of the EIS.) Undergrounding effectively eliminates the electric field. The cost for undergrounding the lines next to Village Park could add approximately $21.8 million more (and this does not include the cost of land needed for overhead to underground transition stations) to the $31.8 million construction cost of the preferred H-1 Overhead alternative. Total construction cost of the H-1 Overhead route with undergrounding at Village Park could be $53.6 million.

Section 5.C of the EIS addresses the concerns about potential adverse health effects from EMF by discussing current scientific research, the directions of future research, and the response of federal and state governmental agencies in promulgating policies and standards to regulate EMF exposure to the public. The EIS also addresses how undergrounding of transmission lines affects exposure levels, noting that magnetic fields cannot be eliminated. The lack of conclusive evidence on the health effects of EMF has impeded the ability of government to set health-related numerical standards for EMF exposure. Thus, the EIS cannot reach a conclusion regarding how design of the transmission lines relates to the risk of health impacts. Locating the lines away from populated areas does minimize exposure; however, the urbanized nature of the study area (Waipahu and Pearl City) makes it impossible to completely avoid populated areas. And, placing the transmission lines underground does not completely mitigate the public's exposure to EMF levels.

As a regulated utility, HECO is required to provide necessary and reliable service at a reasonable cost. HECO's application and supporting documentation to the PUC discuss the advantages and disadvantages of overhead and underground lines with respect to cost, EMF, and other environmental and socioeconomic impacts.

HECO and its consultants are not aware of any law that requires the undergrounding of transmission lines in the Ewa, Waipahu, and Pearl City areas. There are State and City laws and regulations that strongly discourage overhead transmission lines in certain special districts (e.g., Capital Special District, Punchbowl Special District, Kakaako Community Development District, and Diamond Head Special District). Construction of overhead transmission lines in these districts requires waivers, variances, or exemptions. Local distribution lines are often placed underground in the newer subdivisions. In the older parts of Honolulu, existing overhead utilities are placed underground through the formation of local improvement districts. In both cases, property owners share in the cost of placing the lines underground.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

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

IN REPLY REFER TO:

11011
Ser 00F(2411)/2017
20 MAY 1992

Highways Division
Attn: Mr. Kenneth Umemoto
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, HI 96813

Gentlemen:

The State of Hawaii Office of Environmental Quality Control provided a copy of the Draft Environmental Impact Statement for Part II (EWA NUI SUBSTATION TO WAIAU POWER PLANT) of the Hawaiian Electric Company (HECO) Waiau-Campbell Estate Industrial Park 138KV Transmission Line Project for our review and comments. The transmittal letter advised that comments regarding the project should be submitted to your office.

The following are our comments with regard to the document:

a. It should address the cumulative socio-economic impact of this power line on the visual resources of the island of Oahu. For example, how will the proposed power line in addition to all the existing overhead power and communication lines and other visible man-made objects affect the visitor industry and desirability (land value) of the area for residents?

b. The OR&L alternative route may impact the Pearl Harbor National Wildlife Refuge on Waiawa Peninsula and should be addressed.

Additionally, the Navy has requested that HECO use the bikeway east of Lehua Elementary School as the route through Navy land on Pearl City Peninsula. The reason is that the 138kv improvements are not readily removable and an expansion of its present right-of-way would have an adverse impact on Navy planning and siting of facilities for this area. HECO officials are aware that separate environmental documentation must be prepared in accordance with federal laws for the proposed easement grants over Navy lands required for this project.

Sincerely,

W.K. Liu

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

Copy to:
Office of Environmental Quality Control
State of Hawaii
220 South King Street, 4th Floor
Honolulu, HI 96813

Hawaiian Electric Co., Inc.
Attn: Ms. Mary Ellen Nordyke-Grace
P.O. Box 2750
Honolulu, HI 96813

CH2M Hill
Attn: Mr. Paul Luerson
1585 Kapiolani Boulevard, Suite 1312
Honolulu, HI 96814

August 4, 1992

Mr. W. K. Liu
Assistant Base Civil Engineer
Department of the Navy
Commander
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860-5020

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Liu:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Visual Resources

The socioeconomic impacts of each of the alignment alternatives are addressed in the DEIS. It is recognized that there are adverse visual impacts associated with overhead transmission lines. The proposed overhead transmission lines, as well as all other overhead utility lines (telephone and cable), are not visually pleasing to Hawaii's residents and visitors. However, overhead utility lines exist throughout most of the island and HECO is not aware of serious objections from visitors. The proposed lines are not located in a resort area, and although visitors would see them while touring the island or en route to resort areas on the west coast of Oahu, the lines should not diminish the visitors' enjoyment. If visitors want to experience a tropical environment uncluttered by manmade objects, then they must travel to specific isolated valleys in Hawaii. Manmade objects cannot be avoided on Oahu, particularly in the urbanized study area of the proposed transmission lines.

In a few areas of the island (e.g., in newer subdivisions and local improvement districts), utilities are underground. The cost of placing the lines underground was paid for in whole or in part by adjacent property owners and residents. The willingness of property owners to share in the cost of underground utilities indicates that the benefits (less visual clutter) outweigh the costs. Thus, underground utilities could result in higher prices for commercial and residential properties because buyers perceive the absence of overhead lines to be a benefit.

A few years ago, the City of Honolulu's Chief Engineer 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 could be four times higher than today's cost. This financial impact to residents must be weighed against the benefit to residents and visitors alike before making a decision to place lines underground in order to mitigate visual impacts.

Impact of OR&L Alternative on Pearl Harbor National Wildlife Refuge

The impact of the OR&L alternative on the Pearl Harbor National Wildlife Refuge is addressed throughout the DEIS. Specific page references include 5-6, 5-15, 5-51, 5-68, and 5-69. The most thorough discussion is found under Probable Impacts, Biological Resources (page 5-68). HECO has not selected this alternative as its preferred alternative.

Bicycle Path East of Lehua Elementary School

An optional alignment for all alternatives begins just east of Lehua Elementary School and follows a bicycle path adjacent to and makai of H-1, ending at a point just east of Waimano Stream on HECO property. The bike path optional alignment is described in Chapter 4 of the FEIS. Figures 4-3, 5-3a, 5-13a, and 5-16a show the bike path option. The impacts of this option are addressed in Chapter 5.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

May 7, 1992

Mr. Kenneth Umemoto
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Subject: Draft Environmental Impact Statement (DEIS) - Waiau-Campbell Industrial Park Transmission Line Part 2 - Ewa Nui Substation to Waiau Power Plant

We have reviewed the DEIS for the Waiau-Campbell Industrial Park 138 kV Transmission Line, Part 2 - Ewa Nui Substation to Waiau Power Plant and have no comments to offer at this time.

Thank you for the opportunity to comment on this proposed project. We would appreciate reviewing the Final EIS when it is completed.

Sincerely,

Gordon O Cuyfetat

WARREN M. LEE
Acting State Conservationist

cc:
Ms. Mary Ellen Nordyke-Grace, Hawaiian Electric Company, P.O. Box 2750, Honolulu, HI 96813
Mr. Paul Luersen, CH2M Hill, 1585 Kapiolani Blvd., Suite 1312, Honolulu, HI 96814

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-00

August 4, 1992

Mr. Warren Lee
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Lee:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement (FEIS) for this project. A copy of the FEIS will be mailed to you.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AE0.PDX

JOHN WAIHEE
GOVERNOR

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

CHARLES T. TOGUCHI
SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

RECEIVED
MAY 4 1992
CONST & MAINT BR

April 23, 1992

Mr. Kenneth Umemoto
Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

SUBJECT: Draft Environmental Impact Statement (DEIS)
Waiau-Campbell Industrial Park Part 2, Ewa, Oahu
TMK: Various in Zone and Sections: 9-1,2,3,4,6,7,8

Our review of the subject draft EIS indicates that the proposed transmission lines from the Waiau Power Plant in Pearl City to the new Ewa Nui Substation in the Ewa District may be aligned in proximity to existing schools in Pearl City and Waipahu. Depending on the corridor chosen for this project, high voltage transmission lines close to a school are a serious concern to the Department. The schools which may possibly be affected are Lehua Elementary, Pearl City Elementary, Waipahu Intermediate, and Waipahu High.

Health effects of electric and magnetic fields created by high voltage transmission lines have been inconclusive and more studies are being done as stated on page 5-38 in the draft EIS. As such, the Department strongly recommends that high voltage transmission lines be situated away from schools to prevent and minimize a possible health risk to our students and staff.

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

Sincerely,

Charles T. Toguchi

Charles T. Toguchi
Superintendent

CTT:hy

cc: A. Suga
L. Chung

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

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

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Toguchi:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement.

Five alternative alignments were examined in the DEIS. Of these five alternatives, HECO has identified the H-1 Overhead as its preferred alternative. Table 5-13 of the DEIS is a list of all the schools within the study area, as well as the alternative(s) to which they are closest. The four schools mentioned in your letter, in addition to several others, are listed in this table. With regard to the four schools mentioned in your letter, the Farrington Highway alternatives and the OR&L alternative pass on either side of Waipahu Intermediate School and Waipahu High School. Pearl City Elementary School is across Kamehameha Highway from the single-circuit line of the Farrington and H-1 alternatives. Lehua Elementary School is adjacent to the OR&L alignment. As you state in your letter, data are inconclusive on the health effects of electric and magnetic fields (EMF) created by transmission lines. The potential effects discussed in the DEIS represent a comprehensive review of recent, major research and governmental evaluation.

Concerning HECO's preferred alternative (H-1 Overhead), two schools are relatively close to the alignment: Pearl City Elementary School and Lehua Elementary School. The other schools are not in close proximity to the preferred alternative. The portion of

Mr. Charles Toguchi
Page 2
August 4, 1992

the transmission alignment near Pearl City Elementary School will contain a single-circuit line that follows an existing 46 kV line on the opposite side of Kamehameha Highway (a distance of 112 feet). The alignment near Lehua Elementary School is also a single-circuit line that joins existing 46 kV lines on the Diamond Head side of the school. At this point in the project, we have not yet identified pole locations in the vicinity of Lehua Peninsula. During the design phase, we will make every effort to locate the poles and lines away from the east property line of Lehua Elementary School. There may be temporary construction impacts, but no long-term adverse impacts to the school are anticipated. The discussion on EMF impacts indicates that potential impacts are lessened where 138 kV lines are installed on the same pole as lower voltage lines, as HECO proposes.

The preferred alternative represents the least potential impact to public schools. HECO shares your concern about the potential health effects from exposure to EMF. Every possible effort has been made to minimize potential EMF impacts, as discussed in section 5.C of the DEIS.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010B16.PDX

JOHN WAIHEE
GOVERNOR

BRIAN J. J. CHOY
Director

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813

TELEPHONE (808) 586-4185

April 25, 1992

Department of Transportation
Highways Division
Attn: Kenneth Umemoto
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Subject: Draft Environmental Impact Statement for the Waiau-Campbell Industrial Park Part 2 138 kV Transmission Lines

Thank you for the opportunity to review the subject document. We have no comments to offer.

If you have any questions, please call Margaret Wilson at 586-4185.

Sincerely,

Brian J.J. Choy

Brian J.J. Choy
Director

BC:mw

c: CH2M HILL
Attn: Paul Luersen
1585 Kapiolani Boulevard, Suite 1312
Honolulu, Hawaii 96814

Hawaiian Electric Company
Attn: Mary Ellen Nordyke-Grace
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Brian J. J. Choy
Director
State of Hawaii
Office of Environmental Quality Control
220 South King Street
Fourth Floor
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Choy:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement for this project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AE1.PDX

JOHN WAIHEE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:

July 1, 1992

92-147/epo

Mr. Kenneth Umemoto
Highways Division
State Department of Transportation
689 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Subject: Draft Environmental Impact Statement
Waiau-Campbell Industrial Park, Part 2
138 KV Transmission Lines
Ewa, Oahu

Thank you for allowing us to review and comment on the subject request. We have no comments to offer at this time.

Sincerely,

Thomas E. Arizumi

for JOHN C. LEWIN, M.D.
Director of Health

c: Office of Environmental Quality Control
Hawaiian Electric Company
CH2M Hill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Dr. John C. Lewin
Director
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Dr. Lewin:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement for this project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Project Manager

10010E21.PDX

An HEI Company

JOHN WAIHEE
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

May 7, 1992

Mr. Rex D. Johnson, Director
State of Hawaii, Department
of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Kenneth Umemoto

Dear Mr. Johnson:

Subject: Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line; Part 2 - Ewa Nui Substation to Waiau Power Plant

The Department of Business, Economic Development and Tourism has referred the subject DEIS to our office for response.

Based on our review of the DEIS, we have the following comments.

1) All four alternative corridors for the proposed Ewa Nui Substation to Waiau Power Plant Project cross the State Land Use Agricultural and Urban Districts at various points in their alignments.

2) We confirm that the OR&L alignment is adjacent to the Conservation District as determined by the Land Use Commission Boundary Interpretation No. 91-52, and that the precise location of the Conservation District Boundary is subject to a current certified shoreline survey.

3) We find that the portions of the corridor boundary makai of the OR&L alignment in the Kapakahi Stream wetland and West Loch areas, as shown on Figure 5-14 and 5-15, are located within the State Land Use Conservation District.

4) The Land Regulation Map, Figure 6-1, does not reflect the official State Land Use District boundaries in the Varona Village and the West Loch Phase II Project areas.

We have no other comments to offer at this time.

Thank you for the opportunity to comment on this matter. If you have any questions, please call me or Steve Tagawa of my staff at 587-3822.

Sincerely,

Esther Ueda

ESTHER UEDA
Executive Officer

EU:fl

cc: Mary Ellen Nordyke-Grace
Paul Luersen
OEQC
DBED

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Ms. Esther Ueda, Executive Officer
State of Hawaii
Department of Business, Economic Development and Tourism
Land Use Commission
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Ms. Ueda:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

HECO has not selected the OR&L Overhead/Underground alternative as the preferred alternative. If state and county approvals require HECO to use the OR&L alternative, then a certified shoreline survey would be obtained before design of the transmission line to see if work in the Protective Subzone of the Conservation District could be avoided.

The corridor boundary shown makai of the OR&L is a hypothetical study area within which an alignment would be defined. Based on the certified survey, HECO would try to avoid the Protective Subzone.

Figure 6-1, Land Regulation Map, has been revised in the FEIS to show the current Land Use District boundaries in the area as of June 2, 1992.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Project Manager

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 PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

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

REF:OCEA:SKK

MAY 12 1992

FILE NO.: 92-631
DOC. ID.: 677

The Honorable Rex Johnson, Director
Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Johnson:

SUBJECT: Draft Environmental Impact Statement for the Waiau-Campbell Industrial Park Part II, 138KV Transmission Lines - Ewa, Oahu

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

Brief Description:

The Hawaiian Electric Company, Inc. proposes to install (in its Waiau - Campbell Industrial Park (CIP) Transmission Line Park 2 Project) double-circuit, 138 kilovolt (kV) alternating current (AC) transmission lines between the new Ewa Nui Substation (next to Farrington Highway in the Ewa District) and its Waiau Power Plant. Three reasons are given for the proposed project; 1) to increase system reliability by establishing an alternate transmission line corridor, 2) to provide additional transmission capacity in leeward and central Oahu to meet expected load growth and 3) to meet transmission requirements for existing and planned power generation projects in the Campbell Industrial Park area.

Alternatives for constructing the 138 kV transmission lines between the Waiau Power Plant and the Ewa Nui Substation include the conventional overhead construction, underground construction or a combination of these two technologies.

For Part 2 of the Waiau-CIP transmission line, several technical studies on alternative alignments along H-1 freeway, Farrington Highway and the Oahu Rail and Land (OR&L) were conducted. In the alternative analyses, HECO considered all-overhead, partial-underground and all-underground configurations.

HECO's preferred alignment from the Ewa Nui Substation to the Waiau Power Plant is the H-1 Overhead.

Four other alignment alternatives presented in the Draft EIS are 1) H-1 Overhead/Underground Alternative, 2) Farrington Overhead Alternative, 3) Farrington Underground Alternative and 4) OR&L Overhead/Underground Alternative.

Division of Aquatic Resources Comments:

We do no have any aquatic resources concerns with the HECO preferred H-1 Overhead alignment from the Ewa Nui Substation to the Waiau Power Plant.

The OR&L Overhead/Underground alignment alternative, however has the potential for the most significant adverse effect of all the alignment alternatives discussed in the Draft EIS. This corridor is adjacent to Pearl Harbor, would require reconstruction and/or widening of existing bridges, as well as construction of an all-weather access road for maintenance purposes.

Our main concern with this alignment alternative is the damage or rupturing of existing pipelines during and after the construction phase of the project. Mitigation measures are discussed on page 5-85 and 5-86 for all alternatives. These measures would minimize damage to the existing pipelines which were laid long ago and are old and fragile. The EIS also makes recommendations to minimize environmental damage in the event of a hazardous material spill.

The document notes that existing pipelines carry oil and propane. If the pipeline carrying oil products breaks it could cause contamination to the soil and nearby water bodies of Pearl Harbor and cause serious damage to the aquatic environment and its resources. Leakage of the existing propane line, on the other hand, could result in an explosion and fire. Mitigation measures proposed should be required conditions of all permits.

Historic Preservation Division Comments:

The DEIS presents five alternative plans (excluding no action) that mix a variety of overhead and underground configurations. We concur with the determination in the report that overhead lines are likely to have "no effect" on historic sites, including human burials. There remains the possibility that human burials will be discovered in the routine construction activities associated with pole placement. If this should be the case, then construction activity in the vicinity will stop and our office contacted at phone number 587-0047.

Underground lines, particularly in the vicinity of Pearl Harbor, are likely to have an "adverse effect" on sub-surface historic sites. This area, which many prehistorians believe to be a likely spot for early Polynesian settlement, has seen little archaeological study, and an underground line that did not follow existing utilities rights-of-way would be likely to yield much information on Hawaii history and pre-history. In this instance, to ensure a "no adverse effect", we would ask that a qualified archaeologist monitor trench excavation in order to record sub-surface historic sites, collect samples for analysis, and produce an acceptable report. Underground lines that follow existing utilities rights of way would be likely to have "no effect" on historic sites.

Office of Conservation and Environmental Affairs Comments:

We note that the proposed OR&L alignment is adjacent to Pearl Harbor where there are several conservation areas. The State Land Use Commission should be advised to confirm the exact location of the Conservation District boundary relative to the OR&L transmission corridor. A Conservation District Use Application (CDUA) is required for transmission easements.

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,

John P. Keppeler

for WILLIAM W. PATY

cc: Hawaiian Electric Company
CH2M Hill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

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

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Paty:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Division of Aquatic Resources

These comments regarding the potential impacts of the OR&L alternative are consistent with the impacts described in the DEIS. They are noted.

Historic Preservation Division

Concerns regarding the potential for discovery of subsurface historic sites are noted. The FEIS includes specific mitigation recommended for underground lines.

Office of Conservation and Environmental Affairs

HECO contacted the Land Use Commission and requested confirmation of the Conservation District boundary. The Commission staff advised HECO that a certified shoreline survey of current conditions would be necessary to locate the exact position of the Conservation District boundary relative to the OR&L corridor. HECO has not selected the OR&L alternative as its preferred alternative. If state and county approvals require HECO to use the OR&L, the precise location of the District boundary would be identified, and HECO would obtain the appropriate permits prior to construction.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

JOHN WAIHEE
GOVERNOR

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) [redacted]
587-0600

IN REPLY REFER TO:
92:PPE/1999mo

May 15, 1992

Mr. Kenneth Umemoto
State of Hawaii
Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Subject: Waiau-Campbell Industrial Park Part 2
Draft Environmental Impact Statement

We have examined the document and have the following comment:

We request that further investigation on the effects of electric and magnetic fields be completed. The draft EIS states that previous studies were inconclusive. The Housing Finance and Development Corporation (HFDC) has a project which will be adjacent to the proposed transmission line along the Farrington Highway corridor. We are concerned about the health impact to area residents.

Thank you for the opportunity to comment.

Sincerely,

JOSEPH K. CONANT
Executive Director

c: Ms. Mary Ellen Nordyke-Grace, Hawaiian Electric Company
Mr. Paul Luersen, CH2M Hill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Joseph K. Conant
Executive Director
State of Hawaii
Department of Budget and Finance
Housing Finance and Development Corporation
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Conant:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement.

Ms. Michelle Otaki and Mr. Michael McElroy of your office were contacted by our consultant, CH2M HILL, to obtain more information on the state project referenced in your letter. It is our understanding that the project, "Kau'ola Elderly Project," is located one block mauka of Farrington Highway next to Mokuola Street and Kauolu Place. The project is being developed in phases (Phase 1 construction has begun) and would include housing for the elderly, a civic center, and other community facilities.

The preferred alternative selected by HECO, H-1 Overhead, would not affect your project.

HECO shares your concern about the potential health effects from EMF exposure. Further investigation into the potential health effects of EMF is being conducted by scientific, governmental, and industry groups. HECO provides financial contributions to support such studies. The DEIS summarizes the results of past and current studies. The statement that data are inconclusive as to the health effects of EMF is based on overview studies by the U.S. Environmental Protection Agency and the federal Office of Technology Assessment.

Joseph K. Conant
Page 2
August 4, 1992

If state and county approvals require HECO to implement the Farrington Overhead alternative, then HECO will make every practical effort to minimize EMF exposure, as described in section 5.C of the DEIS.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AEB.PDX

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

(P)1444.2

MAY 18 1992

Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Mr. Kenneth Umemoto

Gentlemen:

Subject: Waiau-Campbell Industrial Park Part 2
138 kV Transmission Lines
Draft Environmental Impact Statement

Thank you for the opportunity to review the subject document. We have no comments to offer.

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

Very truly yours,

T. Tominaga

TEUANE TOMINAGA
State Public Works Engineer

RY:jk
cc: OEQC
Hawaiian Electric Company
✓CH2M Hill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Teuane Tominaga
State Public Works Engineer
Department of Accounting and General Services
Division of Public Works
P.O. Box 119
Honolulu, Hawaii 96810

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Tominaga:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement for this project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

An HEI Company

10010AE5.PDX

JOHN WAIHEE
GOVERNOR

MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE

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

PHONE (808) 734-2161

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

May 20, 1992

TO: Mr. Kenneth Umemoto
Highways Division
Department of Transportation

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

SUBJECT: Draft Environmental Impact Statement for Waiau-Campbell Industrial Park Part 2, 138 kV Transmission Lines

State Civil Defense appreciates this opportunity to comment on the installation of the Waiau-Campbell Industrial Park Part 2, 138 kV transmission lines located in the southwest quadrant of Oahu, Hawaii, in various zones and sections of TMK: 9-1, 9-2, 9-3, 9-4, 9-6, 9-7 and 9-8.

We do not have negative comments specifically directed at the Draft Environmental Impact Statement. However, we do have a concern that the installation of overhead 138 kV power lines combined with the existing 46kV line along Kamehameha Highway and Waimano Home Road could adversely impact the proper operation of the outdoor warning siren located at the Pearl City Courthouse. Our concerns are that the electromagnetic field generated by the transmission lines may interfere with the line-of-sight radio control signals used to activate the siren. Should this concern be verified at a later date, the siren would have to be resited and relocated in the vicinity of its present location to insure that the alerting capability coverage is not compromised.

Request that the cost of the siren relocation be treated as support for siren infrastructure, as in the permitting process for new developments, and be coordinated with the Office of State Planning. The cost is to be borne by the applicant/requestor.

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.

c: Ms. Mary Ellen Nordyke-Grace
Hawaiian Electric Company

Mr. Paul Luersen
CH2M Hill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

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

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Price:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement.

If it is verified after construction that the electric and magnetic fields from the transmission lines along Kamehameha Highway interfere with the line-of-sight radio control signals used to activate the siren, HECO will pay to relocate the outdoor warning siren located at the Pearl City Courthouse. We will coordinate with the Office of State Planning with regard to this matter.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AEA.PDX

OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540
STREET ADDRESS: 250 SOUTH HOTEL STREET, 4TH FLOOR
TELEPHONE: (808)587-2846, 587-2800

FAX: Director's Office 587-2848
Planning Division 587-2824

Ref. No. P-3108

May 22, 1992

MEMORANDUM

TO: The Honorable Rex Johnson, Director
Department of Transportation

ATTN: Mr. Kenneth Umemoto
Highways Division

SUBJECT: Draft Environmental Impact Statement, Waiau-Campbell Industrial Park Part 2 138 kV Transmission Lines

We have reviewed the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line, Part 2 - Ewa Nui Substation to Waiau Power Plant and have the following comments.

In the analysis of the Coastal Zone Management (CZM) law, the DEIS notes that the OR&L alignment will affect recreational, visual, scenic and open space, and significant coastal ecosystem (wetland) resources. It summarizes the CZM analysis by stating, "The alternative alignments, except for the OR&L alignment, are not expected to affect water quality, areas of open water free of visible structures, fisheries and fishing grounds, wildlife habitats, or agricultural land. Wildlife habitat for four endangered waterbird species adjacent to the OR&L alignment could be adversely impacted from project development activities." Therefore, this alignment should not be considered further. The alternative, if selected, would be a violation of the CZM law, Chapter 205A, HRS.

The wetlands near the Waiau Power Plant should be avoided as much as possible. However, if this is not possible, effective mitigation measures should be thoroughly discussed.

We note your section on the unresolved issue of electromagnetic fields and their potential threats to public health. This issue is of concern to us as we want to be sure we protect the people of Hawaii from foreseeable health problems. However, we must defer to the State Department of Health to assess the potential impacts and recommend any alternate routes or mitigating measures that should be applied in this era of uncertainty.

If you have any questions, please call the CZM Program at 587-2875.

Harold S. Masumoto
Director

cc: Mr. Paul Luerson, CH2M Hill
Ms. Mary Ellen Nordyke-Grace, Hawaiian Electric Co.
Office of Environmental Quality Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Harold S. Masumoto
Director
Office of State Planning
P.O. Box 3840
Honolulu, Hawaii 96811

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Masumoto:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Coastal Zone Management and the OR&L Alternative

Your comments in the first paragraph of your letter regarding Coastal Zone Management and the impacts associated with the OR&L alternative are noted. These impacts are identified in the Environmental Impact Statement. We recognize that the OR&L alternative has more environmental impacts than the other alternatives. HECO has not selected it as the preferred alternative because of the unlimited liability for the costs of cleanup and damage to the area's shoreline environment that could result from a rupture of the existing fuel lines during or after construction. Your comments strengthen HECO's position in not selecting the OR&L alternative.

Wetlands Impacts

Poles in the vicinity of the wetlands near the Waiau Power Plant will be located on fingers of dry land to completely avoid adverse wetland impacts. Maintenance of the lines can also occur without impacts to the wetlands by using these fingers of dry land to reach the poles from an existing access road near H-1 freeway.

10010AE3.PDX

Electric and Magnetic Fields

Your comments regarding the impacts of electric and magnetic fields (EMF) are noted. The implications of EMF are addressed as thoroughly as possible in the DEIS. The State Department of Health (DOH) reviewed the DEIS and had no comment. The State DOH's policy on EMF is quoted in full in section 5.C of the DEIS. The policy states that, because data are inconclusive on the health effects of EMF, it is not possible to make an adequate, accurate risk assessment or to establish rules that would be useful to protect the public health. The policy recommends a "prudent avoidance" approach to siting new facilities by minimizing public exposure where technically feasible and practical. HECO has employed this approach in siting the proposed transmission lines.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

University of Hawaii at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawaii 96822
Telephone: (808) 956-7361

May 22, 1992
RE:0606

Mr. Kenneth Umemoto
Department of Transportation,
Highways Division
869 Punchbowl Street
Honolulu, Hawai'i 96813

Dear Mr. Umemoto:

Draft Environmental Impact Statement (DEIS)
Waiau-Campbell Industrial Park Part 2
138 kV Transmission Line
Ewa, O'ahu

Hawaiian Electric Company, Inc. (HEI) is proposing the Waiau-Campbell Industrial Park (CIP) Transmission Line Part 2 Project as a double circuit 138 KV alternating current (AC) overhead transmission line between the proposed Ewa Nui Substation next to Farrington Highway in the Ewa District and the Waiau Power Plant. The lines will extend a distance of 7.8 miles and generally will follow the mauka edge of H-1 freeway in Waipahu and the makai side of Kamehameha Highway in Pearl City. This project constitutes the eastern portion of a new 138 kV line system that will interconnect the CIP Substation with the Waiau Power Plant. The western portion is the Waiau-CIP Transmission Line Part 1.

The Environmental Center has reviewed the referenced document with the assistance of Paul Weaver and Henry Hwang, Electrical Engineering; Terry Hunt, Anthropology; and Alex Buttaro, Environmental Center.

Paper Conservation

While we commend the preparers of this document for using single rather than double spacing in the text, we note that significantly less paper would have been needed had the text been printed on both sides of each page. Incorporating this suggested format in the EIS would reduce bulk and require less filing space, reduce Final EIS production costs, and would provide a less formidable, reader friendly document.

Cultural and Historic Resources (Section 5.I)

The following questions were raised by reviewers of this DEIS:

1) What criteria and methodology were used in the "predictive model" (page 5-94)?

2) Could a predictive model be used to assess the potential for undiscovered and subsurface archaeologic sites in the already surveyed study area?

Also, figure 5-22 (page 5-96) might be easier to read and more informative if it boldly identified the proposed alignment alternatives so their relationship to the various archaeological districts could be assessed more clearly.

Summary of Unresolved Issues (Section 9)

Our reviewers note that there was no discussion of the potential effects of electro-magnetic field (EMF) radiation at distances of potential impact. While we understand that no conclusive information is yet available, description of the potential effects at environmentally relevant distances should be included.

Tables describing usership travel times and traffic volume versus annual cumulative exposure may be helpful in assessing the potential of EMF exposure for various people from different departure and destination points.

The discrepancy between those who benefit and those who pay seems to constitute the main social equity issue of this project. Relegating this discussion to the Public Utilities Commission (PUC) may be appropriate pursuant to regulation, but it tends to raise the question of monetizing quality of life. A dollar value is difficult to assign to a visual impact, and while we all may pay for the benefits of the new line thru rate hikes, those who are near the proposed corridor will pay, both in terms of rates <u>and</u> reduced quality of life. Why is the best available technology (BAT) justified for some projects such as public wastewater management, and not for public utility distribution?

Section 11-200-17(n) of Title 11 EIS Rules requires that the DEIS summarize unresolved issues and discuss "how such issues will be resolved prior to commencement of the action, or what overriding reasons there are for proceeding without resolving the problems."

Cumulative Impacts, Irreversible and Irretrievable Commitments of Resources, and the Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity.

To what extent might the cumulative visual impacts of the overhead alternative affect the long-term perception of O'ahu as an increasingly urbanized city as opposed to a tropical country/city tourist destination?

Socioeconomic Impacts

1) Does the public's perception of power lines as a potential health hazard constitute an adverse psychological impact?

2) What are the potential economic impacts upon the marketability of housing projects whose views and perceptions of safety may be affected?

Honolulu Rapid Transit Development Project

The City and County of Honolulu Department of General Planning asked about potential conflicts between proposed Rapid Transit alignments and this project's alignment in their comments on the EIS Preparation Notice. A response letter in Appendix C says the text of the DEIS will discuss this matter. Our reviewers were unable to find sufficient discussion of this issue but noted the statement, "little is known about the actual alignment of the transit system and the location of the rapid transit stations" (page 5-11). A DEIS was issued in March of 1992 and proposed a preferred alignment that should be used in the FEIS to assess this project's potential conflicts.

Will any of the overhead lines traverse the alignment of the planned Rapid Transit development and is there any potential for conflict between the two projects?

Summary

Our reviewers acknowledge this DEIS generally is well prepared. However, the FEIS should more adequately address the above mentioned issues.

Thank you for the opportunity to review this document and we hope our comments are helpful.

Sincerely,

Jacqueline N. Miller for

John T. Harrison, Ph.D.
Environmental Coordinator

cc: OEQC
Mary Ellen Nordyke-Grace,
Hawaiian Electric Company
Paul Luerson, CH2M Hill
Roger Fujioka
Paul Weaver
Henry Hwang
Terry Hunt
Alex Buttaro

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Dr. John T. Harrison, Ph.D.
Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Dr. Harrison:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Paper Conservation

Thank you for your positive comment regarding the single spacing of the DEIS. The FEIS has been printed on both sides of the page, as you have suggested.

Cultural and Historic Resources

1. The predictive model used for the cultural resources investigation is described in the Routing Report for this project, published in February 1992. Following is a portion of that discussion:

> Three areas of archaeological potential were established within the study area based on discussions with the Oahu specialist, Historic Sites Section, Department of Land and Natural Resources. Ecological factors relating to site frequency were primary determinants. Borders between the three areas were arbitrarily established. The three areas may be defined as follows:

Unsurveyed Area with High Likelihood of Archeological Recovery

Determination for this category is based on a number of criteria. To begin with, similar environmental settings on other Hawaiian Islands (and on Oahu as well) have proven to contain a high number of sites and other types of important archaeological data. Ethnographic and ethnohistoric data for the area also indicates that there is an excellent chance that information relating to these topics may also be forthcoming. Archaeological site inventory information demonstrates that the frequency is quite high in shoreline and riverine areas.

Unsurveyed Area with Medium Likelihood of Archeological Recovery

This determination is established to identify those sections of the study area which have not been surveyed but which may afford the chance of archaeological recovery. Such areas are not considered very promising but previous survey projects in similar settings around the state have turned up a variety of site types, albeit at a rather low frequency.

Unsurveyed Areas with a Poor Likelihood of Archaeological Recovery

These are the locations within the study area where archaeological recovery is unlikely. Large sections of land have been disturbed considerably by urbanization, sugar cane and pineapple production. Most important in the formulation of this consideration is the supposed land use existent before these activities took place. For example, urban archaeology is a fast growing subfield and archeological recovery in so called "plow zones" has been quite productive. However, in terms of this report, much of the urbanized and farming land considered a poor candidate for archaeological recovery was done so with the indication that prehistoric activities were unlikely to have occurred here.

2. For this project, the predictive model was applied in combination with a field survey. A predictive model was used to identify constraints during the corridor-level study. The site survey was implemented for the selected corridor. A predictive model could be developed to predict the likelihood of site discovery within the surveyed area. It is not, however, a tool used to predict the number of sites present in an area. Additionally, in response to comments on the DEIS, the FEIS states that an archaeologist will be present during any trenching for underground transmission lines.

3. Figure 5-22 has been modified as requested and is in the FEIS.

Summary of Unresolved Issues

Potential Effects of EMF Exposure at Relevant Distances

Concerning your questions on environmentally relevant distances from sources of EMF, the data are inconclusive as to whether or not electric and magnetic fields cause adverse health effects. (See section 5.C for a discussion of the results of scientific studies on the health effects of EMF and the State Department of Health EMF policy, which recognizes that "too little is presently known to be able to determine where or what rules would provide useful public-health protection.") If the DEIS described potential effects at specific distances from EMF sources or as a result of exposure over time to a certain EMF level, it would do so with no basis in fact. Thus, the EIS could mislead a reviewer to believe that a certain distance from an EMF source or a certain level of EMF is environmentally safe (no adverse health effects).

In recognition that opinions will vary on the health effects of EMF, the DEIS (in section 5.C and Appendix B) provides tables and graphs that show calculated levels of electric and magnetic fields for several types of transmission line pole configurations at various distances from the transmission lines. From these data, one can estimate the EMF exposure level for a land use or location of human activity at a specific distance from the transmission lines.

EMF Exposure to Motorists

The first paragraph under Potential Effects of EMF Exposure at Relevant Distances applies to your question on the effects of cumulative exposure to persons using the highways over which a transmission line may be built (e.g., Kamehameha Highway, H-1, Farrington Highway).

For the number of motorists who could be exposed to EMF, the DEIS provides the peak hour and 24-hour traffic volumes for major roads affected by the alternative transmission line alignments in Tables 5-9 (H-1), 5-10 (Kamehameha Highway), and 5-11 (Farrington Highway).

Best Available Technology

With regard to the comments in your third paragraph under Summary of Unresolved Issues, best available technology (BAT) is a practice applied to some types of projects because of laws and regulations specific to a type of project, as in wastewater treatment. There are no laws that require transmission lines to use BAT.

Resolution of Unresolved Issues: EMF and Social Equity

Concerning your comments in the third and fourth paragraphs under Summary of Unresolved Issues, Chapter 9 of the DEIS describes the processes available to resolve the issues of EMF and social equity. In the case of EMF, the DEIS references the State Department of Health's policy on EMF ("prudent avoidance," as described in section 5.C of the DEIS) as prescribing the appropriate policy for decision makers to follow in reviewing HECO's application to construct the project along its preferred alternative: H-1 Overhead. However, the DEIS recognizes that the larger issue of whether or not EMF exposure causes adverse health effects will remain an unresolved issue because the data are inconclusive. Resolution of this issue will require more scientific studies, peer review, and policy evaluation by federal, state, and local regulators.

In the case of social equity, the DEIS identifies the Public Utilities Commission (PUC) as the duly appointed public authority to evaluate the pros and cons of underground and overhead lines for this project through its decision making process. As noted in Chapter 4 of the DEIS, the PUC directed HECO to "consider underground placement of the lines (in whole or in part)" in its Decision and Order No. 11135 of 1991 concerning the Waiau-Makalapa No. 2 138 kV Transmission Line Project. Thus, the PUC anticipated the need to evaluate the issue of underground versus overhead lines for this project. During the PUC's May 28, 1992, public hearing on HECO's application for this project, public comments requested that the PUC review the FEIS before making its decision. It is HECO's intent that the FEIS describe the environmental, engineering, and cost impacts of the two technologies and that it be made available to the PUC, other agencies, and the public prior to any governmental decisions.

Cumulative Visual Impact

Regarding the cumulative visual impact of this project, the combination of existing overhead utilities and urban development probably affects visitors' perceptions of Oahu as an increasingly urbanized island compared with less developed tropical tourist destination areas. Because Oahu is already urbanized, the proposed transmission line project should have a negligible effect on the tourist industry. None of the alternative alignments pass through a resort area and, although overhead lines would be visible to visitors touring the island or en route to Oahu's resort areas, the preferred overhead alternative should not diminish the visitors' enjoyment.

Socioeconomic Impacts

The perception by members of the public that EMF exposure is a potential health hazard may be an adverse psychological impact. As discussed in section 5.C of the DEIS, a variety of common household electrical appliances create exposure levels equal to or significantly higher than levels generated by 138 kV 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). Placing 138 kV transmission lines underground does not eliminate magnetic fields (as explained in section 5.C of the DEIS). Faced with the situation that technology cannot guarantee elimination of magnetic fields and that electricity is an essential utility for the public, the public's perception that EMF poses a health hazard is an unavoidable adverse impact.

The perception of EMF and the visual impacts of overhead transmission lines could affect the value and marketability of housing, depending on the buyer's perception of value. Underground lines would eliminate visual impacts of transmission lines from being a factor in the marketplace. Placing all overhead utilities underground would address this factor for all residential areas. A few years ago the City's Chief Engineer 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 could be four times higher than today's cost to pay for placing overhead utilities underground. This financial impact to residents must be weighed against the benefit to residents, and visitors, before making the decision to place lines underground. As noted above, underground placement of 138 kV lines does not eliminate exposure to magnetic fields; thus the public perception that EMF exposure is a health hazard would continue to be a factor in the marketplace.

Dr. John T. Harrison, Ph.D.
Page 6
August 4, 1992

Honolulu Rapid Transit Development Project

Concerning the City's rapid transit project, the DEIS's statement that little is known about the *actual* (emphasis added) alignment of the transit system is based on the fact that the locally preferred transit alignment described in the transit project's Supplemental Draft EIS had not yet been approved and that the transit project is still in its planning stages. The Waiau-CIP 138 kV Transmission Line Project (Part 2) DEIS was reviewed by rapid transit project staff before publication. During a meeting with transit staff and in subsequent conversations, specific areas of potential conflict and mitigating measures were discussed. The DEIS presents this information in several sections, including section 5.A "Proposed Land Use," Figure 5-3, and section 5.E "Transportation and Traffic." The FEIS presents possible mitigating measures in sections 5.A and 5.E. Additional specific page references for the DEIS are pages 5-11, 5-13, 5-14, 5-16, 5-75, 5-76, and 5-77.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010B18.PDX

CITY COUNCIL
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII 96813 / TELEPHONE 523-4000

ARNOLD MORGADO, JR.
Chair
(808) 523-4829

May 5, 1992

TO: STATE DEPARTMENT OF TRANSPORTATION
C/O KENNETH UMEMOTO, HIGHWAYS DIVISION

FROM: ARNOLD MORGADO, JR., CHAIR
HONOLULU CITY COUNCIL

RE: DRAFT ENVIRONMENTAL IMPACT STATEMENT
WAIAU-CAMPBELL INDUSTRIAL PARK PART 2
138 KV TRANSMISSION LINES

Hawaiian Electric Company's proposed Waiau-Campbell Industrial Park Part 2, 138 KV Transmission Line project interconnects the Campbell Industrial Park (CIP) Substation and the Waiau Power Plant with double circuit overhead transmission lines.

Recent scientific and public concern regarding the health effects of electromagnetic radiation produced by overhead transmission lines suggests that it may not be prudent to commit to new overhead lines that may subsequently prove harmful to public health. Supporting this conclusion is the Public Utilities Commission's (PUC) recent statement in Decision & Order No. 11135 (Docket No. 6789) that they will shortly review the subject more thoroughly. The expectation that significant new knowledge will be developed on this issue over the next several years further suggests that construction of overhead lines is not now appropriate.

It has been demonstrated that when required by law or when confronted with vocal public outcry over aesthetic and environmental impacts, the cost of undergrounding transmission lines has been approved. In such cases, the added cost was passed on to ratepayers islandwide regardless of whether such lines were for islandwide or local benefit only. This was the situation in the installation of transmission lines from School Street and Iwilei substations to the Archer Lane substation, and also in the installation of distribution lines in connection with the Kalanianaole Highway widening project.

Until such time that the public health impacts of this project are clearly delineated and mitigated to the community's satisfaction, this project should be deferred. Environmental and health concerns must take precedence.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

The Honorable Arnold Morgado, Jr.
Chair, Honolulu City Council
City and County of Honolulu
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Chairman Morgado:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement.

The Public Utilities Commission (PUC) is currently reviewing HECO's application for approval to construct overhead 138 kV transmission lines from the planned Ewa Nui Substation to the Waiau Power Plant along HECO's preferred H-1 Overhead alternative alignment. Documentation submitted to the PUC, along with additional testimony and documentation obtained during the PUC's review process, addresses the concerns cited in your letter about the need for this project, the potential adverse health effects from EMF from overhead and underground lines, the costs of overhead and underground lines, the environmental impacts of overhead and underground lines, and the effect on ratepayers for the costs of overhead or underground lines.

HECO has installed 138 kV transmission lines underground when required by law, such as the 138 kV line you mention in your letter. These lines pass through the Hawaii Capital Special District and the Kakaako Special District, both created by State law. The governing agencies may waive the requirement based on aesthetics to place lines underground, but only if no other alternative exists. In the Waiau-CIP 138 kV Transmission Line Part 2 Project, other alternatives exist. These other alternatives, including an all-underground and partial-underground configurations, are evaluated in the DEIS and have been presented to the PUC.

Concerning the undergrounding of distribution lines in connection with the Kalanianaole Highway widening project, the existing 12 kV and secondary lines, as well as service connections, are being placed underground because of State Department of Transportation requirements to have all overhead utilities placed underground as part of the highway widening project. The State has required HECO to share in the costs of undergrounding the lines, except for service lines from a property boundary to a customer's meter. The State is paying the entire cost of placing these service lines underground. In the Kalanianaole Highway widening project, the State determined the need to place electrical lines underground and the method of paying the costs.

The DEIS discusses in Chapter 9, "Summary of Unresolved Issues," why the issues of social equity and the potential adverse health effects from EMF exposure remain unresolved. The DEIS suggests that the PUC and other governmental agencies with jurisdiction over the project can resolve the social equity issue by considering the benefits and costs to the public for overhead and underground lines.

On the issue of potential adverse health effects from EMF exposure, there is no indication in the literature that the issue will soon be resolved. Placing the 138 kV lines underground does not eliminate magnetic field exposure. The Waiau-CIP Transmission Line Project is needed now to maintain system reliability and meet the electrical transmission needs generated by planned growth in west and central Oahu. Deferral of the project would have an adverse impact on reliable service for the people of Oahu.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

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 04/92-1220

April 28, 1992

Mr. Kenneth Umemoto
Highways Division
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Draft Environmental Impact Statement for the proposed Waiau-Campbell Industrial Park 138 kV Transmission Line Part 2-Ewa Nui Substation to Waiau Power Plant

In reviewing the Draft Environmental Impact Statement (DEIS) for the proposed Waiau-Campbell Industrial Park 138 kV Transmission Line Part 2-Ewa Nui Substation to Waiau Power Plant, we have the following comments to offer from the various City agencies:

BOARD OF WATER SUPPLY
The Board of Water Supply (BWS) had no objections to the proposed project and indicated that the alignment of the proposed transmission lines should be coordinated with their representatives to avoid conflicts with existing water facilities. In addition, construction plans should be submitted to BWS for their review and approval.

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
The Department of Housing and Community Development (DHCD) had no objections to the H-1 Overhead Corridor. DHCD indicated that, according to Figure 5-1 of the DEIS, the H-1 Overhead route will pass along the makai boundary of the property which the City intends to acquire and has designated the Ewa Land Bank project (formerly known as Hale Ola).

DHCD also mentioned that the City would provide substantial buffers between H-1 Freeway and any residential units developed on the property, so they do not object to the placement of the proposed transmission lines as indicated.

However, should the alignment of the proposed transmission lines be routed further mauka of H-1 and into the Ewa Land Bank property, DHCD would be concerned about the potential health risks posed to project residents and request to be consulted.

DEPARTMENT OF GENERAL PLANNING
Hawaiian Electric Company, Inc. (HECO) should continue to coordinate with the City's Office of Rapid Transit to ensure that there are no conflicts between the rapid transit project and the transmission line project. The Final Environmental Impact Statement (FEIS) should also include a discussion on mitigative measures to be considered where the transmission lines will traverse the alignment of the Honolulu Rapid Transit Development Project.

The FEIS should disclose the relationship of underground transmission line alternatives to application(s) for future General Rate Increase(s) to the Public Utilities Commission to cover the projected costs. The cost increase should be estimated on a per household basis.

The FEIS should include a discussion on the relationship of the proposed project to Bill No. 13 (1992), which would require regional electrical transmission lines (above 46 kV) and transmission substations served directly from these transmission lines to be placed on the Development Plan Public Facilities Map (see attached). Bill No. 13 (1992) passed Second Reading on March 4, 1992 and is pending in the City Council's Planning Committee.

DEPARTMENT OF LAND UTILIZATION
The Department of Land Utilization concurs with the description of the proposed project area that is within the Special Management Area (SMA).

According to page 5-64 of the DEIS, "An SMA Use Permit will guide environmental review of construction and operations activities associated with the project." Anticipated construction impacts affecting SMA concerns should be discussed in the FEIS, prior to submission of the SMA Permit application.

DEPARTMENT OF PUBLIC WORKS
In general, the Department of Public Works had no objections to the proposed project. However, in view of possible conflict with their existing sewer system, construction plans should be submitted to the Wastewater Management Division for review and approval.

<u>FIRE DEPARTMENT</u>
The Fire Department foresee no adverse impact in Fire Department facilities or services. The Fire Department indicated that access for fire apparatus, water supply and building construction shall be in conformance to existing codes and standards.

<u>HONOLULU POLICE DEPARTMENT</u>
With regard to traffic safety, the Honolulu Police Department supports the mitigative measures described on page 5-78 of the DEIS and welcomes any otner additional measures that would minimize the disruptions and hazards of the construction phase.

The Building Department, Department of Parks and Recreation, and Department of Transportation Services had no comments to offer.

Thank you for the opportunity tc review and comment on the subject DEIS. Should there be any questions, please contact either Roland Libby at 523-4715 or Matthew Higashida at 527-6056.

Sincerely,

BENJAMIN B. LEE
Chief Planning Officer

BBL:ft

Attachments

cc: Managing Director
Hawaiian Electric Company, Inc. - Mary Ellen Nordyke-Grace
CH2M HILL - Paul Luersen
Office of Environmental Quality Control
Board of Water Supply
Building Department
Department of Housing and Community Development
Department of General Planning
Department of Land Utilization
Department of Parks and Recreation
Department of Public Works
Department of Transportation Services
Fire Department
Honolulu Police Department

ORDINANCE NO. ____________ BILL NO. 13 (1992)

A BILL FOR AN ORDINANCE TO AMEND PORTIONS OF THE DEVELOPMENT PLAN COMMON PROVISIONS.

BE IT ORDAINED by the People of the City and County of Honolulu:

SECTION I. Portions of the Development Plan Common Provisions, Chapter 32, Article 1, Revised Ordinances of Honolulu, 1990, as amended, are hereby further amended as described in Attachment A, attached hereto and by reference incorporated herein.

SECTION II. This Ordinance shall take effect upon its approval.

INTRODUCED BY:

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Councilmembers

DATE OF INTRODUCTION:

January 31, 1992

Honolulu, Hawaii

APPROVED AS TO FORM AND LEGALITY:

____

Deputy Corporation Counsel

Approved this ______ day of ____________________, 1992.

____

FRANK F. FASI, MAYOR

City and County of Honolulu

RECEIVED

(D-65/1-29-92)

ATTACHMENT A

DEVELOPMENT PLAN COMMON PROVISIONS

SECTION 32-1.2. IMPLEMENTATION

. . .

(i)

. . .

(2) Development Plan Public Facilities Maps

The development plan public facilities maps show general locations of proposed facilities. Where linear facilities are depicted, they represent approximate alignments and conceptual solutions to facility needs. Linear facilities include sewer lines, water lines and tunnels, drainage lines and channels, regional electrical transmission lines (above 46 kV), public thoroughfares, highways, streets and bikeways. Changes in alignment which do not significantly alter the design solution, change capacity, impact on surrounding land uses, or affect the natural environment may be made without an amendment to an existing facility symbol.

. . .

SECTION 32-1.8. IDENTIFICATION OF PUBLIC BUILDINGS, PUBLIC OR PRIVATE FACILITIES FOR UTILITIES, TERMINALS AND DRAINAGE

. . .

(b)

. . .

(2) Public or Private Facilities for Utilities.

Energy efficiency, both in terms of facility operating and capital costs and collection and/or distribution costs, shall be given priority consideration in the selection of sites for public and private utilities.

. . .

(D) Electrical Generation and Regional Electrical Transmission Facilities. Electrical power generation facilities [and transmission stations] ,regional electrical transmission lines (above 46 kV) and transmission substations served directly from these transmission lines are shown as public facility uses on the public facilities map. Local [Electrical] electrical distribution lines (46 kV and below) and their substations are not depicted and may be allowed in any land use district.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Benjamin B. Lee
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Lee:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Board of Water Supply (BWS)

HECO will coordinate design of the project with BWS and will submit construction plans to BWS for review and approval. The mitigation discussion in FEIS Chapter 5, section H reflects this response.

Department of Housing and Community Development (DHCD)

HECO does not propose to move the alignment of its preferred H-1 Overhead alternative farther mauka than the edge of H-1 freeway. If governmental approvals or negotiations with landowners cause HECO to review such a change in alignment, HECO staff will consult with the DHCD to determine areas of potential impact and possible solutions to mitigate the impacts.

Department of General Planning

Ongoing discussions between HECO staff and the rapid transit project staff have identified several possible measures to resolve potential conflicts between the two projects. These measures include higher poles to provide an adequate safety clearance between the transmission lines and the transit facilities; undergrounding of conductors (such as existing 46 kV lines that may be installed on the new steel poles below the 138 kV conductors); undergrounding of all the lines that cross over a transit facility; and providing sufficient spacing of poles so that lines can span a transit facility. These potential mitigation measures are included in the FEIS. The appropriate solution will depend on the specifics of the conflict. In one area of potential conflict (the transit station at Kamehameha Highway near Waimano Home Road), HECO is proposing to the PUC that it approve the request to place the existing 12 kV distribution lines underground to help mitigate the visual impacts of the 138 kV lines. This undergrounding could also benefit the rapid transit project.

Concerning future rate increases to ratepayers if the proposed project were placed underground (described in the DEIS as the Farrington Underground alternative), the impact would depend on the outcome of the PUC review of HECO's application. The construction costs of an all-underground and partial-underground alternatives for the Waiau-CIP 138 kV Transmission Line Part 2 Project are provided in Table 9-1 of the DEIS. If the cost of the all-underground alternative were passed on to ratepayers, then the average residential customer that consumes 600 kilowatt-hours per month would pay an extra $2.10 per month. These are only estimates; the actual rate increase would depend on the PUC.

If the 138 kV transmission lines for this project were placed underground, then such a decision could set a precedent to place all electrical lines underground. A few years ago, the City's Chief Engineer estimated the cost of placing all existing lines underground at $14 billion, including $10 billion for electrical facilities. Over time, the cost of electricity to customers could be four times higher than today's cost to pay for placing utilities underground. This financial impact to residents must be weighed against the benefit to other residents before making the decision to place lines underground.

With regard to Bill No. 13 (1992), attached is a copy of the Bill sent to HECO from the City and County of Honolulu Legislative Branch on May 26, 1992. The attached Bill No. 13 contains a provision that states in Section II, "This Ordinance shall not apply to regional electrical transmission projects which have been filed with the Public Utilities Commission for approval by April 1, 1992." HECO's application to the PUC for approval of the Waiau-CIP 138 kV Transmission Line (Part 2) Project was filed on March 12, 1992. If the attached Bill is adopted as Ordinance, then this project would not require an amendment to the Development Plan Public Facilities Map.

Department of Land Utilization

Construction of the preferred H-1 Overhead alternative will involve construction activities in the Special Management Area (SMA) between Lehua Elementary School and the Waiau Power Plant, the only portion of the preferred alternative within the SMA.

However, construction will not require any activity in or on a wetland. Potential impacts of constructing and operating the transmission lines on the SMA resources are discussed in the DEIS, particularly in Chapter 6, where the SMA goals, objectives, and review guidelines are discussed in detail with respect to the project (i.e., views, access, recreation, natural resources, and historic/cultural resources). Of all the alternatives considered in the DEIS, the OR&L Overhead/Underground alignment would have the greatest adverse impact on the SMA resources. HECO did not select the OR&L alignment as its preferred alternative.

Department of Public Works (DPW)

HECO will coordinate with DPW in the design of the project and submit construction plans for review and approval. The FEIS contains this statement.

Fire Department

HECO will design the project in conformance with existing codes and standards.

Honolulu Police Department

During design of the project, HECO staff will consult with the State Department of Transportation and the City's Department of Transportation Services to identify design and construction standards and practices to minimize traffic disruption and hazards.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Project Manager

Enclosure

10010B06.PDX

5/26 Fax to: Mary Ellen
From: Donna
4 pgs.

ORDINANCE NO. ________ BILL NO. 13 CD-1 (1992)

A BILL FOR AN ORDINANCE TO AMEND PORTIONS OF THE DEVELOPMENT PLAN COMMON PROVISIONS.

BE IT ORDAINED by the People of the City and County of Honolulu:

SECTION I. Portions of the Development Plan Common Provisions, Chapter 24, Article 1, Revised Ordinances of Honolulu, 1990, as amended, are hereby further amended as described in Attachment A-1, attached hereto and by reference incorporated herein.

SECTION II. This Ordinance shall not apply to regional electrical transmission projects which have been filed with the Public Utilities Commission for approval by April 1, 1992.

SECTION III. This Ordinance shall take effect upon its approval.

INTRODUCED BY:

Arnold Morgado, Jr. (BR)

Councilmembers

DATE OF INTRODUCTION:

January 31, 1992

Honolulu, Hawaii

APPROVED AS TO FORM AND LEGALITY:

Deputy Corporation Counsel

APPROVED this ____ day of ____________, 1992.

FRANK F. FASI, Mayor
City and County of Honolulu

ATTACHMENT A-1

Article 1. Development Plan Common Provisions

Sec. 24-1.2 Implementation.

. . .

(i)

. . .

(2) Development Plan Public Facilities Maps. The development plan public facilities maps show general locations of proposed facilities. Where linear facilities are depicted, they represent approximate alignments and conceptual solutions to facility needs. Linear facilities include sewer lines, water lines and tunnels, drainage lines and channels, regional electrical transmission lines (above 46 kV), public thoroughfares, highways, streets and bikeways. Changes in alignment which do not significantly alter the design solution, change capacity, impact on surrounding land uses, or affect the natural environment may be made without an amendment to an existing facility symbol. Project boundaries depicted on the public facilities maps indicate approximate locations and shall be interpreted flexibly to allow reasonable implementation. Where the site undetermined symbol is used, any site within approximately one-quarter mile of the map symbol shall be acceptable. The approximate location of all major planned public facilities is shown on the development plan public facilities map. However, where time is of the essence to protect public health, safety or property or to prevent the loss of state or federal funds, funding for capital improvement projects may be initiated and appropriated without amending the development plan public facilities map. Major facilities generally include those which:

(A) Significantly increase system capacity;

(B) Expand service areas;

(C) Change the function of an existing facility;

(D) Involve replacement of or renovations to existing facilities which would permit significant new development or redevelopment;

(E) Have a significant impact on surrounding land uses; or

(F) Cost over $1,000,000.00 for capital improvements.

Any question of interpretation shall be resolved by the city council.

. . .

Sec. 24-1.8 Identification of public buildings, public or private facilities for utilities, terminals and drainage.

. . .

(b)

. . .

(2) Public or Private Facilities for Utilities. Energy efficiency, both in terms of facility operating and capital costs and collection and/or distribution costs, shall be given priority consideration in the selection of sites for public and private utilities.

. . .

(D) Electrical Generation and Regional Electrical Transmission Facilities. Electrical power generation facilities [and transmission stations], regional electrical transmission lines (above 46 kV) and transmission substations served directly from these transmission lines are shown as public facility uses on the public facilities map. [Electrical] Local electrical distribution lines (46 kV and below) and their substations are not depicted and may be allowed in any land use district.

. . .

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

May 22, 1992

Mr. Rex D. Johnson, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Mr. Kenneth Umemoto, Highways Division

Gentlemen:

Subject: Draft Environmental Impact Statement Dated April 1992, Regarding the Proposed Waiau-Campbell Industrial Park Part 2 Electric Transmission Lines, TMK: 9-1 to 9-4, 9-6 to 9-8

Thank you for the opportunity to review and comment on the proposed electric transmission line project.

We have no objections to the preferred H-1 Overhead Alignment Alternative. The construction drawings for the selected alternative 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

cc: Hawaiian Electric Co.
CH2M Hill

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Hayashida:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

HECO will coordinate design of the project with the Board of Water Supply (BWS) and will submit construction plans to BWS for review and approval. The mitigation discussion in Chapter 5, section H reflects this response.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Project Manager

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 5TH FLOOR
HONOLULU, HAWAII 96813
PHONE: 523-4427 • FAX: 527-5498

FRANK F. FASI
MAYOR

E. JAMES TURSE
DIRECTOR

GAIL M. KAITO
DEPUTY DIRECTOR

April 24, 1992

MEMORANDUM

TO: BENJAMIN B. LEE, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: E. JAMES TURSE, DIRECTOR
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
WAIAU-CAMPBELL INDUSTRIAL PARK PART 2
138KV TRANSMISSION LINES

The Department has reviewed the subject Draft Environmental Impact Statement (DEIS). We have no objections to the H-1 Overhead Corridor, which is identified in the DEIS as the preferred location for the proposed transmission lines. Figure 5-1 of the DEIS indicates that the H-1 Overhead route will pass along the makai boundary of the property which the City intends to acquire and has designated the Ewa Land Bank project in the Fiscal Year 1993 Capital Improvements Program budget proposal now before the City Council (for your information, the DEIS identifies the site by its previous name, Hale Ola).

Since the City would provide substantial buffers between H-1 Freeway and any residential units developed on the property anyway, we would not object to the placement of the transmission lines as indicated. Should changes be required which cause the transmission lines to be routed further mauka of H-1 and into the Ewa Land Bank property, however, we would be concerned about the potential health risks posed to project residents and request to be consulted.

Thank you for the opportunity to comment.

E. JAMES TURSE
Director

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. E. James Turse, Director
Department of Housing and Community Development
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Turse:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

HECO does not propose to move the alignment of its preferred H-1 Overhead alternative farther mauka than the edge of H-1 freeway. If governmental approvals or negotiations with landowners cause HECO to review such a change in alignment, HECO staff will consult with the DHCD to determine areas of potential impact and possible solutions to mitigate the impacts.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

UT142-1395

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 92-368

April 20, 1992

MEMO TO: BENJAMIN LEE, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: WAIAU-CAMPBELL INDUSTRIAL PARK, PART 2
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

We understand that the Department of General Planning will be preparing a unified response for the subject DEIS.

Please be advised that we do not have any comments to offer.

Herbert K. Muraoka
HERBERT K. MURAOKA
Director and Building Superintendent

cc: J. Harada

RECEIVED

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Herbert K. Muraoka
Director and Building Superintendent
Building Department
City and County of Honolulu
Honolulu Municipal Building
650 South King Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Muraoka:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement (FEIS) for this project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AE6.PDX

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

April 20, 1992

Mr. Tetsuo Harano
Highway Administrator
Highways Division
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Mr. Kenneth Umemoto

Dear Mr. Harano:

Subject: Draft Environmental Impact Statement (DEIS)
Waiau-Campbell Industrial Park, Part 2
138 kV Transmission Lines
Ewa, Oahu, Hawaii
Tax Map Key 9-1, 9-2, 9-3, 9-4, 9-6, 9-7 & 9-8

We have reviewed the DEIS for the proposed Waiau-Campbell Industrial Park 138kV Transmission Lines project and have no comment to offer.

Should you have any questions, please contact Lester Lai of our Advance Planning Branch at 523-4696.

Sincerely,

WALTER M. OZAWA, Director

WMO:ei

cc: ✓CH2M Hill (Paul Larsen)
HECO (Mary Ellen Nordyke-Grace)

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Walter M. Ozawa
Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Ozawa:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement (FEIS) for this project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AE8.PDX

An HEI Company

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 KN-LK

April 21, 1992

Mr. Rex D. Johnson, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Mr. Kenneth Umemoto, Highway Division

Dear Mr. Johnson:

Subject: Waiau-Campbell Industrial Park Part 2
138 kV Transmission Lines

We have reviewed the environmental impact statement for the Waiau Campbell Industrial Park 138 kV transmission line and would like to offer the following comments.

In the interest of traffic safety, we support the mitigative measures that are spelled out on page 5-78. Any other additional measures that would minimize the disruptions and hazards of the construction phase will be welcomed.

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

cc: Hawaiian Electric Company
CH2M Hill
OEQC

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-000

August 4, 1992

Mr. Chester E. Hughes
Assistant Chief of Police
Support Services Bureau
Police Department
City and County of Honolulu
Police Department
1455 South Beretania Street
Honolulu, Hawaii 96814

Subject: Waiau-Campbell Industrial Park 138 kV Transmission Line DEIS (Part 2)

Dear Mr. Hughes:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

We recognize that there is the potential for traffic disruption during construction of the proposed transmission line. Every effort will be made to minimize that disruption. Your support of the proposed mitigation measures is noted and appreciated.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Ken T. Morikami
Project Manager

10010AE4.PDX

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-1539
PL92.1.126

April 24, 1992

Mr. Kenneth Umemoto
Highways Division
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Umemoto:

Subject: Waiau - Campbell Industrial Park, Part 2
138 kV Transmission Lines
Draft Environmental Impact Statement (DEIS)
TMK: 9-1 thru 4; 9-6 thru 8

This is in response to the DEIS submitted to us for review on April 9, 1992, by the Office of Environmental Quality Control.

Based on our review, we have no comments or objections to the proposed project.

Should you have any questions, please contact Lance Watanabe of my staff at 523-4199.

Sincerely,

JOSEPH M. MAGALDI, JR.
Director

cc: CH2M Hill
Department of General Planning
Hawaiian Electric Company
Office of Environmental Control

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Joseph M. Magaldi, Jr.
Director
Department of Transportation Services
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Magaldi:

Thank you for reviewing the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Your response is noted, and your letter has been included in the Final Environmental Impact Statement (FEIS) for this project.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami
Project Manager

10010AEC.PDX

WAIKELE CENTER

April 16, 1992

CH2M-Hill
Suite 1312
1585 Kapiolani Blvd.
Honolulu, Hawaii 96814

Attn: Paul Luersen, Project Manager

Re: April '92 HEI Environmental Impact Statement

Dear Mr. Luersen:

We are the owners of 59 acres of commercial property which extends to 3,000 feet from the Paiwa interchange diamond head along the H-1 right-of-way. We acquired this property right in January of 1992 and, as such, had a copy of your environmental impact statement forwarded to us by your client, Hawaiian Electric Company, Inc. The following are our comments after an initial review.

Page 5-7, Paragraph 2

You incorrectly indicate that there is a proposed 17.2 acre retail complex for an area east of Paiwa Road. This is a 59 acre complex upon which will be built 750,000 square feet of retail space forming the third largest retail complex in the State of Hawaii. A significant portion of this project has been designed and leased to national tenants with construction schedule to start in May of 1992.

Page 5-7, Paragraph 4

With respect to the portion concerning commercial employment in the 17.2 acre retail complex, this is dramatically understated. Waikele Center will employ between 1200 - 1500 people at completion and will be unquestionably the largest employment generation in this portion of the island, exceeding the current agricultural employment at Oahu Sugar by a factor of four to one.

Page 5-10, Waipahu Section

Your client has had in its possession for two months very accurate project information on the location of buildings and infra-structure within Waikele Center and the potential implications of the H-1 overhead routing on our development.

700 Bishop Street, Suite 200 / Amfac Tower / Honolulu, Hawaii 96813
Phone: (808) 531-4266 / Fax: (808) 524-3452

CH2M-Hill
Attn: Mr. Paul Luersen
April 16, 1992
Page 2

Depending on a variety of circumstances, including the width of the necessary easement, the location of the poles, the uses to which areas beneath the service line can be put, and other very tangible considerations, the direct cost of the taking of this section of the route may be more than the proposed budget for the entire system, or create the necessity for taking a component of the mauka H-1 alternative underground to mitigate these circumstances.

If your client has not provided you with these facts, which were widely known well in advance of the publication date of your report, we would be pleased to supply them to you for your review and analysis. As it is, your report is grievously flawed as to this portion of the H-1 overhead alternative, the implications of which could affect the entire routing decision.

If you have any questions, I encourage you to call me directly.

Sincerely yours,

WCC ASSOCIATES
By WRWG, Inc.
Its Managing General Partner

By RICHARD W. GUSHMAN, II
Its President

RWG:vw

cc: Bill Milks, Esq.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Richard W. Gushman II
Managing General Partner
WCC Associates
700 Bishop Street, Suite 200, Amfac Tower
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Gushman:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Page 5-7, Paragraph 2

The subject paragraph has been revised in the FEIS to incorporate the information in your letter.

Page 5-7, Paragraph 4

This paragraph states that your proposed development, as well as other employment centers in the area, will provide employment at a time when agricultural lands are being converted to nonagricultural uses, thus resulting in a decline in agricultural employment. The DEIS does not quantify employment. The estimated employment figures for your development are noted in the FEIS as an example of how many jobs a new commercial development can create.

Page 5-10, Waipahu Section

A new figure has been included in the FEIS (Figure 5-2a) to illustrate your development as well as other developments proposed for the Waikele area mauka of H-1.

HECO staff are negotiating with you ways to locate the proposed overhead transmission lines and steel poles with respect to your development's buildings and infrastructure. Since these discussions are ongoing and have not yet been concluded, the FEIS does not illustrate the placement of poles and lines. These discussions also include the width of the easement and the appropriate value of the easement for which the WCC Associates will be compensated.

With respect to placing the lines underground in the Waikele section of the alignment, HECO has provided you with a construction cost estimate. It would cost approximately $30 million more (i.e., the cost for overhead lines by Waikele is not included) to place the lines underground through Waikele than to place them overhead. This undergrounding cost would be paid for by the adjoining landowners unless the Public Utilities Commission decides that all ratepayers should bear the cost.

At the time HECO selected its preferred alternative, it was aware that the Waikele area was proposed for urban development. When considering all the factors along all the alternative alignments, the H-1 Overhead alternative is the least objectionable alternative. The route selection process is described in the project's February 1992 Routing Report (Chapter 7). This report is referenced in the EIS and is available to the public.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AFC.PDX

THE ESTATE OF JAMES CAMPBELL

May 19, 1992

RECEIVED
MAY 20 5 47 AM '92
DEPT. OF TRANSPORTATION
HIGHWAYS DIVISION

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

Dear Sirs:

We have reviewed the DEIS W-C-I-P-Pt 2, etc. and offer the following comments.

Part 2 involves land which we own. Hawaiian Electric Company (HECo) has announced its intention to use its power of Eminent Domain to acquire the necessary easements. While we have reached preliminary understanding with HECo as to the alignment of the route on Campbell Estate property, no agreement has been reached as to valuation.

We do not agree that (Table 1-2) H-1 and Farrington Alternatives do not have adverse impacts on land use. While Campbell Estate's lands are now in sugarcane production, that may change over time so that the DEIS should consider impacts on future uses. The potential impact upon future land uses is indicated by the fact that the county is considering requiring proposed 138 KV transmission lines to be shown on the County Development Plan Public Facilities Map (Page 6-1).

All indicators are that these transmission lines will have a significant impact upon future land uses. This has already been shown by action taken by the Ewa Neighborhood Board No. 23 in their review and recommendation of HECO's proposed amendment to the Ewa Development Plan Public Facilities Map for locating the Ewa Nui 138 KV substation. The September 25, 1991 report to the City Planning Commission from the Department of general Planning states:

> "The Ewa Neighborhood Board No. 23 unanimously passed a motion to approve the placement of the Ewa Nui substation on the Development Plan Map, but recommended that public and private developers exercise prudent avoidance, by not permitting new homes or businesses to be built within a measurable electric or magnetic field adjacent to the substation or its transmission lines (this could mean 100 or more feet away from them), and that plans be revised as new conclusive, scientific data becomes available".

This Neighborhood Board recommendation indicates that the substation and transmission lines have a significant impact upon the future use of Campbell Estate lands.

R 5|21

Suite 500, 828 Fort Street Mall, Honolulu, Hawaii 96813 (808) 536-1961

The visual impact of the above-ground configuration will be considerable. One only has to view similar installations around Honolulu and even along Fort Weaver Road to question the conclusion that visually there will be only a "minor adverse impact" caused by the poles (Table 1-2, Page 1-5).

The DEIS study provides analysis of public land ownership along the H-1 alignment (Page 3-5), but fails to analyze private land ownerships along the route which may be an important factor.

Thank you for the opportunity to comment.

Very truly yours,

Charles A. Ehrhorn
Land Planning Coordinator

llb:01002900\K10150

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

August 4, 1992

Mr. Charles A. Ehrhorn
Land Planning Coordinator
The Estate of James Campbell
828 Fort Street Mall, Suite 500
Honolulu, Hawaii 96813

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Ehrhorn:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Future Land Uses

HECO considered all available public sources to identify future land uses in the project's regional study area. At the time the studies were performed, the Kapolei Area Long Range Master Plan (1991) prepared for the Estate of James Campbell showed the subject area for agriculture. Nonetheless, it is recognized that the area could ultimately be converted to urban uses, such as commercial, residential, or public facility uses.

Where Table 1-2 identifies no adverse impacts to land use, it refers to the extent to which the easements impact the use of the property within the easement area. The preferred alignment from the planned Ewa Nui Substation to the mauka side of H-1 deliberately follows an existing 46 kV line easement to minimize disruption to present and future land uses. Mauka of H-1, the preferred alignment follows the edge of the H-1 property line and tries to minimize easement requirements by overhanging one of the two circuits into H-1 property. The Farrington Overhead alternative follows an existing highway, consistent with the siting criteria. Following existing corridors such as this also minimizes impacts to existing, adjacent land uses. Impacts to land uses adjacent to the transmission lines are identified in other categories (e.g., visual resources and EMF) in Table 1-2.

Electric and Magnetic Fields

There is no governmental policy or standard based on scientific evidence to establish a distance between sources of EMF and types of land uses or to establish exposure levels for people. The DEIS shows various EMF level standards adopted by other states and by the International Radiation Protection Association. The proposed transmission lines would have EMF levels far below those standards. In Hawaii, the State Department of Health's EMF policy recognizes that, "Too little is presently known to be able to determine where or what rules would provide useful public-health protection." The State's policy suggests the use of a prudent avoidance approach to reduce EMF exposure to the public in siting transmission lines, the approach used by HECO in its routing study. In the unpopulated areas next to the transmission lines, it may be possible to plan for future land uses that are not intensively used by people (e.g., agriculture, parking, land-extensive industrial uses, or storage yards). This type of planning would allow the land to be converted to necessary urban uses. The DEIS also evaluates the effectiveness of underground lines in shielding EMF; electric fields are shielded, but magnetic fields are not completely eliminated.

Visual Impacts

The poles and lines for the overhead alternatives (except the OR&L alternative) were not given the rating of significant adverse visual impact in Table 1-2 because only the OR&L alternative specifically impairs views from significant public viewpoints identified in the City's *Coastal View Study* (see page 5-26 of the DEIS). View impacts to private properties were not accorded the same significance rating given to public viewpoints. Nonetheless, the DEIS recognizes that overhead lines create a visual impact, and so rated all other overhead alternatives as having a "Minor Adverse Impact (may not be significant)." The DEIS evaluates underground alternatives and rates the all-underground alternative as having no adverse visual impact.

Public and Private Land Ownership

The DEIS analyzes public ownership for the preferred alternative on page 3-5 because this is a requirement of the State's EIS regulations. Private ownership patterns are illustrated on Figures 5-14, 5-15, 5-16, and 5-16a. Campbell Estate lands are specifically identified on the maps. In its route selection process, HECO specifically considered property ownership and met numerous times with staff from the Campbell Estate before selecting the preferred alignment. HECO continues to meet with your staff to negotiate an easement.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

AMFAC/JMB HAWAII, INC.

700 Bishop Street
P.O. Box 3230
Honolulu, Hawaii 96801
(808) 945-8111
Fax (808) 945-8153

Amfac

May 22, 1992

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

Attention: Mr. Kenneth Umemoto

Gentlemen:

Re: Comments to Draft Environmental Impact Statement--Waiau-Campbell Industrial Park Part 2--138 kV Transmission Line

Amfac/JMB Hawaii, Inc. ("Amfac") is the master developer of the Waikele master-planned community, which will be affected by one of the transmission line alignments discussed in the above-referenced Draft Environmental Impact Statement ("DEIS"). We offer the following comments in response to the DEIS. In general, we do no believe the DEIS adequately evaluates the environmental impacts of the proposed action and alternatives described in the document. In particular, three major issues are not sufficiently examined in the DEIS: (1) transmission line siting, (2) overhead vs. underground placement, and (3) treatment of the Waikele development.

I. Transmission Line Siting

The first issue is that of the social equity of the transmission line location. In Chapter 1, the Routing Report is cited as concluding that five alignments should be considered, as well as the no action alternative, in the DEIS. No explanation for this decision is offered, although the rationale for the alignments proposed is suggested in other areas of the DEIS. In Chapter 2, system reliability supplies the basis of the decision to locate the new transmission line corridor some distance from the existing Kahe corridor which travels from Campbell Industrial Park across the mountains towards central Oahu. The system reliability reasoning is echoed in the Electric Utilities subsection of Chapter 5. To provide the public with a comprehensive evaluation of the costs and benefits of the available alternatives, a rationale for the alignments proposed should be supplied, including a more extensive discussion supporting the conclusion that a new transmission corridor separate from the existing Kahe corridor is necessary and prudent.

II. Overhead v. Underground Placement

The second issue of major concern is consideration of underground transmission line placement. A general statement as to the cost differential between overhead and underground placement is furnished on pages 4-5 and 6-15. However, the only quantified basis for these statements is provided in Table 1-1. This table covers only capital cost figures, no operating and maintenance cost figures are supplied. This information is insufficient to determine the difference in long-term financial costs and benefits between underground and overhead lines. Although the DEIS recognizes that underground lines have the advantage of greater protection from accidents and weather, there is no attempt to quantify these savings. The analysis is further confused by the fact that the DEIS discusses the placement of 12 kV lines underground in the H-1 overhead and Farrington overhead alternatives without explaining why such a strategy is endorsed form a financial, technical or environmental perspective. In short, the DEIS does not adequately support the conclusion that underground placement would be cost-prohibitive.

The DEIS should consider one or more additional alternatives which follow the H-1 alignment but have a greater or different portion of the line placed underground. This request is especially appropriate since the PUC has instructed Hawaiian Electric Company ("HECO") to consider underground placement (page 4-5).

To supply the public with the basis for the decision to proceed with an overhead alignment, information should be provided in the EIS delineating the specific cost differential between overhead and underground options. Attention should be paid to the additional operating and maintenance costs of underground lines versus the savings from the lower probability of accidents and weather-related degradation.

From an environmental perspective, the costs of underground placement in the H-1 corridor may be offset by the improvement in visual impact and decrease in any electric or magnetic field impacts. Although the DEIS does not identify major environmental impacts from the H-1 alignment (the "biological and cultural resources" of concern which are referred to on page 4-5 are those involved with the OR&L corridor) the environmental impacts (beneficial or otherwise) of fully underground placement have not been evaluated. The only area of environmental concern identified with underground placement in the H-1 alignment is poor soils in the are where the H-1 overhead/underground alternative goes underground. Poor soils raise concern that the pipe will be subject to stress from foundation loads and potentially fracture. Several scenarios may require examination in order to determine the balance of overhead and underground placement which optimizes the associated environmental and financial costs.

III. Waikele Treatment

Moving to the third issue of major concern, Amfac's Waikele development is mentioned at a couple of different points in the DEIS, but its treatment is not thorough or consistent. Although on page 5-7 the DEIS recognizes that the Waikele development is under construction, the maps showing existing land use (figure 5-10) and geophysical and biological elements of the area (figure 5-12) show the entire Waikele area as sugar cane fields. At a minimum, these graphics should be updated to emphasize the nature of the area to be impacted during the construction and operation of the transmission line. On page 5-10, the land use impacts of the proposed alignment on the Waikele development are addressed and the claim is made that future residential development at the project "can include appropriate setbacks." This statement is incorrect at this time. For example, residences are already in place on the east end of Waikele along the recommended alignment, other affected residential parcels are presently under contract for sale without including a "setback," construction of the affected commercial parcel begins on May 22, 1992, without a designed "setback," and construction on the affected golf course parcel is nearly complete, again without a designed "setback." The impacts of any setback requirements on development already completed or under construction should be included in the DEIS. Moreover, the public perceptions towards high voltage powerlines as a health hazard in developed areas could adversely impact the marketability of the various projects within Waikele. The economic impact of the proposed action and alternatives is within the scope of the EIS. Evidence of any measurable impact on property values must be included in the cost/benefit analysis of overhead versus underground line placement.

Another deficiency in the DEIS is the apparent conflict between the mitigation measures proposed for traffic and noise impacts, especially as those impacts relate to Waikele. On page 5-78, the DEIS states that for construction work requiring traffic impacts, "work will be scheduled to make maximum use of weekends, holiday, nights, and other periods when construction work will cause the least disruption." In contrast, in the noise impact section on page 5-92, the DEIS states that "All construction activity would take place during daylight hours." The DEIS states that the noise impacts expected in the H-1 alignment in the Waikele vicinity are expected to be "negligible," presumably due to the characterization of the area as having "relatively high existing noise levels and few residences." This characterization is inaccurate. By the time construction begins on the powerline, a significant number of residences will be occupied in the vicinity of the line, and the golf course and commercial center will be in operation. Accordingly, the DEIS should be revised to reflect this. In addition, the DEIS should be revised to further clarify the construction plans for the preferred alignment in light of this adjacent development.

The last area of concern is visual impact. The degree of visual impact on the Waikele development will be significant and is not sufficiently addressed in the DEIS. Amfac has made a significant investment in placing all Waikele utilities underground, including the burying of offsite communication lines fronting the Waikele project along Kamehameha Highway. The master plan for Waikele orients its sites to take of advantage of the makai views to the ocean, diamond head and the Ewa plains, and Amfac is constructing a new freeway interchange, planned to be the main entrance into the project. Clearly, the installation of an overhead powerline along the "front door" of Waikele would negate Amfac's efforts to preserve the views from the project. Such an overhead alignment would also violate Policy 2 of Objective B of the County General Plan (page 6-16) regarding the protection of scenic views and Policy 5 of Objective D (page 6-15) requiring "the installation of underground utility lines wherever feasible." Thus, the DEIS should be revised to describe the views from the Waikele development and visual impacts resulting from the proposed alignment. The DEIS should also be revised to address the violation of the County General Plan policies.

Summary

In summary, we ask that the DEIS be revised in the following ways to insure that it accurately and thoroughly addresses all of the impacts of the proposed alignment on the Waikele development:

- Provide explanation of the rationale used to select the alignments proposed in the EIS;
- Provide additional information on the difference in long-term financial and environmental costs between overhead and underground placement of the line;
- Revise the graphics depicting the nature of the Waikele development property to reflect the situation which will be present at the time of construction;
- Correct inaccuracies related to setback requirements;
- Provide any pertinent information regarding the economic impact of the preferred alignment on the Waikele development;
- Provide clarification of the traffic and noise mitigation plans in the Waikele vicinity;
- Provide any pertinent information regarding the visual impacts of the preferred alignment on the Waikele development.

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Please call the undersigned if you should have any questions.

Very truly yours,

LAW DEPARTMENT

Tim

Timothy E. Johns
Senior Counsel

cc: Mary Ellen Nordyke-Grace
(Hawaiian Electric Co.)
Paul Luersen
(CH2M HILL)
Chris Kanazawa

L2/DEIS.TEJ

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-000

August 4, 1992

Mr. Timothy E. Johns
Senior Counsel
AMFAC/JMB HAWAII, INC.
700 Bishop Street
P.O. Box 3230
Honolulu, Hawaii 96801

Subject: DEIS Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2)

Dear Mr. Johns:

Thank you for your comments regarding the Draft Environmental Impact Statement (DEIS) for the Waiau-Campbell Industrial Park 138 kV Transmission Line (Part 2). Following is our response to your comments. Copies of your letter and this response have been included in the Final Environmental Impact Statement (FEIS).

Transmission Line Siting

The DEIS's discussion of the need for the transmission line and the rationale for selecting alternative alignments for evaluation in the DEIS is a summary of the detailed explanation contained in the project's February 1992 Routing Report, as referenced in the DEIS. This Routing Report was submitted to the Public Utilities Commission (PUC), along with HECO's application for approval of the project, on March 12, 1992. The Routing Report is available to the public, and a copy was sent to AMFAC/JMB during the DEIS comment period.

Routing Report Chapter 1 discusses the need for the project and why an alternate transmission line corridor some distance from the existing Kahe Transmission Line corridor is necessary for reliable service to the entire island. The need for an alternate transmission corridor was identified in a comprehensive study prepared by Stone and Webster in 1984. Routing Report Chapter 5 discusses how transmission line corridors were identified. Routing Report Chapter 6 discusses the process and factors considered in selecting transmission line corridors (one-quarter to one-half mile wide) for further detailed analysis to identify alternative alignments (approximately 100 feet wide). Routing Report Chapter 7 discusses how HECO evaluated alternative alignments and selected its preferred alternative, H-1 Overhead. These chapters provide a detailed rationale of the route selection process (which included extensive consultations with the public, landowners, elected officials, and agencies) employed by HECO to identify alternative alignments evaluated in the DEIS.

Overhead versus Underground Placement

Concerning the costs of underground and overhead transmission lines, the DEIS (in Table 9-1 of Chapter 9) gives a detailed breakdown of the estimated construction costs of the overhead, partial overhead/underground, and all-underground alternatives. This chapter has been revised in the FEIS to include estimated operation and maintenance costs of typical overhead and underground 138 kV transmission lines.

With regard to the placement of existing 12 kV and secondary distribution lines and services underground, HECO requested approval from the PUC to place these existing facilities underground because the new 138 kV transmission lines are proposed along the same alignment. The reason for doing this for this project is to mitigate the visual impacts of the proposed 138 kV transmission lines. If 46 kV subtransmission lines also exist along the same alignment, as is the case on the makai side of Kamehameha Highway in Pearl City, these subtransmission lines are installed on the new steel poles below the 138 kV lines ("underbuilt"). This allows HECO to shorten the existing wooden utility poles (if other utilities, such as telephone lines, still need to use the poles) or to remove the poles. Figure 5-6 of the DEIS illustrates the visual effect along Kamehameha Highway of undergrounding existing 12 kV and secondary lines and services, as well as underbuilding existing 46 kV lines to the new 138 kV transmission line's steel poles. Some existing wooden poles are shortened to maintain service for street lights, while others are removed. The costs for undergrounding existing 12 kV and secondary lines are presented in Table 9-1 of the DEIS.

Three of the five (excluding No Action) alternatives evaluated in the DEIS included underground 138 kV transmission lines: the Farrington all-underground alternative, the H-1 partial Overhead/Underground alternative, and the OR&L partial Overhead/Underground alternative. The relative effects of these alternatives in terms of cost, environmental impacts, and social equity issues are described throughout the DEIS. In this respect, HECO has complied with the PUC's instructions to "consider underground placement of the lines (in part or in whole)." As you are aware, HECO has provided AMFAC/JMB with the cost of undergrounding the double-circuit

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transmission lines along H-1 where they would pass AMFAC/JMB lands between Waikele Gulch and the H-1/H-2 Interchange. The estimated additional cost of undergrounding the lines in this section to the H-1 Overhead alternative is approximately $30 million. At the same time, HECO is negotiating with AMFAC/JMB and developers of land in the area to define an easement for double-circuit overhead lines.

From an environmental perspective, the DEIS evaluates the relative visual, electric and magnetic field (EMF), and cost impacts of overhead and underground alignments in sections 5.B, 5.C, and Chapter 9, respectively. Page 4-5 of the DEIS, as referenced in your letter, summarizes the relative advantages and disadvantages of overhead and underground technologies, not specific alternative alignments. That page concludes an environmental evaluation of transmission technologies in the first section of DEIS Chapter 4. The evaluation of environmental impacts, beneficial or adverse, of underground and overhead alignments is discussed in DEIS Chapters 5, 6, 7, 8, and 9.

Concerning the optimization of environmental and financial factors, the DEIS compares the advantages and disadvantages of overhead and underground alternative alignments in Chapters 1, 6, 7, and 9. The question of which of the alternatives is the optimal alternative will be resolved in the PUC review process. The project's Routing Report, referenced above in this letter, provides more detail on the factors considered and the process employed by HECO to select its preferred alternative alignment.

Waikele Treatment

Figures 5-10 and 5-12 in the DEIS represent conditions during 1991 and earlier. To alert reviewers to proposed land use changes, Figures 5-1, 5-2, and 5-3 illustrate properties where future projects have been announced to the public. A new graphic has been included in the FEIS (Figure 5-2a) to illustrate the specific proposed uses in the Waikele area mauka of H-1. Page 5-10 of the DEIS has been revised in the FEIS to reflect the status of development in Waikele as of June 1992. Impacts of the H-1 Overhead alternative along Waikele for development already completed or under construction are addressed in the FEIS. The impacts are similar to those for Village Park's residences along the mauka edge of H-1. Please refer to the FEIS sections in Chapter 5 that discuss impacts of the H-1 Overhead alternative with respect to land use; visual impacts; EMF; biology, water, and earth resources; air quality and noise; and cultural and historic resources. These sections have been revised in the FEIS to reflect the current status of the Waikele development.

Public perceptions of the visual effects of overhead transmission lines and the lack of conclusive data on the potential adverse health effects of EMF may have an effect on the marketability of projects and the price of developed and undeveloped lands, depending on the buyer's perception of value. Underground lines would eliminate visual impacts of transmission lines from being a factor in the marketplace. Placing all overhead utilities underground would address this factor for all residential areas. A few years ago, the City's Chief Engineer estimated the cost of placing all existing lines underground at $14 billion, including $10 billion for electrical facilities. Over time, the cost of electricity to customers could be four times higher than today's cost to pay for placing utilities underground. This financial impact to residents must be weighed against the benefit to other residents before making the decision to place lines underground. As noted in the EIS, underground placement of 138 kV lines does not eliminate exposure to magnetic fields; thus, the public perception that EMF exposure is a health hazard would continue to be a factor in the marketplace.

Page 5-78 of the DEIS pertains to construction work on established roads and highways that are not bordered by land uses sensitive to noise (e.g., residences, hospitals, schools). The FEIS revises this discussion and recommends time and day limitations for construction activities to mitigate noise impacts on sensitive land uses. The FEIS also revises the discussion for the H-1 Overhead alternative to recognize land uses at the time of construction and to follow the appropriate noise mitigation measures discussed in the FEIS. For example, near residential areas, construction activities and noise would be limited as required by the State Department of Health regulations. The specific methods of construction for the preferred alignment in the Waikele area cannot be determined until easements are negotiated. The analysis of construction impacts is based on the description of typical construction methods in Chapter 3 of the Routing Report and summarized in FEIS Chapters 3 and 5 for each of the environmental areas that could be affected by construction activities. It should be noted that noise, dust, and cultural resource impacts from constructing underground lines are greater than for overhead lines, as discussed in sections 5.G and 5.H.

The visual impacts of the preferred H-1 Overhead alternative are described in DEIS Chapter 5 (section 5.B) and illustrated in computer-simulated, color photographs that show existing and future views in the Waipahu area along H-1 and from residences in Village Park mauka of H-1. Figure 5-5, in particular, shows makai views from property mauka of H-1 and would be representative of the visual impacts of the preferred alternative for the Waikele area. The EIS further evaluates the relative visual impacts of the all-underground alternative and the two partial overhead/ underground alternatives.

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Concerning the discussion of the County General Plan on pages 6-15 and 6-16 of the DEIS, it is feasible to place the 138 kV transmission lines underground, as shown in the Farrington Underground alternative, and thus be consistent with Policy 5 of Objective D. All alternatives with overhead lines would not meet this specific objective, and the FEIS has been revised accordingly. The DEIS discussion of the County General Plan's Policy 2 of Objective B does reference makai views and refers the reviewer to the discussion of visual impacts in section 5.B. The DEIS states that underground lines would not have the same visual impact as overhead ones.

However, the cost of undergrounding the 138 kV lines could be inconsistent with other policies and objectives, such as the Hawaii State Plan (Section 226-18 of Chapter 226, Hawaii Revised Statutes). This policy, as discussed on page 6-2 of the DEIS, states: "To achieve the energy/telecommunications objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable power and telecommunication services to accommodate demand." As discussed in Chapter 9 of the DEIS, the public decision makers for the project have the authority to determine what alternative is "reasonably priced" to balance competing goals and policies in deciding whether the transmission lines will be placed overhead or underground.

Should the public decision maker decide not to require HECO to place the transmission lines underground, a property owner can pay for the additional cost of underground lines, over and above the cost of overhead lines. If a property owner agrees to pay this additional cost, HECO would be willing to place the lines underground.

We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AF4.PDX

Mr. Timothy E. Johns
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August 4, 1992

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We appreciate your review of the DEIS. Please call me at 543-7819 if I can be of further assistance.

Sincerely,

Ken T. Morikami

Ken T. Morikami
Project Manager

10010AF4.PDX

END

CERTIFICATION

I HEREBY CERTIFY THAT THE MICROPHOTOGRAPH APPEARING IN THIS REEL OF FILM ARE TRUE COPIES OF THE ORIGINAL DOCUMENTS.

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